R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY

[An Autonomous Institution]

R.S.M Nagar, Puduvoyal, Gummidipoondi Taluk, Thiruvallur District,
Tamil Nadu- 601206

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 ENGINEERING(CYBER SECURITY)
REGULATIONS – 2022
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Computer Science and Engineering (Cyber Security) Program will

1. Become globally competent professional in all spheres and pursue higher education world over.

2. Successfully carry forward domain knowledge in computing and allied areas to solve complex real world engineering problems.

3. Continuously upgrade their technical knowledge and expertise to keep pace with the technological revolution.

4. Serve the humanity with social responsibility combined with ethics..

PROGRAM OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

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

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

PEO / PO Mapping

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

Programme Educational Objectives (PEOs)	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
I	✓	✓	✓	✓	✓	✓				✓		✓
II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
III	✓	✓	✓	✓	✓						✓	
IV						✓	✓	✓	✓		✓	

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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

YEAR	SEMESTER	COURSE NAME	Programme Outcome (PO)											
			1	2	3	4	5	6	7	8	9	10	11	12
YEAR I	SEMESTER I	Matrices and Calculus	✓	✓	✓	✓	✓	✓	✓					✓
		Engineering Chemistry	✓	✓				✓	✓					✓
		Problem Solving using C++	✓	✓	✓					✓	✓	✓		✓
		Software Development Practices	✓	✓	✓		✓	✓		✓	✓	✓		✓
		Digital Principles and System Design	✓	✓	✓					✓	✓	✓		✓
		Computer aided Engineering Graphics	✓		✓		✓					✓		
		Product Development Lab-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Induction Program						✓	✓	✓	✓	✓	✓	✓
	SEMESTER II	Heritage of Tamils												
		Transforms and Numerical Methods	✓	✓	✓	✓	✓	✓						✓
		Data Structures	✓	✓	✓					✓	✓	✓		✓
		Physics for Computer Science and Information Technology	✓	✓	✓	✓								
		Professional Communication								✓	✓			✓
		Java Programming	✓	✓	✓		✓			✓	✓	✓		✓
		Database Management System	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Product Development Lab - 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Environmental Sciences and Sustainability (Non Credit)	✓	✓				✓	✓			✓		✓
		Yoga for Stress Management												

YEAR	SEMESTER	Course												
		Tamils and Technology												
YEAR II	SEMESTER III	Discrete Mathematics	✓	✓	✓	✓								
		Universal Human Values 2: Understanding Harmony					✓	✓	✓	✓	✓	✓	✓	
		Computer Organization and Architecture	✓	✓	✓	✓								
		Advanced Java Programming	✓	✓	✓	✓				✓	✓	✓		✓
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Operating Systems Using Linux	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Product Development Lab - 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Aptitude and Coding Skills I	✓	✓	✓						✓	✓		
		Internship and Seminar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Value Education (Non-Credit)												
		Linear Algebra and Number Theory	✓	✓	✓	✓				✓	✓	✓		✓
		Distributed and Cloud Computing	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Cyber Security Essentials	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Artificial Intelligence	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Elective I												
		Aptitude and Coding Skills II	✓	✓	✓						✓	✓		
		Mini Project and Design Thinking Practices Lab	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Product Development Lab - 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Yoga/Personality Development (Non-Credit)												

Year	Semester	Course												
YEAR III	SEMESTER V	Computer Networks	✓	✓	✓		✓			✓	✓	✓		✓
		Ethical Hacking	✓	✓	✓		✓			✓	✓	✓		✓
		Secure Coding	✓	✓	✓		✓			✓	✓	✓		✓
		Professional Elective II												
		Professional Elective III												
		Open Elective I												
		Advanced Aptitude and Coding Skills I	✓	✓	✓						✓	✓		
		Internship and Seminar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Indian Constitution (Non Credit)	✓	✓							✓	✓		
	SEMESTER VI	Professional Ethics						✓	✓	✓	✓	✓	✓	✓
		Automata Theory and Compiler Design	✓	✓	✓		✓			✓	✓	✓		✓
		Secure Software Engineering	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Professional Elective IV												
		Professional Elective V												
		Open Elective II												
		Advanced Aptitude and Coding Skills II	✓	✓							✓	✓		
	SEMESTER VII	Cryptography and Cyber Security	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Intrusion Detection and Internet Security	✓	✓	✓	✓	✓			✓	✓	✓		✓
		Professional Elective VI												
		Open Elective III												
		Open Elective IV												

	Course	1	2	3	4	5	6	7	8	9	10	11	12
	Professional Readiness for Innovation, Employability and Entrepreneurship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Essence of Indian Knowledge Tradition (Non Credit)	✓	✓							✓	✓		
SEMESTER VIII	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVES

VERTICALS	COURSE NAME	PROGRAM OUTCOMES											
		1	2	3	4	5	6	7	8	9	10	11	12
CYBER SECURITY	Information Security	✓	✓	✓		✓			✓	✓	✓		✓
	Social Network Security	✓	✓	✓		✓			✓	✓	✓		✓
	Steganography and Digital Watermarking	✓	✓	✓		✓			✓	✓	✓		✓
	Web Security	✓	✓	✓		✓			✓	✓	✓		✓
	Digital and Mobile Forensics	✓	✓	✓		✓			✓	✓	✓		✓
	Vulnerability Analysis and Penetration Testing	✓	✓	✓		✓			✓	✓	✓		✓
	Engineering Secure software systems	✓	✓	✓		✓			✓	✓	✓		✓
	Network Design and Programming	✓	✓	✓		✓			✓	✓	✓		✓
	Fault Tolerant Computing	✓	✓	✓		✓			✓	✓	✓		✓
	Advanced Network Security	✓	✓	✓		✓			✓	✓	✓		✓
	Capstone Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Program	Course	1	2	3	4	5	6	7	8	9	10	11	12
CLOUD COMPUTING	Cloud Foundations	✓	✓	✓		✓			✓	✓	✓		✓
	Cloud Architecting	✓	✓	✓		✓			✓	✓	✓		✓
	Virtualization	✓	✓	✓		✓			✓	✓	✓		✓
	DevOps	✓	✓	✓		✓			✓	✓	✓		✓
	Data Engineering in Cloud	✓	✓	✓		✓			✓	✓	✓		✓
	Cloud Security Foundations	✓	✓	✓		✓			✓	✓	✓		✓
	Software Defined Networks	✓	✓	✓		✓			✓	✓	✓		✓
	Storage Technologies	✓	✓	✓		✓			✓	✓	✓		✓
	Machine Learning for NLP in Cloud	✓	✓	✓		✓			✓	✓	✓		✓
	Cloud Services Management	✓	✓	✓		✓			✓	✓	✓		✓
	Capstone Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FULL STACK DEVELOPMENT	UI/UX Design	✓	✓	✓	✓	✓			✓	✓	✓		✓
	MERN Stack Development	✓	✓	✓	✓	✓			✓	✓	✓		✓
	Mobile Architecture and Application Development	✓	✓	✓	✓	✓			✓	✓	✓		✓
	C# and .Net Programming	✓	✓	✓	✓	✓			✓	✓	✓		✓
	Micro Service Architecture	✓	✓	✓	✓	✓			✓	✓	✓		✓
	Web Application Security	✓	✓	✓	✓	✓			✓	✓	✓		✓
	Capstone Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DATA SCIENCE	Data Science using Python	✓	✓	✓	✓	✓			✓	✓	✓		✓
	Data Exploration Feature Engineering and Visualization	✓	✓	✓		✓			✓	✓	✓		✓
	Health Care Analytics	✓	✓	✓					✓	✓	✓		✓
	Business Intelligence and Analytics	✓	✓	✓		✓			✓	✓	✓		✓
	Ethics in Data Science	✓	✓	✓		✓			✓	✓	✓		✓
	Text and Speech Analytics	✓	✓	✓					✓	✓	✓		✓
	Image and Video Analytics	✓	✓	✓					✓	✓	✓		✓

