R.M.K. ENGINEERING COLLEGE

[An Autonomous Institution]

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

B.E. COMPUTER SCIENCE AND DESIGN

REGULATIONS - 2020

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES

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

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

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

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

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

PROGRAMME OUTCOMES (POs)

On successful completion of the programme,

Engineering Graduates will be able to:

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

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

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

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

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

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

- Apply knowledge acquired from the basic system design and core software areas of Computer Science and Design for solving real world problems.
- Apply recent technologies and robust analytical skills to produce quality software in scientific and business applications.
- Excel in emerging computer languages and design methodologies for innovative career paths as an entrepreneur and pursue higher studies.

Mapping of POs/PSOs to PEOs

Contribution 1: Reasonable 2: Significant 3: Strong

PEOs & POs

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

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

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

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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

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

		Problem Solving and C Programming	✓	✓	✓						✓			✓
		Basic Electrical, Electronics and Measurement Engineering	✓	✓	✓									
		Induction Program						✓	✓	✓	✓	✓	✓	✓
		Physics & Chemistry Laboratory	✓	✓			✓				✓			✓
		C Programming Laboratory	✓	✓	✓						✓			✓
		Interpersonal Skills - Listening & Speaking									✓	✓		✓
	SEMESTER 2	Technical English									✓		✓	✓
		Engineering Mathematics II	✓	✓	✓	✓	✓	✓						✓
		Environmental Science and Engineering	✓	✓				✓	✓			✓		✓
		Computer Aided Engineering Graphics	✓		✓		✓					✓		
		Data Structures	✓	✓	✓									✓
		Python Programming (Lab Integrated)	✓	✓	✓		✓			✓	✓	✓		✓
		Engineering Practices Laboratory	✓	✓	✓						✓			✓
		Data Structures Laboratory	✓	✓	✓					✓	✓	✓		✓
		Advanced Reading & Writing									✓	✓		✓
YEAR II	**SEMESTER 3**	Discrete Mathematics	✓	✓	✓	✓								
		Digital Principles and Computer Architecture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
		Database Management Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming	✓	✓	✓									
		Design Thinking	✓	✓	✓	✓	✓	✓	✓					
		Universal Human Values-2: Understanding Harmony						✓	✓	✓	✓	✓	✓	✓
		Database Management Systems Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Object Oriented Programming Laboratory	✓	✓	✓					✓	✓	✓		✓
		Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Aptitude and Coding Skills - I	✓	✓							✓	✓		

	SEMESTER 4	Probability and Statistics	✓	✓	✓	✓					✓	✓		✓
		Human Computer Interaction	✓	✓	✓	✓	✓	✓	✓					
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓				✓			✓
		Design Programming (Lab Integrated)	✓	✓	✓	✓	✓				✓			✓
		Information Design and Visualization	✓	✓	✓	✓	✓	✓	✓					
		Operating System Design	✓	✓	✓	✓	✓	✓	✓					
		Information Design and Visualization Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Operating System Design Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Aptitude and Coding Skills - II	✓	✓							✓	✓		
YEAR III	**SEMESTER 5**	Artificial Intelligence	✓	✓	✓									
		Web Technology	✓	✓	✓	✓	✓	✓	✓					
		Product Centric Agile Development (Lab Integrated)	✓	✓	✓	✓	✓	✓	✓					✓
		Computer Graphics and Animation	✓	✓	✓	✓	✓	✓	✓					
		Open Elective I*												
		Professional Elective I												
		Computer Graphics and Animation Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Web Technology Laboratory	✓	✓	✓	✓	✓	✓	✓		✓			✓
		Advanced Aptitude and Coding Skills – I	✓	✓	✓						✓	✓		
		Mini Project and Design Thinking Practices Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEMESTER 6	Compiler Design (Lab integrated)	✓	✓	✓					✓	✓	✓		✓
		Design of Interactive systems	✓	✓	✓	✓	✓	✓	✓					
		Machine Learning	✓	✓	✓		✓							
		Computer Networks Design	✓	✓	✓	✓	✓	✓	✓					
		Professional Elective II												
		Professional Elective III												

		Mobile Application Development Laboratory	✓	✓	✓					✓	✓	✓		✓
		Networks Design Laboratory	✓	✓	✓					✓	✓	✓		✓
		Advanced Aptitude and Coding Skills - II	✓	✓	✓						✓	✓		
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YEAR IV	**SEMESTER 7**	UI/UX Design	✓	✓	✓	✓	✓	✓	✓					
		Cloud Computing	✓	✓	✓									
		Open Elective II*												
		Professional Elective IV												
		Professional Elective V												
		Professional Elective VI												
		UI/UX Design Laboratory	✓	✓	✓	✓	✓				✓			✓
		Cloud Computing Laboratory	✓	✓	✓					✓	✓	✓		✓
		Project Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEMESTER 8	Project Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVE														
YEAR III	**SEMESTER 5 / SEMESTER 6**	**COURSE NAME**	**Programme Outcome (PO)**											
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
		Game Artificial Intelligence	✓	✓	✓	✓	✓	✓	✓					
		Principles of Information Science	✓	✓	✓	✓	✓	✓	✓					
		Introduction to Data Science	✓	✓	✓	✓	✓	✓	✓					
		Spatial Computing	✓	✓	✓	✓	✓	✓	✓					
		Social, Text and Media Analytics	✓	✓	✓	✓	✓	✓	✓					

		Introduction to Motion Graphics	✓	✓	✓	✓	✓	✓	✓					
		Design for Usability	✓	✓	✓	✓	✓	✓	✓					
		Intelligent system Design	✓	✓	✓	✓	✓	✓	✓					
		Measurement and Data Analysis Practice	✓	✓	✓	✓	✓	✓	✓					
		Design Realization	✓	✓	✓	✓	✓	✓	✓					
		Design for Quality and Reliability	✓	✓	✓	✓	✓	✓	✓					
		Quality Inspection and Product Validation Practice	✓	✓	✓	✓	✓	✓	✓					
		Cyber Physical Systems	✓	✓	✓									
		Web Security	✓	✓	✓					✓				
		Natural Language Processing	✓	✓	✓		✓	✓						
		Image Processing	✓	✓	✓									
		Computer Vision	✓	✓	✓									
		Software Project Management	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Software Quality Assurance	✓	✓	✓								✓	
		Social Network Analysis	✓	✓	✓	✓		✓						
		Semantic Web	✓	✓	✓									
		High Performance Computing	✓	✓	✓									
		Internet of Things	✓	✓	✓				✓		✓			
		Embedded Systems	✓	✓	✓									
		Parallel Programming	✓	✓	✓									
		Introduction to innovation, IP Management and Entrepreneurship	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
		Professional Ethics in Engineering						✓	✓	✓	✓	✓	✓	✓
		Principles of Management	✓	✓	✓								✓	
		Essence of Indian Traditional Knowledge						✓		✓				✓