Category	Course	1	2	3	4	5	6	7	8	9	10	11	12
	Web Information Search and Analytics	✓	✓	✓		✓			✓	✓	✓		✓
	Mining Large Data Sets	✓	✓	✓		✓			✓	✓	✓		✓
	Cognitive Science and Analytics	✓	✓	✓		✓			✓	✓	✓		✓
	Capstone Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ADVANCED SECURITY	Cyber Physical Systems	✓	✓	✓		✓			✓	✓	✓		✓
	AI in Cyber Secrity	✓	✓	✓					✓	✓	✓		✓
	Quantum Cryptography	✓	✓	✓					✓	✓	✓		✓
	Database and Application Security	✓	✓	✓					✓	✓	✓		✓
	Malware Analysis	✓	✓	✓					✓	✓	✓		✓
	Applied Cryptography	✓	✓	✓					✓	✓	✓		✓
	Biometrics and Security	✓	✓	✓		✓			✓	✓	✓		✓
	Cyber Security Governance risk and Compliance	✓	✓	✓		✓			✓	✓	✓		✓
	Hardware Security	✓	✓	✓		✓			✓	✓	✓		✓
	Cyber Security Law	✓	✓	✓		✓			✓	✓	✓		✓
	Capstone Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EMERGING TECHNOLOGIES	Industrial IoT	✓	✓	✓		✓			✓	✓	✓		✓
	GPU Computing	✓	✓	✓		✓			✓	✓	✓		✓
	Edge Stream Analytics												
	Augmented and Virtual Reality	✓	✓	✓		✓			✓	✓	✓		✓
	Digital Marketing	✓	✓	✓		✓			✓	✓	✓		✓
	Quantum Computing	✓	✓	✓		✓			✓	✓	✓		✓
	Intelligent Robots*	✓	✓	✓		✓			✓	✓	✓		✓
	Game Development*	✓	✓	✓		✓			✓	✓	✓		✓
	3D Printing and Design*	✓	✓	✓		✓			✓	✓	✓		✓
	Serverless Computing**	✓	✓	✓		✓			✓	✓	✓		✓

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B.E. - COMPUTER SCIENCE AND ENGINEERING(CYBER SECURITY)
REGULATIONS – 2022
CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTER CURRICULUM AND SYLLABI
(For the Students admitted from the Academic Year 2022-23)

SEMESTER – I								
SI. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	22MA101	Matrices and Calculus	BSC	5	3	0	2	4
2	22CH101	Engineering Chemistry	BSC	5	3	0	2	4
3	22CS101	Problem Solving using C++	ESC	5	3	0	2	4
4	22CS102	Software Development Practices	ESC	5	3	0	2	4
5	22EC101	Digital Principles and System Design	ESC	5	3	0	2	4
LABORATORY COURSES WITH THEORY COMPONENT								
6	22GE101	Computer Aided Engineering Graphics	ESC	3	1	0	2	2
LABORATORY COURSES								
7	22GE111	Product Development Lab-1	EEC	2	0	0	2	1
MANDATORY COURSES								
8		Induction Program (Non Credit)	MC	3 Weeks				
			TOTAL	30	16	0	14	23

SEMESTER – II								
SI. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	22GE201	Heritage of Tamils	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
2	22MA201	Transforms and Numerical Methods	BSC	5	3	0	2	4
3	22CS201	Data Structures	ESC	5	3	0	2	4
4	22PH201	Physics for Computer Science and Information Technology	BSC	5	3	0	2	4
5	22HS101	Professional Communication	HSMC	4	2	0	2	3
6	22CS202	Java Programming	ESC	5	3	0	2	4
7	22CS203	Database Management System	PCC	5	3	0	2	4
LABORATORY COURSES								
8	22GE211	Product Development Lab – 2	EEC	2	0	0	2	1
MANDATORY COURSES								
9	22CH104	Environmental Sciences and Sustainability (Non Credit)	MC	2	2	0	0	0
AUDIT COURSES								
10		Yoga for Stress Management	AC	1	1	0	0	0
			TOTAL	35	21	0	14	25

				SEMESTER – III				
SI. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	22MA301	Discrete Mathematics	BSC	4	3	1	0	4
2	22GE302	Universal Human Values II: Understanding Harmony	HSMC	3	3	0	0	3
3	22GE301	Tamils and Technology	HSMC	1	1	0	0	1
4	22CS302	Computer Organization and Architecture	ESC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5	22CS301	Advanced Java Programming	PCC	5	3	0	2	4
6	22CS303	Design and Analysis of Algorithms	PCC	4	2	0	2	3
7	22CY301	Operating Systems using Linux	PCC	4	2	0	2	3
LABORATORY COURSES								
8	22CS313	Product Development Lab – 3	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
9	22CS311	Aptitude and Coding Skills I	EEC	2	0	0	2	1
10	22CS312	Internship and Seminar	EEC	2	0	0	2	1
AUDIT COURSES								
11		Value Education (Non Credit)	AC	1	1	0	0	0
			TOTAL	**31**	**18**	**1**	**12**	**24**

*2 weeks for one credit. Internship during 4 Semester Summer Vacation

SEMESTER – IV

SI. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	22MA403	Linear Algebra and Number Theory	BSC	5	3	0	2	4
2	22CS401	Distributed and Cloud Computing	PCC	4	2	0	2	3
3	22CY401	Cyber Security Essentials	PCC	5	3	0	2	4
4	22AI301	Artificial Intelligence	PCC	5	3	0	2	4
5		Professional Elective I	PEC	4	2	0	2	3
LABORATORY COURSES								
6	22CS413	Product Development Lab – 4	HSMC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
7	22CS411	Aptitude and Coding Skills II	EEC	2	0	0	2	1
8	22CS412	Mini Project and Design Thinking Lab	EEC	2	0	0	2	1
AUDIT COURSES								
9		Yoga/Personality Development (Non Credit)	AC	1	1	0	0	0
			TOTAL	**30**	**14**	**0**	**16**	**21**

SEMESTER – V								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1		Open Elective I	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
2	22CS501	Computer Networks	PCC	5	3	0	2	4
3	22CS901	Ethical Hacking	PCC	4	2	0	2	3
4	22CY501	Secure Coding	PCC	5	3	0	2	4
5		Professional Elective II	PEC	4	2	0	2	3
6		Professional Elective III	PEC	4	2	0	2	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	22CS511	Advanced Aptitude and Coding Skills I	EEC	2	0	0	2	1
8	22CS512	Internship and Seminar	EEC	2	0	0	2	1
AUDIT COURSES								
9		Indian Constitution (Non Credit)	MC	1	1	0	0	0
			TOTAL	**30**	**16**	**0**	**14**	**22**

*2 weeks for one credit. Internship during 4th Semester Summer Vacation

SI. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
SEMESTER – VI								
THEORY COURSES								
1		Open Elective II	OEC	3	3	0	0	3
2		Professional Ethics	HSMC	2	2	0	0	2
THEORY COURSES WITH LABORATORY COMPONENT								
3	22CY601	Automata Theory and Compiler Design	PCC	5	3	0	2	4
4	22CY602	Secure Software Engineering	PCC	5	3	0	2	4
5	22CS903	Block chain Technology	PCC	4	2	0	2	3
5		Professional Elective IV	PEC	4	2	0	2	3
6		Professional Elective V	PEC	4	2	0	2	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	22CS611	Advanced Aptitude and Coding Skills II	EEC	2	0	0	2	1
			TOTAL	29	17	0	12	23

SEMESTER – VII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1		Open Elective III	OEC	3	3	0	0	3
2		Open Elective IV	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
3	22CS701	Cryptography and Cyber Security	PCC	4	2	0	2	3
4	22CY701	Intrusion Detection and Internet Security	PCC	5	3	0	2	4
5		Professional Elective VI	PEC	4	2	0	2	3
EMPLOYABILITY ENHANCEMENT COURSES								
6	22CS711	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	6	0	0	6	3
MANDATORY COURSES								
7		Essence of Indian Knowledge Tradition (Non Credit)	MC	1	1	0	0	0
			TOTAL	26	14	0	12	19