		Augmented Virtual Reality	✓	✓	✓					✓				
		Digital Marketing	✓	✓	✓					✓				
		Digital Commerce	✓	✓	✓					✓				
YEAR IV	**SEMESTER 7**	Large Scale Information Storage and Retrieval	✓	✓	✓	✓	✓	✓	✓					
		Robotics Engineering	✓	✓	✓	✓	✓	✓	✓					
		GPU Computing	✓	✓	✓	✓	✓	✓	✓					
		Building Game Engines	✓	✓	✓	✓	✓	✓	✓					
		Multimedia Technologies	✓	✓	✓	✓	✓	✓	✓					
		Information System Design	✓	✓	✓	✓	✓	✓						
		Computer Aided Design	✓	✓	✓	✓	✓	✓						
		Software Architecture Design	✓	✓	✓	✓	✓	✓						
		3D Modeling and Design	✓	✓	✓	✓	✓	✓						
		Mobile application design	✓	✓	✓	✓	✓	✓						
		Security Design	✓	✓	✓	✓	✓	✓						
		Design of Optimization algorithms	✓	✓	✓	✓	✓	✓						
		Design Patterns	✓	✓	✓	✓	✓	✓						
		Quality Design	✓	✓	✓	✓	✓	✓						
		Cyber Forensics	✓	✓	✓					✓				
		Blockchain Technologies	✓	✓	✓		✓							
		Bigdata and Cloud Databases	✓	✓	✓		✓							
		Deep Learning Techniques	✓	✓	✓		✓	✓						
		Pattern Recognition	✓	✓	✓									
		Computational Intelligence	✓	✓	✓									
		Intelligent Agent Technology	✓	✓	✓									

		Service Oriented Architecture	✓	✓	✓									
		Image and Video Analytics	✓	✓	✓	✓		✓						
		Nature Inspired Computing Techniques	✓	✓	✓									
		Game Theory & Programming	✓	✓	✓									
		Intelligent Robots	✓	✓	✓									
		Operational and Supply Chain Management	✓	✓	✓									
		Lean Six Sigma	✓	✓	✓			✓		✓	✓	✓		✓
		Indian Constitution						✓		✓				✓

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B.E. COMPUTER SCIENCE AND DESIGN

REGULATIONS - 2020
CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTERS CURRICULA & I-IV SYLLABI

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	20MA101	Engineering Mathematics - I	BS	5	3	2	0	4
3.	20PH101	Physics for Computer Science and Information Technology	BS	3	3	0	0	3
4.	20CH101	Engineering Chemistry	BS	3	3	0	0	3
5.	20GE101	Problem Solving and C Programming	ES	3	3	0	0	3
6.	20EE102	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
7.		Induction Program	MC	3 Weeks	-	-	-	-
PRACTICALS								
8.	20PC111	Physics & Chemistry Laboratory	BS	4	0	0	4	2
9.	20GE111	C Programming Laboratory	ES	4	0	0	4	2
10.	20EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1
			TOTAL	**29**	**17**	**2**	**10**	**23**

SEMESTER II

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

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20MA302	Discrete Mathematics	BS	5	3	2	0	4
2.	20AI301	Digital Principles and Computer Architecture	ES	3	3	0	0	3
3.	20IT403	Database Management Systems	PC	3	3	0	0	3
4.	20CS302	Object Oriented Programming	PC	3	3	0	0	3
5.	20CB505	Design Thinking	PC	4	2	2	0	3
6.	20GE301	Universal Human Values-2: Understanding Harmony	HS	4	2	2	0	3
PRACTICALS								

7.	20IT412	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	20CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9.	20CS312	Mini Project	EEC	2	0	0	2	1
10.	20CS313	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
			TOTAL	**34**	**16**	**6**	**12**	**25**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20MA402	Probability and Statistics	BS	5	3	2	0	4
2.	20CS907	Human Computer Interaction	PC	3	3	0	0	3
3.	20CS402	Design and Analysis of Algorithms	PC	4	2	2	0	3
4.	20CD401	Design Programming(Lab Integrated)	PC	5	3	0	2	4
5.	20CD402	Information Design and Visualization	PC	3	3	0	0	3
6.	20CD403	Operating System Design	PC	3	3	0	0	3
PRACTICALS								
7.	20CD411	Information Design and Visualization Laboratory	PC	4	0	0	4	2
8.	20CD412	Operating System Design Laboratory	PC	4	0	0	4	2
9.	20CD413	Internship	EEC	-	-	-	-	1
10.	20CS414	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
			TOTAL	**33**	**17**	**4**	**12**	**26**

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20AI401	Artificial Intelligence	PC	3	3	0	0	3
2.	20CD501	Web Technology	PC	3	3	0	0	3
3.	20CD502	Product Oriented Agile Development (Lab Integrated)	PC	5	3	0	2	4
4.	20CD503	Computer Graphics and Animation	PC	3	3	0	0	3
5.		Open Elective I*	OE	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	20CD511	Computer Graphics and Animation Laboratory	PC	4	0	0	4	2
8.	20CD512	Web Technology Laboratory	PC	4	0	0	4	2
9.	20CS512	Advanced Aptitude and Coding Skills – I	EEC	2	0	0	2	1
10.	20CS513	Mini Project and Design Thinking Practices Laboratory	EEC	2	0	0	2	1
			TOTAL	**32**	**18**	**0**	**14**	**25**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CS601	Compiler Design (Lab integrated)	PC	5	3	0	2	4
2.	20CD601	Design of Interactive Systems	PC	3	3	0	0	3
3.	20AI502	Machine Learning	PC	3	3	0	0	3
4.	20CD602	Computer Networks Design	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Professional Elective III	PE	3	3	0	0	3

PRACTICALS								
7.	20CS611	Mobile Application Development Laboratory	PC	4	0	0	4	2
8.	20CD611	Networks Design Laboratory	PC	4	0	0	4	2
9.	20CS614	Advanced Aptitude and Coding Skills-II	EEC	2	0	0	2	1
10.	20CD612	Internship	EEC	-	-	-	-	1
			TOTAL	**30**	**18**	**0**	**12**	**25**

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CD701	UI/UX Design	PC	3	3	0	0	3
2.	20CS701	Cloud Computing	PC	3	3	0	0	3
3.		Open Elective II*	OE	3	3	0	0	3
4.		Professional Elective IV	PE	3	3	0	0	3
5.		Professional Elective V	PE	3	3	0	0	3
6.		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
7.	20CD711	UI/DX Design Laboratory	PC	4	0	0	4	2
8.	20CS711	Cloud Computing Laboratory	PC	4	0	0	4	2
9.	20CD712	Project Phase I	EEC	2	0	0	2	1
			TOTAL	**28**	**18**	**0**	**10**	**23**

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	20CD811	Project Phase II	EEC	20	0	0	20	10
			TOTAL	**20**	**0**	**0**	**20**	**10**

TOTAL NO. OF CREDITS: 182

***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.	20EL101	Communicative English & Life Skills	HS	2	2	0	0	2
2.	20EL111	Interpersonal Skills (Listening & Speaking)	HS	2	0	0	2	1
3.	20EL201	Technical English	HS	2	2	0	0	2
4.	20EL211	Advanced Reading & Writing	HS	2	0	0	2	1
5.	20CH102	Environmental Science and Engineering	HS	3	3	0	0	3
6.	20GE301	Universal Human Values-2: Understanding Harmony	HS	4	2	2	0	3

BASIC SCIENCES (BS)

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

ENGINEERING SCIENCES (ES)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20GE101	Problem Solving and C Programming	ES	3	3	0	0	3
2.	20EE102	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
3.	20GE111	C Programming Laboratory	ES	4	0	0	4	2
4.	20ME103	Computer Aided Engineering Graphics	ES	6	2	0	4	4
5.	20CS202	Python Programming (Lab Integrated)	ES	5	3	0	2	4

6.	20EM111	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	20AI301	Digital Principles and Computer Architecture	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CS201	Data Structures	PC	3	3	0	0	3
2.	20CS211	Data Structures Laboratory	PC	4	0	0	4	2
3.	20AI301	Digital Principles and Computer Architecture	PC	3	3	0	0	3
4.	20IT403	Database Management Systems	PC	3	3	0	0	3
5.	20CS302	Object Oriented Programming	PC	3	3	0	0	3
6.	20CB505	Design Thinking	PC	4	2	2	0	3
7.	20IT412	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	20CS311	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9.	20CS907	Human Computer Interaction	PC	3	3	0	0	3
10.	20CS402	Design and Analysis of Algorithms	PC	3	2	2	0	3
11.	20CD401	Design Programming (Lab Integrated)	PC	5	3	0	2	4
12.	20CD402	Information Design and Visualization	PC	4	2	0	2	3
13.	20CD403	Operating System Design	PC	3	3	0	0	3
14.	20CD411	Information Design and Visualization Laboratory	PC	4	0	0	4	2
15.	20CD412	Operating System Design Laboratory	PC	4	0	0	4	2
16.	20AI401	Artificial Intelligence	PC	3	3	0	0	3
17.	20CD501	Web Technology	PC	3	3	0	0	3
18.	20CD502	Product Oriented Agile Development (Lab Integrated)	PC	5	3	0	2	4
19.	20CD503	Computer Graphics and Animation	PC	3	3	0	0	3
20.	20CD511	Computer Graphics and Animation Laboratory	PC	4	0	0	4	2
21.	20CD512	Web Technology Laboratory	PC	4	0	0	4	2

22.	20CS601	Compiler Design (Lab integrated)	PC	5	3	0	2	4
23.	20CD601	Design of Interactive Systems	PC	3	3	0	0	3
24.	20AI502	Machine Learning	PC	3	3	0	0	3
25.	20CD602	Computer Networks Design	PC	3	3	0	0	3
26.	20CS611	Mobile Application Development Laboratory	PC	4	0	0	4	2
27.	20CD611	Networks Design Laboratory	PC	4	0	0	4	2
28.	20CD701	UI/UX Design	PC	3	3	0	0	3
29.	20CS701	Cloud Computing	PC	3	3	0	0	3
30.	20CD711	UI/UX Design Laboratory	PC	4	0	0	4	2
31.	20CS711	Cloud Computing Laboratory	PC	4	0	0	4	2

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.	20CD901	Game Artificial Intelligence	PE	3	3	0	0	3
2.	20CD902	Principles of Information Science	PE	3	3	0	0	3
3.	20CD903	Introduction to Data Science	PE	3	3	0	0	3
4.	20CD904	Spatial Computing	PE	3	3	0	0	3
5.	20CD905	Social, Text and Media Analytics	PE	3	3	0	0	3
6.	20CD906	Introduction to Motion Graphics	PE	3	3	0	0	3
7.	20CD907	Design for Usability	PE	3	3	0	0	3
8.	20CD908	Intelligent system Design	PE	3	3	0	0	3
9.	20CD909	Measurement and Data Analysis Practice	PE	3	3	0	0	3
10.	20CD910	Design Realization	PE	3	3	0	0	3
11.	20CD911	Design for Quality and Reliability	PE	3	3	0	0	3
12.	20CD912	Quality Inspection and Product Validation Practice	PE	3	3	0	0	3

13.	20CS901	Cyber Physical Systems	PE	3	3	0	0	3
14.	20CS902	Web Security	PE	3	3	0	0	3
15.	20AI702	Natural Language Processing	PE	3	3	0	0	3
16.	20CS904	Image Processing	PE	3	3	0	0	3
17.	20CS905	Computer Vision	PE	3	3	0	0	3
18.	20CS906	Software Project Management	PE	3	3	0	0	3
19.	20CS909	Software Quality Assurance	PE	3	3	0	0	3
20.	20CS910	Social Network Analysis	PE	3	3	0	0	3
21.	20AI911	Semantic Web	PE	3	3	0	0	3
22.	20CS911	High Performance Computing	PE	3	3	0	0	3
23.	20CS913	Internet of Things	PE	3	3	0	0	3
24.	20CS914	Embedded Systems	PE	3	3	0	0	3
25.	20CS915	Parallel Programming	PE	3	3	0	0	3
26.	20CB404	Introduction to innovation, IP Management and Entrepreneurship	PE	3	3	0	0	3
27.	20CE917	Professional Ethics in Engineering	PE	3	3	0	0	3
28.	20ME926	Principles of Management	PE	3	3	0	0	3
29.	20IT917	Essence of Indian Traditional Knowledge	PE	3	3	0	0	3
30.	20CD917	Augmented and Virtual Reality	PE	3	3	0	0	3
31.	20CD929	Digital Marketing	PE	3	3	0	0	3
32.	20CD930	Digital Commerce	PE	3	3	0	0	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.	20CD913	Large Scale Information Storage and Retrieval	PE	3	3	0	0	3
2.	20CD914	Robotics Engineering	PE	3	3	0	0	3