SEMESTER – VIII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
EMPLOYABILITY ENHANCEMENT COURSES								
1	22CS811	Project Work	EEC	16	0	0	16	8

| | | | | | | | | TOTAL | 16 | 0 | 0 | 16 | 8 |

Credit Summary

S. No.	Subject Area	Credits Per Semester								Credit Total	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1	HSMC		4	4			2			10	6.06%
2	BSC	8	8	4	4					24	14.55%
3	ESC	14	8	3						25	15.33%
4	PCC		4	10	11	11	11	7		54	33.12%
5	PEC				3	6	6	3		18	10.91%
6	OEC					3	3	6		12	7.27%
7	EEC	1	1	3	3	2	1	3	8	22	13.33%
8	MC/AC										
Total		23	25	24	21	22	23	19	8	163+2	

HSMC - Humanities and Social Sciences including Management Course; BSC – Basic Science Course; ESC – Engineering Science Course; PCC – Professional Core Course; PEC – Professional Elective Course; OEC – Open Elective Course; EEC – Employability Enhancement Course; MC – Mandatory Course; AC – Audit Course.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Cyber Security	Cloud Computing	Full Stack Development	Data Science	Advanced Security	Emerging Technologies
Ethical Hacking	Cloud Foundations	UI/UX Design	Data Science using Python	Cyber Physical Systems	Industrial IoT
Social Network Security	Cloud Architecting	MERN Stack Development	Data Exploration Feature Engineering and Visualization	AI in Cyber Security	GPU Computing
Block Chain Technology	Virtualization	Mobile Architecture	Health Care Analytics	Quantum Cryptography	Edge Stream Analytics

		and Application Development			
Web Security	DevOps	C# and .Net Programming	Business Intelligence and Analytics	Database and Application Security	Augmented and Virtual Reality
Digital and Mobile Forensics	Data Engineering in Cloud	Micro Service Architecture	Ethics in Data Science	Malware Analysis	Digital Marketing
Vulnerability Analysis and Penetration Testing	Cloud Security Foundations	Web Application Security	Text and Speech Analytics	Applied Cryptography	Quantum Computing
Engineering Secure software systems*	Software Defined Networks*	Software Testing and Automation*	Image and Video Analytics*	Biometrics and Security	Intelligent Robots
Network Design and Programming*	Storage Technologies*	Server-side Programming with Ruby on Rails*	Web Information Search and Analytics*	Cyber Security Governance risk and Compliance	Game Development
Fault Tolerant Computing*	Machine Learning for NLP in Cloud*	Principles of Programming Languages*	Mining Large Data Sets*	Hardware Security	3D Printing and Design
Advanced Network Security*	Cloud Services Management*	Capstone Project*	Cognitive Science and Analytics*	Cyber Security Law	Serverless Computing
Capstone Project*	Capstone Project*		Capstone Project*	Capstone Project*	

∗ **Minimum of 2 advanced courses with Capstone Project for Honours Degree**

ELECTIVE VERTICALS

CYBER SECURITY								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	22CY901	Information Security	PEC	4	2	0	2	3
2	22CS902	Social Network Security	PEC	4	2	0	2	3
3	22CY902	Steganography and Digital Watermarking	PEC	4	2	0	2	3
4	22CS904	Web Security	PEC	4	2	0	2	3
5	22CS905	Digital and Mobile Forensics	PEC	4	2	0	2	3
6	22CS906	Vulnerability Analysis and Penetration Testing	PEC	4	2	0	2	3
7	22CS923	Engineering Secure software systems*	PEC	4	2	0	2	3
8	22CS924	Network Design and Programming*	PEC	4	2	0	2	3
9	22CS925	Fault Tolerant Computing*	PEC	4	2	0	2	3
10	22CS926	Advanced Network Security*	PEC	4	2	0	2	3
11	22CS812	Capstone Project*	EEC	12	0	0	12	6

		CLOUD COMPUTING						
1	22CS907	Cloud Foundations	PEC	4	2	0	2	3
2	22CS908	Cloud Architecting	PEC	4	2	0	2	3
3	22CS909	Virtualization	PEC	4	2	0	2	3
4	22CS910	DevOps	PEC	4	2	0	2	3
5	22CS911	Data Engineering in Cloud	PEC	4	2	0	2	3
6	22CS912	Cloud Security Foundations	PEC	4	2	0	2	3
7	22CS927	Software Defined Networks*	PEC	4	2	0	2	3
8	22CS928	Storage Technologies*	PEC	4	2	0	2	3
9	22AI922	Machine Learning for NLP in Cloud*	PEC	4	2	0	2	3
10	22CS930	Cloud Services Management*	PEC	4	2	0	2	3
11	22CS812	Capstone Project*	EEC	12	0	0	12	6
		FULL STACK DEVELOPMENT						
1	22CS913	UI/UX Design	PEC	4	2	0	2	3
2	22CS914	MERN Stack Development	PEC	4	2	0	2	3
3	22CS915	Mobile Architecture and Application Development	PEC	4	2	0	2	3
4	22CS916	C# and .Net Programming	PEC	4	2	0	2	3
5	22CS917	Micro Service Architecture	PEC	4	2	0	2	3
6	22CS918	Web Application Security	PEC	4	2	0	2	3
7	22CS933	Software Testing and Automation*	PEC	4	2	0	2	3
8		Server-side Programming with Ruby on Rails*	PEC	4	2	0	2	3
9	22CS934	Principles of Programming Languages*	PEC	4	2	0	2	3
11	22CS812	Capstone Project*	EEC	12	0	0	12	6
		DATA SCIENCE						
1	22AI302	Data Science using Python	PEC	4	2	0	2	3
2	22AI502	Data Exploration Feature Engineering and Visualization	PEC	4	2	0	2	3
3	22AI924	Health Care Analytics	PEC	4	2	0	2	3
4	22AI901	Business Intelligence and Analytics	PEC	4	2	0	2	3
5	22AI905	Ethics in Data Science	PEC	4	2	0	2	3
6	22AI903	Text and Speech Analytics	PEC	4	2	0	2	3
7	22AI907	Image and Video Analytics*	PEC	4	2	0	2	3
8	22AI906	Web Information Search and Analytics*	PEC	4	2	0	2	3
9	22AI909	Mining Large Data Sets*	PEC	4	2	0	2	3
10	22AI910	Cognitive Science and Analytics*	PEC	4	2	0	2	3
11	22CS812	Capstone Project*	EEC	12	0	0	12	6
		ADVANCED SECURITY						

1	22CY903	Cyber Physical Systems	PEC	4	2	0	2	3
2	22CY904	AI in Cyber Security	PEC	4	2	0	2	3
3	22CY905	Quantum Cryptography	PEC	4	2	0	2	3
4	22CY906	Database and Application Security	PEC	4	2	0	2	3
5	22CY907	Malware Analysis	PEC	4	2	0	2	3
6	22CY908	Applied Cryptography	PEC	4	2	0	2	3
7	22CY909	Biometrics And Security	PEC	4	2	0	2	3
8	22CY910	Cyber Security Governance Risk And Compliance	PEC	4	2	0	2	3
9	22CY911	Hardware Security	PEC	4	2	0	2	3
10	22CY912	Cyber Security Law	PEC	4	2	0	2	3
11	22CS812	Capstone Project*	EEC	12	0	0	12	6
EMERGING TECHNOLOGIES								
1	22CS921	Industrial IoT	PEC	4	2	0	2	3
2	22AI933	GPU Computing	PEC	4	2	0	2	3
3	22AI904	Edge Stream Analytics	PEC	4	2	0	2	3
4	22AI937	Augmented and Virtual Reality	PEC	4	2	0	2	3
5	22AI935	Digital Marketing	PEC	4	2	0	2	3
6	22CS922	Quantum Computing	PEC	4	2	0	2	3
7	22AI936	Intelligent Robots	PEC	4	2	0	2	3
8	22CS930	Game Development	PEC	4	2	0	2	3
9	22CS931	3D Printing and Design	PEC	4	2	0	2	3
10	22CS932	Serverless Computing	PEC	4	2	0	2	3

OPEN ELECTIVE OFFERED TO OTHER DEPARTMENTS

1	22CS902	Social Network Security	OEC	3	3	0	0	3
2	22CS908	Cloud Architecting	OEC	3	3	0	0	3
3	22CY903	Cyber Physical Systems	OEC	3	3	0	0	3
4	22CY904	AI in Cyber Security	OEC	3	3	0	0	3

R2022 CURRICULUM
B.E (HONOURS) IN COMPUTER SCIENCE AND ENGINEERING(CYBER SECURITY)
WITH SPECIALIZATION IN

Sl. No.	NAME OF THE HONOURS DEGREE WITH SPECIALIZATION
1	Cyber Security
2	Cloud Computing
3	Full Stack Development
4	Data Science
5	Advanced Security

Additional 18 credits to be completed from the courses offered in the specific Professional Elective Verticals

R2022 CURRICULUM

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

Additional 18 credits to be completed from the courses offered in the Professional Elective Verticals.