3.	20CD915	GPU Computing	PE	3	3	0	0	3
4.	20CD916	Building Game Engines	PE	3	3	0	0	3
5.	20CD918	Multimedia Technologies	PE	3	3	0	0	3
6.	20CD919	Information System Design	PE	3	3	0	0	3
7.	20CD920	Computer Aided Design	PE	3	3	0	0	3
8.	20CD921	Software Architecture Design	PE	3	3	0	0	3
9.	20CD922	3D Modeling and Design	PE	3	3	0	0	3
10.	20CD923	Mobile application design	PE	3	3	0	0	3
11.	20CD924	Security Design	PE	3	3	0	0	3
12.	20CD925	Design of Optimization algorithms	PE	3	3	0	0	3
13.	20CD926	Design Patterns	PE	3	3	0	0	3
14.	20CD927	Quality Design	PE	3	3	0	0	3
15.	20CS919	Cyber Forensics	PE	3	3	0	0	3
16.	20CS920	Blockchain Technologies	PE	3	3	0	0	3
17.	20AI913	Bigdata and Cloud Databases	PE	3	3	0	0	3
18.	20AI701	Deep Learning Techniques	PE	3	3	0	0	3
19.	20AI913	Pattern Recognition	PE	3	3	0	0	3
20.	20AI919	Computational Intelligence	PE	3	3	0	0	3
21.	20AI917	Intelligent Agent Technology	PE	3	3	0	0	3
22.	20CS922	Service Oriented Architecture	PE	3	3	0	0	3
23.	20AI915	Image and Video Analytics	PE	3	3	0	0	3
24.	20AI902	Nature Inspired Computing Techniques	PE	3	3	0	0	3
25.	20CS924	Game Theory & Programming	PE	3	3	0	0	3
26.	20AI918	Intelligent Robots	PE	3	3	0	0	3
27.	20CS928	Operational and Supply Chain Management	PE	3	3	0	0	3
28.	20CS930	Lean Six Sigma	PE	3	3	0	0	3
29.	20IT927	Indian Constitution	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20CS313	Aptitude and Coding Skills - I	EEC	2	0	0	2	1
2.	20CS312	Mini Project	EEC	2	0	0	2	1
3.	20CS414	Aptitude and Coding Skills - II	EEC	2	0	0	2	1
4.	20CD413	Internship	EEC	-	-	-	-	1
5.	20CS513	Mini Project and Design Thinking Practices Lab	EEC	2	0	0	2	1
6.	20CS512	Advanced Aptitude and Coding Skills - I	EEC	2	0	0	2	1
7.	20CD612	Internship	EEC	-	-	-	-	1
8.	20CS614	Advanced Aptitude and Coding Skills - II	EEC	2	0	0	2	1
9.	20CD712	Project Phase I	EEC	2	0	0	2	1
10.	20CD811	Project Phase II	EEC	20	0	0	20	10

SUMMARY

S. NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	PERCENTAGE
		I	II	III	IV	V	VI	VII	VIII		
1.	**HS**	3	6	3						**12**	**6.59%**
2.	**BS**	12	4	4	4					**24**	**13.19%**
3.	**ES**	8	10	3						**21**	**11.54%**
4.	**PC**		5	13	20	17	17	10		**82**	**45.05%**
5.	**PE**					3	6	9		**18**	**9.89%**
6.	**OE**					3		3		**6**	**3.30%**
7.	**EEC**			2	2	2	2	1	10	**19**	**10.44%**
8.	**MC**										
	TOTAL	**23**	**25**	**25**	**26**	**25**	**25**	**23**	**10**	**182**	
9.	**Non Credit/ Mandatory**										

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

SEMESTER I

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

OBJECTIVES:

The Course will enable learners to:

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

UNIT I	COMMUNICATION BASICS	06

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

UNIT II	COMMUNICATION INTERMEDIATE	06

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

UNIT III	COMMUNICATION VANTAGE	06

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

UNIT IV	SYNERGISTIC COMMUNICATION	06

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

UNIT V	COMMUNICATION HIGHER	06

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

TOTAL: 30 PERIODS

OUTCOMES:

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

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

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

CO3: Comprehend conversations and short talks delivered in English.

CO4: Write short essays of a general kind and personal letters and emails in English.
CO5: Develop vocabulary of a general kind by enriching their reading skills.
CO6: Use appropriate thinking and problem- solving techniques to solve new problems.

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

- Explain the concepts of matrix algebra.
- Make the students understand the idea of curvature, evolutes and envelopes.
- Impart the knowledge of functions of several variables.
- Introduce the concepts of Gamma and Beta integral.
- Develop an understanding on the basics of multiple integrals.

UNIT I	MATRICES	9+6

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

UNIT II	APPLICATIONS OF DIFFERENTIAL CALCULUS	9+6

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

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	9+6

Limits – Continuity – Partial derivatives (excluding Euler's theorem) – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV	GAMMA, BETA INTEGRALS AND APPLICATIONS	9+6

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

UNIT V	MULTIPLE INTEGRALS	9+6

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

TOTAL: 75 PERIODS

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The Course will enable learners to:

1. To learn the fundamental concepts of physics and apply this knowledge to scientific, engineering and technological problems.
2. To make the students enrich basic knowledge in electronics and quantum concepts and apply the same in computing fields.

UNIT I	LASER AND FIBRE OPTICS	9

Population of energy levels – Einstein's A and B coefficients derivation -Resonant cavity - Optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction- Engineering applications of lasers in data storage (qualitative).

Fibre optics: Principle, numerical aperture and acceptance angle -V-number - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic

communication- Fibre optic sensors (pressure and displacement).

UNIT II	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetic dipole moment - atomic magnetic moments - Origin of magnetic moments- Magnetic permeability and susceptibility - Magnetic material classifications- Diamagnetism - Paramagnetism- Ferromagnetism -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.

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

OBJECTIVES:

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

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

UNIT I	CHEMISTRY IN EVERYDAY LIFE	8

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

Water – impurities – industrial uses of water – hardness, external treatment (demineralization) –

desalination (reverse osmosis).