R2022 CURRICULUM

B.E. CSE WITH MINOR DEGREE

Sl. No.	Name of the Minor Degree	Offering Department
1.	Internet of Things	Electronics and Communication Engineering
2.	Web development Frameworks	Computer Science and Engineering
3	Ethics in AI	Artificial Intelligence and Data Science
4	Intelligent Healthcare	Artificial Intelligence and Data Science

R2022 CURRICULUM

MINOR DEGREE CURRICULUM OFFERED BY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(CYBER SECURITY)
(FOR OTHER B.E. / B.Tech PROGRAMMES)

Sl. No.	NAME OF THE MINOR DEGREE WITH SPECIALIZATION
1	Data Science
2	Advanced Security

DATA SCIENCE

1	22AI302	Data Science using Python	PCC	4	2	0	2	3
2	22AI917	Health Care Analytics	PCC	4	2	0	2	3
3	22AI901	Business Intelligence and Analytics	PEC	4	2	0	2	3
4	22AI904	Text and Speech Analytics	PEC	4	2	0	2	3
5	22CS812	Capstone Project	EEC	12	0	0	12	6

ADVANCED SECURITY

1	22CY903	Cyber Physical Systems	PCC	4	2	0	2	3
2	22CY904	AI in Cyber Security	PEC	4	2	0	2	3
3	22CY906	Database and Application Security	PEC	4	2	0	2	3
4	22CY907	Malware Analysis	PEC	4	2	0	2	3
5	22CS812	Capstone Project	EEC	12	0	0	12	6

SEMESTER – I

22MA101	MATRICES & CALCULUS (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Explain the concepts of matrix algebra techniques needed for practical applications.
- Determine the curvature of the curves.
- Illustrate the simple applications of multivariable calculus and vector calculus.
- Elaborate the concept and application of multiple integrals.

UNIT I	MATRICES	15

Eigenvalues and Eigenvectors of a real matrix – 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.

Theory: 9

Experiments using SCILAB:

1. Introduction to SCILAB through matrices and general syntax.
2. Finding the Eigenvalues and Eigenvectors.
3. Plotting the graph of a quadratic form.

Laboratory: 6

UNIT II	SINGLE VARIABLE CALCULUS	15

Curvature in Cartesian and Polar Co-ordinates – Centre and radius of curvature – Circle of curvature–Evolutes.

Theory: 9

Experiments using SCILAB:

1. Evaluating the radius of curvature.
2. Finding the coordinates of the center of curvature.
3. Tracing of Curves.

Laboratory: 6

UNIT III	MULTIVARIABLE CALCULUS	15

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.

Theory: 9

Experiments using SCILAB:
1. Evaluating the maxima of functions of several variables.
2. Evaluating the minima of functions of several variables.
3. Evaluation of Jacobians.

Laboratory: 6

UNIT IV	MULTIPLE INTEGRALS	15

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

		Theory: 9
Experiments using SCILAB: 1. Evaluating area under a curve. 2. Evaluating area using double integral. 3. Evaluation of volume by integrals.	
	Laboratory: 6

UNIT V	VECTOR CALCULUS	15

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

Theory: 9

Experiments using SCILAB:

1. Evaluating gradient.
2. Evaluating directional derivative.
3. Evaluating divergent and curl.

Laboratory: 6

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Use the matrix algebra methods to diagonalize the matrix.
CO2: Determine the evolute of the curve.
CO3: Apply differential calculus ideas on the function of several variables.
CO4: Evaluate the area and volume by applying the concept of multiple integration.
CO5: Utilize the concept of vector calculus in evaluating 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.

REFERENCES:

1. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
2. SivaramakrishnaDass, 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.

LIST OF EQUIPMENTS:
   1. SCILAB- Open source

22CH101	ENGINEERING CHEMISTRY	L	T	P	C
	(Common to All Branches)	3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand the water quality criteria and interpret its applications in water purification.
- To gain insights into the basic concepts of electrochemistry and implement its applications in chemical sensors.
- To acquire knowledge on the fundamental principle of energy storage devices and relate it to electric vehicles.
- To identify the different types of smart materials and explore their applications in Engineering and Technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

UNIT I	WATER TECHNOLOGY	15

Sources of water –Impurities - Drinking water quality parameters –Hardness and its types, problems - Municipal water treatment and disinfection (chlorination- break-point chlorination,UV, Ozonation). Boiler troubles- Scales and sludges, Boiler feed water: Requirements - Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning). External treatment –Ion exchange demineralization - Principle, process and fouling.

Desalination of brackish water: Reverse osmosis –principle-types of membranes, process and fouling.

(Theory-9)

Determination of total, temporary and permanent hardness of water by EDTA method.
Determination of chloride content of water sample by argentometric method.
Determination of alkalinity in water sample

(Laboratory-6)

UNIT II	ELECTROCHEMISTRY AND SENSORS	15

Introduction- Conductance- factors affecting conductance – Electrodes– origin of electrode potential – single electrode potential, standard electrode potential – measurement of single electrode potential –over voltage - reference electrodes (standard hydrogen electrode, calomel electrode)-ion selective electrode- glass electrode - Nernst equation (derivation),numerical problems, Electrochemical series and its applications.
Chemical sensors – Principle of chemical sensors – Breath analyzer– Gas sensors – CO_2 sensors-Sensor for health care – Glucose sensor.

(Theory-9)

Determination of the amount of NaOH using a conductivity meter.

Determination of the amount of acids in a mixture using a conductivity meter.
Determination of the amount of given hydrochloric acid using a pH meter.

(Laboratory-6)

UNIT III	ENERGY STORAGE DEVICES AND ENERGY SOURCES	15

Batteries –Primary alkaline battery - Secondary battery - Pb-acid battery, Fuel cell - H_2 – O_2 fuel cell.
Batteries used in E- vehicle: Ni-metal hydride battery, Li-ion Battery, Li-air Battery
Nuclear Energy – Nuclear fission, fusion, differences, characteristics – nuclear chain reactions – light water nuclear reactor – breeder reactor.

(Theory-9)

Determination of single electrode potential of the given electrode.
Estimation of the iron content of the given solution using apotentiometer.
Determination of electrochemical cell potential (using different electrodes/ different concentrations of electrolytes)

(Laboratory-6)

UNIT IV	SMART MATERIALS FOR ENGINEERING APPLICATIONS	15

Polymers – Definition – Classification – smart polymeric materials - Preparation, properties and applications of Piezoelectric polymer - Polyvinylidene fluoride (PVDF), Electroactive polymer- Polyaniline (PANI) and Biodegradable polymer - Polylactic acid (PLA).
Polymer composites: Definition, Classification – FRP's – Kevlar.
Shape Memory Alloys: Introduction, Shape memory effect – Functional properties of SMAs – Types of SMA - Nitinol (Ni-Ti) alloys - applications.
Chromogenic materials:Introduction – Types - applications.

(Theory-9)

Determination of themolecular weight of polymer using Ostwald viscometer.
Application of polymeric fibers in 3D printing.

(Laboratory-6)

UNIT V	NANO CHEMISTRY	15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

(Theory-9)

Determination of concentration of $BaSO_4$ nanoparticles by conductometric titrations.
Preparation of ZnO nanocrystal by precipitation method.

(Laboratory-6)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Interpret the water quality parameters and explain the various water treatment methods.

CO2: Construct the electro chemical cells and sensors.

CO3: Compare different energy storage devices and predict their relevance in electric vehicles.

CO4: Classify different types of smart materials, their properties and applications in Engineering and Technology.

CO5: Integrate the concepts of nano chemistry and enumerate its applications in various fields.

TEXT BOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai PublishingCompany Pvt. Ltd., New Delhi, 2022.
2. SivasankarB., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012.

REFERENCES:

1. S.S. Daraand S.S. Umare, "A Textbook of Engineering Chemistry",12thEdition, S.Chand&Company, NewDelhi, 2013.
2. V.R. Gowarikar, Polymer Science, 2nd edition, New Age International Publishers, 2021.
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 and Ludovico Cademartiri, "Nanochemistry: A Chemical ApproachtoNanomaterials",2ndEdition,RSC publishers,2015.
5. Prasanna Chandrasekhar, "Conducting polymers, fundamentals and applications– Including Carbon Nanotubes and Graphene", Second Edition, Springer Science & Business Media, New York, 2019.
6. 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., 2019.

LIST OF EQUIPMENTS:

1. Conductivity meter – 20 Nos.
2. pH meter - 19 Nos.
3. Potentiometer - 20 Nos.

| 22CS101 | PROBLEM SOLVING USING C++ | L | T | P | C |

(Common to All Branches)	3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

UNIT I	PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS	15

Computational thinking for Problem solving – Algorithmic thinking for Problem solving - Building Blocks - Problem Solving and Decomposition - Dealing with Error – Evaluation. Overview of C – Data types – Identifiers – Variables – Storage Class Specifiers – Constants – Operators - Expressions – Statements – Arrays and Strings – Single-Dimensional – Two-Dimensional Arrays – Arrays of Strings – Multidimensional Arrays.

List of Exercise/Experiments:
1. Write C/C++ programs for the following:
   a. Find the sum of individual digits of a positive integer.
   b. Compute the GCD of two numbers.
   c. Find the roots of a number (Newton's method)
2. Write C/C++ programs using arrays:
   a. Find the maximum of an array of numbers.
   b. Remove duplicates from an array of numbers.
   c. Print the numbers in an array after removing even numbers.
3. Write C/C++ programs using strings:
   a. Checking for palindrome.
   b. Count the occurrences of each character in a given word.

UNIT II	POINTERS AND FUNCTIONS	15

Pointers -Variables – Operators – Expressions – Pointers and Arrays – Functions - Scope Rules – Function Arguments – return Statement – Recursion – Structures – Unions – Enumerations.

List of Exercise/Experiments:
1. 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.
2. Compute internal marks of students for five different subjects using structures and functions.

UNIT III	CLASSES AND OBJECTS	15

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

List of Exercise/Experiments:

List of Exercise/Experiments:
1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

UNIT IV	OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM	15

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.
Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

List of Exercise/Experiments:
1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:
   a) Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance.

UNIT V	I/O, FILES AND EXCEPTIONS	15

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

List of Exercise/Experiments:
1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.
4. Mini project.

TOTAL: 45+30 = 75 PERIODS

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

CO1: Solve problems using basic constructs in C.
CO2: Implement C programs using pointers and functions.
CO3: Apply object-oriented concepts and solve real world problems.
CO4: Develop C++ programs using operator overloading and polymorphism.
CO5: Implement C++ programs using Files and exceptions.

TEXT BOOKS:
1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015. (Unit 1 & 2)
2. E Balagurusamy,"Object Oriented Programming with C++", 4th Edition, Tata McGraw-Hill Education, 2008. (Unit 3, 4 & 5)

REFERENCES:
1. Karl Beecher,"Computational Thinking: A beginner's guide to problem-solving and programming", BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, "Programming and Problem Solving with C++", 5th Edition, Jones and Barklett Publishers, 2010.
3. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
4. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
5. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/ lex_auth_01297200240671948837_shared/overview

LIST OF EQUIPMENTS:
1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

22CS102	SOFTWARE DEVELOPMENT PRACTICES (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:
- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I	AGILE SOFTWARE DEVELOPMENT AND Git and GitHub	15

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

List of Exercise/Experiments:
1. Form a Team, Decide on a project:
    a) Create a repository in GitHub for the team.
    b) Choose and follow a Git workflow
        ▪ Each team member can create a StudentName.txt file with contents about themselves and the team project

- Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
- Team members can now create a Pull request to merge the branch to master branch or main development branch.
- The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
- Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

3. Form a Team, Decide on a project:
   c) Create a repository in GitHub for the team.
   d) Choose and follow a Git workflow
   - Each team member can create a StudentName.txt file with contents about themselves and the team project
   - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
   - Team members can now create a Pull request to merge the branch to master branch or main development branch.
   - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
   - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

4. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II	HTML	15

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

List of Exercise/Experiments:
1. Create web pages using the following:
   - Tables and Lists
   - Image map
   - Forms and Form elements
   - Frames

UNIT III	CSS	15

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients –

Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

List of Exercise/Experiments:
    1. Apply Cascading style sheets for the web pages created.

UNIT IV	JAVASCRIPT BASICS	15

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:
    1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

UNIT V	JAVASCRIPT OBJECTS	15

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:

    1. Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.
  a. Online assessment system
  b. Ticket reservation system
  c. Online shopping
  d. Student management system
  e. Student result management system
  f. Library management
  g. Hospital management
  h. Attendance management system
  i. Examination automation system
  j. Web based chat application

TOTAL: 75 PERIODS

OUTCOMES:

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

    CO1: Apply agile development methods in software development practices.
    CO2: Set up and create a GitHub repository.
    CO3: Develop static and dynamic webpages using HTML.
    CO4: Design interactive personal or professional webpages using CSS.
    CO5: Develop web pages using Java script with event-handling mechanism.

TEXT BOOKS:

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

2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.

REFERENCES:

1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/ lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/ toc/lex_auth_0130944214274703362099_shared/overview

LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse

Java/JSP/ISP Webserver/Apache

Tomcat / MySQL / Dreamweaver or

Equivalent/ Eclipse, WAMP/XAMP

22EC101	DIGITAL PRINCIPLESAND SYSTEMS DESIGN (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To acquire the knowledge in Digital fundamentals and its simplification methods.
- To familiarize the design of various combinational digital circuits using logic gates.
- To realize various sequential circuits using flip flops.
- To interpret various clocked sequential circuits.
- To elucidate various semiconductor memories and related technology.
- To build various logic functions using Programmable Logic Devices.

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Review of number systems-representation-conversions, Review of Boolean algebra-theorems, sum of product and product of sum simplification, canonical forms, min term and max term, Simplification of Boolean expressions-Karnaugh map,Implementation of Boolean expressions using logic gates and universal gates.

List of Exercise/Experiments:

1. Implementation of Boolean expression using logic gates.

UNIT II	COMBINATIONAL LOGIC CIRCUITS	9

Design of combinational circuits - Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/De-mux, Parity Generator/Checker

List of Exercise/Experiments:
1. Design of adders
2. Design ofsubtractors.
3. Design of binary adder using IC7483
4. Design of Multiplexers &Demultiplexers.
5. Design of Encoders and Decoders.
6. Implementation of a boolean function using a multiplexer.