UNIT II	ELECTROCHEMISTRY	10

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

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

UNIT III	ENERGY STORAGE DEVICES AND ENERGY SOURCES	9

Batteries – primary battery (alkaline battery) - secondary battery (Pb-acid battery, Ni-metal hydride battery, Li-ion battery) - fuel cells (H2-O2 fuel cell).

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

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

UNIT IV	POLYMERS	9

Introduction – monomer, functionality, degree of polymerization – classification based on sources and applications – effect of polymer structure on properties - types of polymerization (addition, condensation) - thermoplastic and thermosetting resins – preparation, properties and applications of Teflon, polyvinyl chloride, polycarbonate, Bakelite.

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

UNIT V	NANOCHEMISTRY	9

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

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

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

UNIT I	INTRODUCTION TO ALGORITHM AND C	9

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

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

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

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

UNIT II	CONTROL FLOW STATEMENTS	7

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

UNIT III	ARRAYS AND FUNCTIONS	10

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

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

UNIT IV	STRUCTURES AND POINTERS	10

Basic Structures, Structures and Functions, Array of structures.

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

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

UNIT V	FORMATTED I/O AND FILE PROCESSING	9

Formatted Output – fprintf, Formated Input – fscanf, Variable length argument list

Files - file access including FILE structure, fopen, fread, fwrite, stdin, sdtout and stderr, File Types – Text, Binary - Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop simple applications using basic constructs

CO3: Write programs using arrays and strings

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

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

TEXT BOOKS:

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Pearson Education India, 2nd Edition, 2015.
2. Anita Goel and Ajay Mittal, " Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

REFERENCES:

1. B. Gottfried, Programming with C, Schaum Outline Series, Fourth Edition, 2018
2. Herbert Schildt, C: The Complete Reference, McGraw Hill, Fourth Edition, 2017
3. Yashavant Kanetkar, Let Us C, BPB Publications, 16th Edition, 2018.
4. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2018.
5. Zed A. Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (like C)", (Zed Shaw's Hard Way Series), 1st Edition, Addison-Wesley Professional, 2015.

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

OBJECTIVES:

The syllabus is designed to:

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

UNIT I	ELECTRICAL CIRCUITS ANALYSIS	9

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

UNIT II	POWER SYSTEM	9

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

UNIT III	ELECTRICAL MACHINES	9

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

UNIT IV	ELECTRONIC CIRCUITS	9

PN Junction-VI Characteristics of Diode, Rectifier- zener diode, Transistors OPAMP-configuration, differentiator, integrator, ADC- Types, Successive approximation type, DAC-Types, Weighted resistor DAC and R-2R ladder type, Voltage regulator IC using LM 723, LM 317.

UNIT V	ELECTRICAL MEASUREMENT	9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Analyse the electric circuits.

CO2: Classify the different types of electric machines and transformers

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

CO4: Acquire knowledge in basics of electronic circuits.

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

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

LIST OF EXPERIMENTS (Any five experiments to be conducted)

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

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

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

TOTAL: 30 PERIODS

OUTCOMES:

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

they will be able to

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

CO2: Examine the thermal conductivity of a bad conductor.

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

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

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

CO6: Determine the band gap of a semiconductor.

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

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

LIST OF EXPERIMENTS (Any five experiments to be conducted)

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

TOTAL: 30 PERIODS

OUTCOMES:

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

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

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

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

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

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

CO6: Assess the corrosion rate of a given metal.

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

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

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

LIST OF EXPERIMENTS:

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

- 4 if it is a multiple of 4 and divisible by 6.
- 3 if it is a prime number.

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

<10, its weight>, <36, its weight>, <89, its weight>

14. Populate an array with height of persons and find how many persons are above the average

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

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

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

    a. Find the total number of words.

    b. Capitalize the first word of each sentence.

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

    EID, Ename, Designation, DOB, DOJ, Basicpay

    Note that DOB and DOJ should be implemented using structure within structure.
22. Compute internal marks of students for five different subjects using structures and functions.
23. Insert, update, delete and append telephone details of an individual or a company into a

    telephone directory using random access file.
24. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
25. Mini project: Create a ―Railway reservation system with the following modules
    - Booking
    - Availability checking
    - Cancellation
    - Prepare chart

TOTAL: 60 PERIODS

OUTCOMES:

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

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

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

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

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

OBJECTIVES:

The Course will enable learners to:

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

UNIT I		6

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

UNIT II		6

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

UNIT III		6

Deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail.

UNIT IV		6

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

UNIT V		6

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

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Listen and respond appropriately.

CO2: Participate in group discussions.

CO3: Make effective presentations.

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

TEXT BOOKS:

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

REFERENCES:

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

SEMESTER II

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

OBJECTIVES:

The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Demonstrate their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I	INTRODUCTION - TECHNICAL ENGLISH	06

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

UNIT II	READING AND STUDY SKILLS	06

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

impersonal passive voice, numerical adjectives.

UNIT III	TECHNICAL WRITING AND GRAMMAR	06

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

UNIT IV	REPORT WRITING	06

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

UNIT V	GROUP DISCUSSION AND JOB APPLICATIONS	06

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

TOTAL: 30 PERIODS

OUTCOMES:

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

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

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

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

CO4: Write reports and winning job applications.

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The syllabus is designed to:

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

UNIT I	ORDINARY DIFFERENTIAL EQUATIONS	9+6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II	VECTOR CALCULUS	9+6

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

UNIT III	LAPLACE TRANSFORMS	9+6

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

UNIT IV	COMPLEX DIFFERENTIATION AND CONFORMAL MAPPING	9+6

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

UNIT V	COMPLEX INTEGRATION	9+6

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Statement and applications of Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Solve the higher order linear differential equations.

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

CO3: Apply Laplace Transforms method for solving linear ordinary differential

equation.

CO4: Construct an analytic function and analyze conformal mapping.

CO5: Evaluate the real integrals using complex integration.

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

- Appreciate the natural resources of environment which are inherently created for supporting life.
- Learn scientific and technological solutions to current day pollution issues.
- Study the interrelationship between living organisms and environment
- Understand the integrated themes of biodiversity.
- Appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

UNIT I	NATURAL RESOURCES	11

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

Forest resources- Use and over-exploitation, deforestation - timber extraction, mining, dams and their effects on forests and tribal people. **Water resources** - Use and over- utilization of surface and ground water, conflicts over water, dams-benefits and problems. **Mineral resources**- Use and exploitation, environmental effects of extracting and using mineral

resources. **Food resources**- World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. **Energy resources** - Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. **Land resources**- Land as a resource, land degradation, soil erosion and desertification – role of an individual in conservation of natural resources - case studies.