UNIT III	SEQUENTIAL CIRCUITS	9

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Asynchronous and Synchronous Counters Design - Shift registers, Universal Shift Register

List of Exercise/Experiments:
1. Design and implementation of 3 bit ripple counters.
2. Design and implementation of 3 bit synchronous counter
3. Design and implementation of shift registers

UNIT IV	SYNCHRONOUSSEQUENTIAL CIRCUITS DESIGN	9

Design of clocked sequential circuits - Moore/Mealy models, state minimization, state assignment, circuit implementation

UNIT V	MEMORY AND PROGRAMMABLE LOGIC DEVICES	9

Basic memory structure ROM: PROM – EPROM – EEPROM –RAM – Static and dynamic RAM – Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Implement digital circuits using simplified Boolean functions.

CO2: Realize Combinational circuits for a given function using logic gates.

CO3: Demonstrate the operation of various counters and shift registers using Flip Flops.

CO4: Analyze Synchronous Sequential circuits.

CO5: Summarize the various types of memory devices.

CO6: Design the Combinational circuits using Programmable Logic Devices.

CO7: Perform practical exercises as an individual and / or team member to manage the task in time.

CO8: Express the experimental results with effective presentation and report.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.
2. S.Salivahanan and S.Arivazhagan,Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.

REFERENCES:

1. A.Anandkumar, Fundamental of digital circuits, 4th Edition, PHI Publication,2016.
2.WilliamKleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.
3.CharlesH.Roth, Jr. andLarry L. Kinney, Fundamentals of Logic Design, 7th Edition, Thomson Learning, 2014.
4.Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017.
5.John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India, 2006.

NPTEL LINK: https://nptel.ac.in/courses/108/105/108105132/

LIST OF EQUIPMENTS:

22GE101	COMPUTER AIDED ENGINEERING GRAPHICS (Common to All Branches)	L	T	P	C
		1	0	2	2

OBJECTIVES:

The Course will enable learners to:

- To help students understand universal technical drawing standards.
- To provide training on drafting software to draw part models.
- To demonstrate the concepts of orthographic and isometric projections.
- To use drawing skills for communicating concepts, ideas for engineering product design.
- Use pictorial views to visualize and draw the isometric view of the objects.

UNIT I	INTRODUCTION TO CONVENTIONS IN ENGINEERING DRAWING AND CONIC SECTIONS	9

Introduction to Engineering Drawing - Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Conic curves - Ellipse, Parabola and Hyperbola by Eccentricity method.

(Theory - 3)

Drawing of a title block with necessary text, projection symbol and lettering using drafting software.
Drafting of Conic curves - Ellipse, Parabola and Hyperbola

(Laboratory - 6)

UNIT II	ORTHOGRAPHIC PROJECTION	9

Visualization concepts and Orthographic Projection - Layout of views – Orthographic Projection- Conversion of pictorial diagram into orthographic views.

(Theory - 3)

Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc, and dimensioning.

Drawing of orthographic views from the given pictorial diagram.

(Laboratory -6)

UNIT III	PROJECTION OF PLANES	9

Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method.

(Theory - 3)

Drawing of plane Surface inclined to HP.
Drawing of plane Surface inclined to VP.

(Laboratory -6)

UNIT IV	PROJECTION OF SOLIDS	9

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to HP by rotating object method.

(Theory - 3)

Drawing of simple solids like prism and pyramids when the axis is inclined to HP.
Drawing of simple solids like cylinder and cone when the axis is inclined to HP.

(Laboratory -6)

UNIT V	ISOMETRIC DRAWING	9

Principles of isometric view – Isometric view of simple solids – Prism, Pyramid, Cylinder and Cone.

(Theory - 3)

Drawing isometric projection of simple solids.
Modeling of 2D to 3D objects using drafting software.

(Laboratory -6)

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the various engineering standards required for drafting and explore knowledge in conic sections.

CO2: Draw the orthographic views of 3Dprimitive objects.

CO3: Describe the projection of plane surfaces by the rotating plane method.

CO4: Apply the projection concepts and drafting tools to draw projections of solids.

CO5: Sketch the pictorial views of the objects using CAD tools.

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. "Engineering Drawing", Charotar Publishing House, 53rd edition ,2019.
2. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2019.
3. Engineering Drawing Practice for Schools and Colleges BIS SP46:2003 (R2008), Published by Bureau of Indian Standards (BIS), 2008.
4. Parthasarathy. N.S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2019.

5. Gopalakrishna. K.R., Engineering Drawing Vol. 1 & 2, Subhas Publications, 27th Edition, 2017.

LIST OF EQUIPMENTS:

22GE111	PRODUCT DEVELOPMENT LAB - 1 (Common to All Branches)	L	T	P	C
		0	0	2	1

The students may be grouped into 3 to 4 and work under a project supervisor. The device/system/component/prototype Idea to be developed by the students and a final presentation to be done by the students about the idea generated at the end of the semester.

OBJECTIVES:
The Course will enable learners to:
- Understand the functionalities and limitation of various machine/equipment
- Demonstrate various operations that can be performed to machines
- Summarize the basic principles of machines to convert their ideas into products

I   1. Study of Manufacturing Processes (Carpentry, Plumbing, Machines and Welding).
      2. Study of fundamental operations of 3D Printer and Scanner with Software.
      3. Study of Smart Machining (CNC and Laser cutting) and Engraving Techniques.
II   1. Study of Fundamental of Circuit Design.
      2. Study of PCB Milling Machine.
      3. Study of Soldering and Desoldering.
III 1. Study of Computer Peripheral Devices (Processing Information Devices)
IV   1. Present the Product Idea Presentation - Phase – I.

                                                                          TOTAL: 30 PERIODS

Note:
The students can select the prototype to be made of their choice after learning the above exercises.

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Understand the concept of manufacturing processes.
CO2: Describe the working of the machine element.
CO3: Discuss the various applications of engineering materials
CO4: Summarize the basics of core engineering concepts.
CO5: Describe the process for converting ideas into products

LIST OF EQUIPMENTS:
1. CNC Router – 1 No.
2. 3D Printer – 1 No.
3. 3D Scanner – 1 No.
4. Laser cutting Machine – 1 No.

5. Centre lathe – 2 Nos.
6. Arc welding transformer with cables and holders – 2 Nos.
7. Plumbing tools – 2 Nos.
8. Carpentry tools – 2 Nos.
9. Multimeter – 10 Nos.
10. Drilling Machine – 1 No.
11. Solder Stations 5 Sets
12. Desoldering Machine – 1 No.
13. PCB Milling Machine – 1 No.
14. Variable Power Supply – 1 No.
15. Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. – 10 Sets
16. Personal Desktop Computers – 30 Nos.

SEMESTER – II

22GE201	HERITAGE OF TAMILS (Common to All Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES:
The Course will enable learners to:
• Recognize Tamil literature and its significance in Tamil culture.
• Introduce the Tamils' rich artistic and cultural legacy.
• Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
• Acquaint the concept of Thinai in Tamil literature and culture.
• Comprehend the significance of Tamil in developing Indian culture.

UNIT I	LANGUAGE AND LITERATURE	3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -- Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III	FOLK AND MARTIAL ARTS	3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV	THINAI CONCEPT OF TAMILS	15

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

OUTCOMES:

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

CO1: State the role of Tamil literature in shaping Tamil Cultural roots.

CO2: Express the cultural and religious significance of Tamil art and sculptures.

CO3: Identify and describe the techniques of folk and martial arts.

CO4: Classify the role of Thinai concept in Tamil culture and literature.

CO5: Compare the idea of cultural and intellectual contributions of Tamils.

TEXT BOOKS & REFERENCES:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

22MA201	TRANSFORMS AND NUMERICAL METHODS (Common to CSE /ADS / CSE(CS))	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Introduce the concepts of Laplace transforms and Z-transforms.
- Illustrate the application of transforms in solving differential and difference equations.

- Explain the Numerical methods for handling algebraic and transcendental equations.
- Introduce the numerical techniques for interpolation, differentiation and integration.

UNIT I	LAPLACE TRANSFORMS	15

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).

Theory: 9

Experiments using SCILAB:
1. Finding Laplace transform of a function.
2. Finding inverse Laplace Transforms.
3. Determine the input for given output function of Laplace Transform.

Laboratory: 6

UNIT II	Z – TRANSFORMS	15

Z-transforms – Elementary properties – Inverse Z-transforms – partial fractions method –residues method – Convolution theorem.

Theory: 9

Experiments using SCILAB:
1. Finding Z –transform of a sequence.
2. Finding convolution of two sequences.
3. Plotting the input and output function of Z transform.

Laboratory: 6

UNIT III	SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS	15

Solution of linear ordinary differential equation of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transform. Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

Theory: 9

Experiments using SCILAB:
1. Solving second order Ordinary Differential Equation.
2. Finding the Laplace transform and its inverse of a function numerically.
3. Finding the Z-transform numerically

Laboratory: 6

UNIT IV	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	15

Solution of algebraic and transcendental equations by Newton Raphson method - Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Gauss Seidel Iterative method– Eigenvalues of a matrix by Power method.

Theory: 9

Experiments using SCILAB:

1. Finding the real roots of algebraic and transcendental equations using Newton Raphson method.
2. Finding the largest Eigenvalue by power method.
3. Solving system of linear equations using Gauss Seidel Method.

		Laboratory: 6
UNIT V	**NUMERICAL DIFFERENTIATION AND INTEGRATION**	**15**

Finite differences – Forward and Backward differences – Interpolation – Newton's forward and backward interpolation formulae - Lagrange's interpolation for unequal intervals - Numerical Differentiation - Newton's and Lagrange's formulae - Numerical integration using Trapezoidal and Simpson's 1/3 rules – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Theory: 9

Experiments using SCILAB:
1. Finding approximately the missing value using Lagrange interpolation.
2. Evaluating line integrals by trapezoidal rule.
3. Evaluating line integrals by Simpson's rule.

Laboratory: 6

TOTAL: 75 PERIODS

OUTCOMES:
  Upon completion of the course, the students will be able to:
CO1: Determine Laplace transform and inverse transform of simple functions.
CO2: Determine Z- transform and inverse transform of simple functions.
CO3: Solve ordinary differential equations using Laplace transform and difference equations using Z-Transform.
CO4: Compute the solutions of algebraic, transcendental and the system of equations.
CO5: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

TEXT BOOKS:
1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCES:

13. Erwin. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

14. Jain R.K. and Iyengar S. R. K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

15. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

16. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.

17. Sastry S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

LIST OF EQUIPMENTS:
1. SCILAB - Open source

22CS201	DATA STRUCTURES (Common to CSE, ECE, ADS and CSE(CS))	L	T	P	C
		3	0	2	4

OBJECTIVES:
The Course will enable learners to:
- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- 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	15

Algorithm analysis - 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).

List of Exercise/Experiments:
- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

UNIT II	LINEAR DATA STRUCTURES – STACKS, QUEUES	15

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 - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

List of Exercise/Experiments:
- Array implementation of Stack and Queue ADTs.
- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
- Applications of Stack – Infix to postfix conversion and expression evaluation.

UNIT III	NON LINEAR DATA STRUCTURES – TREES	15

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT– AVL Tree.

List of Exercise/Experiments:
- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
- Implementation of Heaps using Priority Queues.

UNIT IV	NON LINEAR DATA STRUCTURES - GRAPHS	15

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

List of Exercise/Experiments:
- Graph representation and Traversal algorithms.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	15

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

List of Exercise/Experiments:

| | | Implement searching and sorting algorithms. | | | | |

| | **TOTAL: 75 PERIODS** |

OUTCOMES:
 Upon completion of the course, the students will be able to:
CO1: Implement abstract data types for list.
CO2: Solve real world problems using appropriate linear data structures.
CO3: Apply appropriate tree data structures in problem solving.
CO4: Implement appropriate Graph representations and solve real-world applications.
CO5: Implement various searching and sorting algorithms.

TEXT BOOKS:
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson Education, 2014.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.

REFERENCES:
1. Rajesh K. Shukla, "Data Structures using C and C++", Wiley India Publications, 2009.
2. Narasimha Karumanchi, "Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles", CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, "Fundamentals of Data Structures in C++", Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/ toc/lex_auth_01350157816505139210584/overview

LIST OF EQUIPMENTS:
 Systems with Linux/Ubuntu Operating System with gnu C++ compiler

		L	T	P	C
22PH201	**PHYSICS FOR COMPUTER SCIENCE AND INFORMATION TECHNOLOGY (Common to All Branches)**	**3**	**0**	**2**	**4**

OBJECTIVES:
The Course will enable learners to:
- Learn the fundamental concepts of Physics and apply this knowledge to scientific, engineering and technological problems.
- Make the students enrich basic knowledge in electronics and quantum concepts and apply the same in computing fields.

UNIT I	**LASER AND FIBRE OPTICS**	**15**

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 and propagation of light through optical fibre - V-number - Types of optical fibres (Material, refractive index and mode) - Losses in optical fibre

- Fibre optic communication - Fibre optic sensors (pressure and displacement).

(Theory -9)

List of Experiments:
1. Determination of divergence of laser beam
2. Determination of acceptance angle and numerical aperture of an optical fibre

(Laboratory -6)

UNIT II	ELECTRON THEORIES OF MATERIALS	15

Classical free electron theory - Expressions for electrical conductivity and thermal conductivity - Wiedemann-Franz law - Success and failures of CFT- Effect of temperature on Fermi function- Density of energy states and average energy of electron at 0 K - Energy bands in solids.

(Theory -9)

List of Experiments
1. Determination of thermal conductivity of a bad conductor by Lee's disc method
2. Measurement of the internal resistance using potentiometer

(Laboratory -6)

UNIT III	SEMICONDUCTOR PHYSICS	15

Intrinsic Semiconductors – E-kdiagram-Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors- Band gap determination-Extrinsic semiconductors - Carrier concentration in n-type and p-type semiconductors -Electrical conductivity of intrinsic and extrinsic semiconductors - Variation of Fermi level with temperature and impurity concentration - Hall effect and its applications.

(Theory -9)

List of Experiments
1. Bandgap determination of intrinsic semiconductor.
2. Determination of wavelength of semiconductor laser

(Laboratory -6)

UNIT IV	INTRODUCTION TO NANO DEVICES AND QUANTUM COMPUTING	15

Introduction to nanomaterial -Electron density in a bulk material - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structures - Band gap of nanomaterial.
Quantum computing: Quantum states - classical bits - quantum bits or qubits - CNOT gate - multiple qubits - Bloch sphere - quantum gates - advantages of quantum computing over classical computing.

(Theory - 9)

List of Experiments
1. Synthesis of nanoparticles by sol-gel method
2. Determination of particle size using laser source

(Laboratory - 6)

UNIT V	MAGNETIC AND SUPERCONDUCTING MATERIALS	15

Introduction- Bohr magneton -magnetic dipole moment - origin of magnetic moments - types of magnetic materials-Ferromagnetism: Domain Theory - antiferromagnetism - ferrimagnetism - magnetic principle in computer data storage

- Magnetic hard disc (GMR sensor) - Introduction to spintronics.
Superconducting materials – properties, types of superconductors, applications – SQUID and MAGLEV trains - *superconducting qubits in quantum computing.*

(Theory -9)

List of Experiments
1. Determination of hysteresis loss using B-H loop
2. Determination of magnetic susceptibility of a paramagnetic liquid using Quincke's apparatus

(Laboratory -6)

TOTAL: 75 PERIODS

OUTCOMES:
 Upon completion of the course, the students will be able to:
 CO1: Discuss the basic principles of working of laser and their   applications in fibre optic communication

 CO2: Summarize the classical and quantum electron theories and energy band structures

 CO3: Describe the conductivity in intrinsic and extrinsic semiconductors and importance   of Hall effect measurements

 CO4: Associate the properties of nanoscale materials and their applications in quantum computing

 CO5: Interpret the properties of magnetic and superconducting materials and their applications in computer data storage

TEXT BOOKS:
1. **S.O. Kasap**,Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition) 2020.
2. **Jasprit Singh**, Semiconductor Devices: Basic Principles, Wiley (Indian Edition) 2007.
3. **Parag K Lala**, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition) 2020.