UNIT II	**POLLUTION AND ITS MANAGEMENT**	**11**

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

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

UNIT III	**ECOSYSTEMS AND BIODIVERSITY**	**9**

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

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

UNIT IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**8**

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

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

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

UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**6**

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Illustrate the importance and conservation of natural resources.

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

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

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

UNIT II	PLANE CURVES	16

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT III	PROJECTION OF POINTS, LINES AND PLANE SURFACE	18

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

UNIT IV	PROJECTION OF SOLIDS AND PROJECTION OF SECTIONED SOLIDS	20

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

UNIT V	DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTION	18

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

TOTAL: 90 PERIODS

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 2012.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition, 2013.
3. Engineering Drawing Practice for Schools and Colleges SP: 46 , BIS, 2003.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy 11th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 1993.
5. Parthasarathy N.S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

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

OBJECTIVES:

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

UNIT I	LINEAR DATA STRUCTURES – LIST	9

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

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9

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

UNIT III	NON LINEAR DATA STRUCTURES – TREES	9

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

UNIT IV	NON LINEAR DATA STRUCTURES - GRAPHS	9

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

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Implement abstract data types for linear data structures.

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

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

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

CO5: Critically analyze the various sorting and searching algorithms.

TEXT BOOKS:

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

2014.

REFERENCES:

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

20CS202	PYTHON PROGRAMMING (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.

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

OBJECTIVES:

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 15

Buildings:

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

Plumbing Works:

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

Carpentry using Power Tools only:

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

II MECHANICAL ENGINEERING PRACTICE 15

Welding:

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

Basic Machining:

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

Sheet Metal Work:

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

Machine assembly practice:

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

Demonstration on:

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

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 15

1. Study of various safety measures in Electrical System
2. Draw and demonstrate the layout for a residential house wiring using energy meter, switches, fuse, indicator, LED lamp, fluorescent lamp with one of the lamps to be controlled by 2 different switches
3. Measurement of electrical quantities – voltage, current, power & power factor in RLC

circuit (series and parallel circuit).

4. Measurement of energy using single phase energy meter for incandescent lamp and LED lamp.
5. Measurement of resistance to earth of an electrical equipment

IV ELECTRONICS ENGINEERING PRACTICE 15

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

TOTAL: 60 PERIODS

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

OUTCOMES:

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

CO1: Develop carpentry components and pipe connections including plumbing works.

CO2: Make use of welding equipments to join the structures

CO3: Analyse the basic machining operations

CO4: Develop the models using sheet metal works

CO5: Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings

CO6: Fabricate carpentry components and pipe connections including plumbingworks.

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

20CS211	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.

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

OBJECTIVES:

The Course will enable learners to:

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

UNIT I		**6**

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

UNIT II		**6**

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

UNIT III		**6**

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

UNIT IV		**6**

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

UNIT V		**6**

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

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Read and evaluate texts critically.

CO2: Display critical thinking in various professional contexts.

CO3: Apply various texts using speed reading techniques.

CO4: Illustrate and write different types of Essays.

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

TEXT BOOKS:

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

REFERENCES:

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

SEMESTER III

20MA302	DISCRETE MATHEMATICS (Common to CSE and CSD)	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: Demonstrate various proof techniques and application of principles.

CO3: Apply graph theory techniques to solve real life problems.

CO4: Identify algebraic techniques to formulate and solve group theoretic problems.

CO5: Utilize the significance of lattices and Boolean algebra in computer science and engineering.

TEXT BOOKS:

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

REFERENCES:

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. S. Lipschutz, and M. Lipson, "Discrete Mathematics", Schaum‘s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. T. Koshy. "Discrete Mathematics with Applications", Elsevier Publications, 1st Edition, 2006.

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

OBJECTIVES:

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

UNIT I	DIGITAL FUNDAMENTALS	10

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates -

Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

UNIT II	COMBINATIONAL AND SEQUENTIAL CIRCUITS	9

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

UNIT III	COMPUTER FUNDAMENTALS	9

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

UNIT IV	BASIC PROCESSING UNIT AND PIPELINING	9

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

UNIT V	I/O AND MEMORY	8

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Simplify complex Boolean functions.

CO2: Implement digital circuits using combinational logic ICs and PLDs

CO3: Understand and execute programs based on 8086 microprocessor

CO4: Design Multiprocessor circuits.

CO5: Design and interface I/O circuits

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	DATABASE CONCEPTS	9

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

UNIT II	DATABASE DESIGN	9

Design a DB for Car Insurance Company - Draw ER diagram and convert ER model to relational schema. Evaluating data model quality - The relational Model Schema Keys Relational Algebra Domain Relational Calculus- Tuple Relational Calculus – Fundamental operations. Relational Database Design and Querying Undesirable Properties of Relations Functional Dependency: Closures- Single Valued Dependency Single valued Normalization (1NF, 2NF 3NF and BCNF) - Desirable properties of
Decompositions 4NF - 5NF Denormalization

UNIT III	TRANSACTIONS	9

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

UNIT IV	DATA STORAGE AND QUERYING	9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices
– B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Overview of physical storage structure- stable storage, failure classification -log based recovery, deferred database modification, check-pointing-File Structures:-Index structures-Primary, Secondary and clustering indices. Single and multilevel indexing. Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

UNIT V	ADAVNCED TOPICS	**9**

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Implement SQL and effective relational database design concepts.

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

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

CO4: Implement queries using normalization criteria and optimization techniques

CO5: Analyze how advanced databases differ from traditional databases.

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

TEXT BOOKS:

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

REFERENCES:

1. Raghu Ramakrishnan, Gehrke "Database Management Systems", MCGraw Hill, 3rd Edition 2014.
2. Plunkett T., B. Macdonald, "Oracle Big Data Hand Book" , McGraw Hill, First Edition, 2013
3. Gupta G K , "Database Management Systems" , Tata McGraw Hill Education Private Limited, New Delhi, 2011.
4. C. J. Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real- Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, " Database Systems: A Practical Approach to Design, Implementation and Management", Pearson , 6th Edition, 2015.

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

OBJECTIVES:

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

UNIT I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9

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

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	9

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

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

UNIT III	**MULTITHREADING, I/O AND GENERIC PROGRAMMING**	9

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

UNIT IV	**STRING HANDLING AND COLLECTIONS**	9

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

UNIT V	**EVENT DRIVEN PROGRAMMING**	9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

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

CO3: Build Java applications with I/O streams, threads and generics classes

CO4: Apply strings and collections in applications

CO5: Develop interactive Java applications using swings and event handling mechanism

TEXT BOOK:

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

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, "Core Java Volume–I Fundamentals", 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dreamtech press, 2011.
   Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.

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

OBJECTIVES:

Familiarize design thinking and its phases.

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

UNIT I	**INTRODUCTION**	6+6

Introduction to design thinking - Importance of design thinking for business – Phases of design

thinking – Experiential activity – Case study.		
UNIT II	**EMPATHIZE PHASE**	6+6
Empathize phase - Steps involved - Immersion activity- Questionnaire – Empathy map for case study		
UNIT III	**DEFINE PHASE**	6+6
Creation of personas in define phase – steps in problem statement creation - problem statement definition – Examples – Key problem statements.		
UNIT IV	**IDEATION PHASE**	6+6
Ideation phase steps – Ideation games – Ideate to find solutions – Doodling – Storytelling in presenting ideas and prototypes.		
UNIT V	**PROTOTYPE AND TESTING**	6+6
Importance of prototype in design thinking –Guidelines - Prototyping the idea – Value proposition statement – Testing in design thinking – Prototype testing – Documentation – Design thinking in functional work – Mapping design thinking to agile methodologies.		
TOTAL: 60 PERIODS		

OUTCOMES:

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

CO1: Understand the phases of design thinking process.
CO2: Conduct an immersion activity to create an empathy map
CO3: Define the key problems of the personas created.
CO4: Apply the ideation phase steps to present the prototype ideas
CO5: Create a prototype with value propositions and test the prototype

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

The objective of the course is fourfold:

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

COURSE TOPICS:

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

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

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

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

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

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

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

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

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, Fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided society, Universal order from family to world family.

- Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

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

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

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

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

OUTCOMES:

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

CO1: Would become more aware of themselves, and their surroundings (family, society, nature).

CO2: Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: Would have better critical ability.

CO4: Would become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).

CO5: Would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOK:

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

REFERENCES:

1. A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.
3. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, "Hind Swaraj or Indian Home Rule", Maheswari Publications, Delhi 2020.
6. Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.
7. Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being
8. ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.
9. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
10. Gandhi, Mohandas Karamchand, "The story of my experiments with truth: An autobiography", Om Books International, 2018.
11. Andrews, Cecile, "Slow is beautiful: new visions of community, leisure, and joie de vivre", New society publishers, 2006.
12. Kumarappa, Joseph Cornelius, "The economy of permanence. CP", All India Village Industries Assn., 1946.
13. Vivekananda-Romain Rolland (English) Gandhi-Romain Rolland (English)

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

OBJECTIVES:

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

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms

4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling
8. Database Design using ER modeling, normalization and Implementation for any application.
9. Database Connectivity with Front End Tools
10. Case Study using real life database applications anyone from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management
    c) Cop Friendly App – Eseva Property
    d) Management – eMall
    e) Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate setting

TOTAL: 60 PERIODS

OUTCOMES:

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

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

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

OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

If the type of the EB connection is domestic, calculate the amount to be paid as follows:
First 100 units - Rs. 1 per unit
101-200 units - Rs. 2.50 per unit
201 -500 units - Rs. 4 per unit
> 501 units - Rs. 6 per unit
If the type of the EB connection is commercial, calculate the amount to be paid as follows:
First 100 units - Rs. 2 per unit
101-200 units - Rs. 4.50 per unit
201 -500 units - Rs. 6 per unit
> 501 units - Rs. 7 per unit

2. Arrays Manipulations:
   a. Find k^{th} smallest element in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Remove duplicate elements in an Array
   e. Accept an integer value N and print the 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.
1. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Numberofsides() that prints the number of sides of the given shape.
7. Write a Java program to apply built-in and user defined exceptions.
8. String Manipulation:
   a. Reversing a set of words and count the frequency of each letter in the string.
   b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
   c. Remove all the occurrences of string S2 in string S1 and print the remaining.
   d. Find the longest repeating sequence in a string.
   e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

9.Write a Java program that correctly implements producer consumer problem using the

concept of inter thread communication.

10. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.
11. Collections:
    a. Write a program to perform string operations using ArrayList. Write functions for the following
        i. Append - add at end
        ii. Insert – add at particular index
        iii. Search
        iv. List all string starts with given letter
    b. Find the frequency of words in a given text.
12. Write a java program to remove all non-alphanumeric characters from a string using regular expression.
13. Design a calculator using event-driven programming paradigm of Java with the following options.
    a. Decimal manipulations
    b. Scientific manipulations
14. Develop a mini project for any application using Java concepts.

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

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

OBJECTIVES:

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

LIST OF EXERCISES:

1. English – Phase I

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

2. Logical Reasoning – Phase I

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

3. Quantitative Ability - Phase I

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

4. Automata Fix – Phase I

Logical, Compilation and Code reuse

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

SEMESTER IV

20MA402	PROBABILITY AND STATISTICS (Common to CSE, CSD 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 ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits.

TOTAL: 75 PERIODS

OUTCOMES:

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

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

distributions.

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	FOUNDATIONS OF HCI	9

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

UNIT II	DESIGN SOFTWARE PROCESS	9

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

UNIT III	INTERACTION DESIGN MODELS	9

GOMS - CMN-GOMS Analysis, Modeling Structure, State Transition Networks - Three-State

Model, Glimpse Model, Physical Models– Shneideman's eight golden rules, Norman's Sever principles, Norman's model of interaction, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Cognitive walk-through.

UNIT IV	MOBILE HCI AND WEB INTERFACE DESIGN	9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies. Designing Web Interfaces – Drag Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.

UNIT V	COLLABORATION AND COMMUNICATION	9

Face-to-face Communication, Conversation, Text-based Communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design: Groupware, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware Implementing synchronous groupware, Mixed, Augmented and Virtual Reality.

TOTAL: 45 PERIODS

OUTCOMES:

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

- **CO1:** Enumerate the basic concepts of human, computer interactions
- **CO2:** Inspect software design process in human computer interaction
- **CO3:** Examine various models and theories related to human computer interaction
- **CO4:** Build meaningful user interface
- **CO5:** Establish the different levels of communication across the application stakeholders.

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	INTRODUCTION	8

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

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	10

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

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	11

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

UNIT IV	ITERATIVE IMPROVEMENT	7

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

UNIT V	COPING WITH THE LIMITATIONS OF ALGORITHM POWER	9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

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

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

CO4: Use iterative improvement technique to solve optimization problems

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

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	BLENDER INTERFACE AND NAVIGATION	9

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

UNIT II	MATERIALS AND TEXTURES	9

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

UNIT III	NURBS AND META SHAPES	9

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

UNIT IV	UNITY SCRIPTS	9

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

UNIT V	DECISION MAKING IN GAMES	9

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

LIST OF EXERCISES:

1. Create and Navigate an object using Blender
2. Formulate 3D scene from primitives
3. Converting Text to Mesh Object using blender
4. With Blender, Convert text to a Curve

UNITY BASED EXERCISES:

5. Integration of 3D Assets into Unity
6. Create Scripts to control the movement of game Assets
7. Creating and loading game prefabs at runtime in the game Engine
8. Construct a GUI in the Game Engine to interact with the Game Assets
9. Design and animate a game character in Unity
10. Deploy the game/app to Windows and other platforms

OUTCOMES:

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

CO1: Learn about Blender interface
CO2: Understand Texture Mapping and Rendering
CO3: Analyze Text to Mesh Object and Curve conversion
CO4: Know the scripting fundamentals
CO5: Understand accessing game objects

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	INTRODUCTION TO DESIGN FUNDAMENTALS	9
Exploration of Complex Information Spaces, Orientation in Complex Information Spaces, Fisheye Views: A Step Towards Abstraction, Applications of Fisheye Views, Fisheye Views for 3D Data, Enrichment and Reuse of Geometric Models, Requirement Analysis, Approach to Reuse and Enrich Models.		
UNIT II	**DESIGN CONTROLLING**	**9**
Rendering line Drawings for Illustrative Purposes, An Analytic Rendering Pipeline, Hidden Line Elimination, Drawing the Lines – Shading, Illustrating with Lines, Measuring and Highlighting in Graphics, Approaches and Techniques in Paintings, Theoretical Background, Measuring Colour Contrasts, Animation Analysis, Colour Discontinuity, Discontinuity in Motion, Emphasizing Objects		
UNIT III	**PYTHON LIBRARIES FOR VISUALIZATION**	**9**
Exploratory Data Analysis Fundamentals, The Significance of EDA, Launching the IPython Shell - Launching the Jupyter Notebook - IPython Magic Commands – Making Sense of data, The Basics of NumPy Arrays-Pandas, SciPy, Matplotlib.		
UNIT IV	**DATA VISUALIZATION**	**9**
Overview-Visualization Design Principles - Univariate Data Visualization- Bivariate Data Visualization- Multivariate Data Visualization-Visualizing Groups-Dynamic Techniques-Overview Data Brushing, Nearness Selection, Sorting and Rearranging, Searching and Filtering		
UNIT V	**MODEL DEVELOPMENT AND EVALUATION**	**9**
Hypothesis testing and regression- Hypothesis testing, p-hacking, understanding regression, Model development and evaluation, Understanding Supervised Learning, Understanding unsupervised Learning, Reinforcement Learning, Machine Learning workflow.		
		TOTAL: 45 PERIODS

OUTCOMES:

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

- **CO1:** Identify the characteristics of Design Fundamentals
- **CO2:** Understand the design controlling process.
- **CO3:** Apply the python libraries for Visualization
- **CO4:** Examine the data visualization process
- **CO5:** Describe the methods of a visualization model

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES:

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

UNIT I	OPERATING SYSTEMS: OVERVIEW	9

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II	MEMORY MANAGEMENT IN OPERATING SYSTEM	9

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

UNIT III	STORAGE MANAGEMENT	9

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

UNIT IV	FILE SYSTEMS AND I/O SYSTEMS	9

Mass Storage system — Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface — File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems — I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V	CASE STUDY	9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the basics of Operating Systems

CO2: Understand deadlock, prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.

CO4: Understand the functionality of file systems and Perform administrative tasks on Linux Servers.

CO5: Compare iOS and Android Operating Systems.

TEXT BOOK:

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

REFERENCES:

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

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

OBJECTIVES:

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

LIST OF EXERCISES:

1. Installing and Creating Basic Shapes with Adobe Illustrator
2. Recreating Map Symbols and Creating Logo Designs
3. Apply 3D drawing and painting
4. 2D/3D Poster Design in illustrator
5. Drawing Compounding vector shapes & strokes / Pathfinder Tool
6. Applying color models, pallets, Transformation and pattern in gimp
7. Apply Filtering techniques in 2D/3D using gimp
8. Download, install and explore the features of R/Python for data analytics.
9. Basic plots using Matplotlib
10. Statistical and Probability measures
    a) Frequency distributions
    b) Mean, Mode, Standard Deviation
    c) Variability
    d) Normal curves
    e) Correlation and scatter plots

f) Correlation coefficient
g) Regression

11. Use the standard benchmark data set for performing the following:
    a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
    b) Bivariate Analysis: Linear and logistic regression modelling.
    c) Multiple Regression Analysis
    d) Compare the results of the above analysis for the two data sets

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

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Apply adobe illustrator for image techniques
CO2: Implement transformation process in computer design
CO3: Apply fundamentals of data visualization with python libraries
CO4: Implement basic classification algorithms with visualization techniques
CO5: Apply Real time dataset using visualization tools.

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

OBJECTIVES:

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

LIST OF EXERCISES:

1. Basics of UNIX commands
2. Shell Programming
3. Write C programs to implement the various CPU Scheduling Algorithms
4. Implementation of Semaphores
5. Implementation of Shared memory and IPC
6. Bankers Algorithm for Deadlock Avoidance
7. Implementation of Deadlock Detection Algorithm
8. Write C program to implement Threading and Synchronization Applications
9. Implementation of the following Memory Allocation Methods for fixed partition
    1. First Fit
    2. Worst Fit
    3. Best Fit

10. Implementation of Paging Technique of Memory Management
11. Implementation Page Replacement Algorithms FIFO, LRU & OPTIMAL
12. Implementation of the various File Organization Techniques
13. Implementation of the following File Allocation Strategies
    1. Sequential
    2. Indexed
    3. Linked

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Compare the performance of various CPU Scheduling Algorithms
CO2: Implement Deadlock avoidance and Detection Algorithms
CO3: Implement Semaphores and Create processes and implement IPC
CO4: Analyze the performance of the various Page Replacement Algorithms
CO5: Implement File Organization and File Allocation Strategies.

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

OBJECTIVES:

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

LIST OF EXERCISES:

1.English – Phase II

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

2. Logical Reasoning – Phase II

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

3. Quantitative Ability - Phase II

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

4. Automata Fix – Phase II

Logical, Compilation and Code reuse

5. Automata - Phase II

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

TOTAL: 30 PERIODS

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.