REFERENCES:
1. **R.P. Feynman**, The Feynman Lectures on Physics - Vol. II, The New Millennium Edition, 2012.
2. **M.A.Wahab**, Solid State Physics, 3rd Edition, Narosa Publishing House Pvt. Ltd., 2015.
3. **B.Rogers, J. Adams and S.Pennathur**,Nanotechnology: Understanding Small System, CRC Press, 2014.
4. **C.P. Williams,** Explorations in Quantum Computing, Springer-Verlag London, 2011.
5. **Wilson J.D. and Hernandez C.A.,** Physics Laboratory Experiments,   Houghton Mifflin Company, New York 2005.
6. **Department of Physics,** Physics laboratory manual, R.M.K. Group of Institutions, 2021.

LIST OF EQUIPMENTS:

1.	Semiconductor Laser	6 Nos.

2.	Determination of optical fibre parameters		6 Nos.	
3.	Lee's disc apparatus		6 Nos.	
4.	Potentiometer		6 Nos.	
5.	Bandgap determination set up		6 Nos.	
6.	Sol-gel synthesis		2 Nos.	
7.	B-H loop set-up		5 Nos.	
8.	Quincke's apparatus		2 Nos.	

		L	T	P	C
22HS101	**PROFESSIONAL COMMUNICATION** **(Common to All Branches)**	**2**	**0**	**2**	**3**

OBJECTIVES:
The Course will enable learners to:
- Strengthen basic reading and writing skills.
- Comprehend listening contexts competently.
- Inculcate reading habit and develop effective reading skills.
- Improve active and passive vocabulary.
- Acquire speech clarity with right pronunciation.
- Develop vocabulary of a general kind and enhance grammatical accuracy.
- Imbibe Content and Language Integrated Learning (CLIL).

UNIT I	FORMAL AND INFORMAL COMMUNICATION	12

Listening: Short Texts, Short Formal and Informal Conversations
Speaking: Self Introduction, Exchanging Personal Information
Reading: Practice in Skimming, Scanning and Predicting, Reading Comprehension
Writing: Free Writing, Hints Development
Grammar: Parts of Speech, Prepositions.
Vocabulary: Compound Nouns, Technical Words.

(Theory 6)

1. Familiarization of Vowel Sounds-Monophthongs, Diphthongs and Consonant Sounds
2. Listening to Formal Conversations in British and American Accents
3. Guided Writing

(Laboratory 6)

UNIT II	GRAMMAR AND LANGUAGE DEVELOPMENT	12

Listening: Telephonic Conversations.
Speaking: Sharing information of a personal kind - Greetings – Taking leave.
Reading: Short comprehension passages - Pre-reading and Post-reading (multiple choice questions shortquestions / open and close ended questions)
Writing: Instructions, Recommendations, Checklists
Grammar: Tenses, Framing 'Wh' & 'Yes' or 'No' questions
Vocabulary: Numerical Adjectives, Collocations
.
(Theory 6)

1. Communication Etiquettes
2. Self -Introduction using SWOT Analysis

(Laboratory 6)

UNIT III	BASIC TECHNICAL WRITING AND STUDY SKILLS	12

Listening: Listening to longer texts and filling up the tables

Speaking: Asking about routine actions and expressing opinions
Reading: Short texts (Cloze Test)
Writing: Formal letters, E-mail writing, Interpretation of Charts and Graphs
Grammar: Cause and Effect expressions, Conditional Clauses
Vocabulary: Often misspelled and confusing words

(Theory 6)

Mechanics of Reading Skills
News Reading–Cloze Tests

(Laboratory 6)

UNIT IV	GROUP DISCUSSION AND JOB APPLICATIONS	12

Listening: Listening to recorded dialogues of conversations and completing exercises based on them
Speaking: Discussion on Social issues.
Reading: Reading text from magazines
Writing: Purpose Expressions, Letter of Application, Minutes of Meeting.
Grammar: Modal Verbs, Subject-Verb agreement
Vocabulary : Sequence Words

(Theory 6)

1. Group Presentation, Group Discussion: Do's and Don'ts of GroupDiscussion
2. Discussions on failure and success in interviews of famous personalities
   Spotting Errors

(Laboratory 6)

UNIT V	ART OF REPORTING	12

Listening: Listening to TED talks
Speaking: Debate & Presentations
Reading: Biographies
Writing: Definitions (Single line & Extended), Report Writing (Industrial visit, Accident and Feasibilityreports)
Grammar: Reported speech
Vocabulary : Verbal Analogies   (Theory 6)
1. Writing based on listening to academic lectures and discussions
2. Leadership skills, Negotiation skills
3. Mechanics of Report Writing

(Laboratory 6)

 LIST OF PROJECTS
 1. Create a podcast on a topic that will be interesting to college students
 2. Read and Review (Movie/Book/Technical Article)
 3. Presentation on Social Issues
 4. Submit a report on "Global English: A study"

TOTAL: 60 PERIODS

OUTCOMES:
 Upon completion of the course, the students will be able to:
　　　CO1: Comprehend conversations and short talks delivered in English
　　　CO2: Participate efficiently in informal conversations and develop an awareness of the self and apply well-defined techniques
　　　CO3: Read articles of a general kind in magazines and newspapers efficiently

CO4: Write short general essays, personal letters and E-mails in English CO5: Develop vocabulary of a general kind by enriching reading skills

TEXT BOOKS:

1. **Kumar, Suresh E, & Sreehari, P.** *Communicative English*. Orient Black Swan, 2007.
2. **Richards, Jack C.** 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.
3. **Elbow, Peter.** *Writing Without Teachers*. London: Oxford University Press, 1973.
4. **Larsen, Kristine.** *Stephen Hawking*: *A Biography*, Greenwood: Publishing Group, 2005.
5. **Redston, Chris & Gillies Cunningham.** Face2Face (Pre- intermediate Students'Book &Workbook) Cambridge University Press, New Delhi: 2005.
6. Lewis, Norman. Word Power Made Easy, Latest Edition: Penguin Random House India: 2015

WEB REFERENCES:

1. Basics of Business Communication

    https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01

    2688768083632128308_shared/overview

2. communicating to Succeed

    https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01

    2686653619175424640_shared/overview

3. Business English

https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683227498151936279_shared/overview

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013267708367904768573/overview (lab support)

4. Business Writing

    https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01268947760100966433_shared/overview

5. Email Etiquettes

    https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01329462386556108817682_shared/overview

6. Email Writing Skills

https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01268954

363013529666_shared/overview

7. Time Management

https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012985

921210736640721_shared/overview

8. Understanding Body Language

https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0129797

3765144576024689_shared/overview

9. ONLINE RESOURCES:

https://infyspringboard.onwingspan.com/web/en/page/home

LIST OF EQUIPMENTS:

22CS202	JAVA PROGRAMMING (Common to All Branches)	L	T	P	C
		3	0	2	4

OBJECTIVES:
The Course will enable learners to:
- To explain object oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

UNIT I	JAVA FUNDAMENTALS	15

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

List of Exercise/Experiments:
1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff
If the type of the EB connection is domestic, calculate the amount to be paid as follows: First 100 units - Rs. 1 per unit
101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit
> 501 units - Rs. 6 per unit
 If the type of the EB connection is commercial, calculate the amount to be paid as

follows: First 100 units - Rs. 2 per unit

101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit

> 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)

a. Find kth smallest element in an unsorted array

b. Find the sub array with given sum

c. Matrix manipulations – Addition, Subtraction, Multiplication

d. Remove duplicate elements in an Array

e. Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

Example: The 11th digit in the sequence 12345678910111213…. is 0.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	15

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.

List of Exercise/Experiments:

1. 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.

2. 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.

3. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.

4. 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.

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

UNIT III	MULTITHREADING, I/O AND GENERIC PROGRAMMING	15

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.

List of Exercise/Experiments:

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

UNIT IV	STRING HANDLING AND COLLECTIONS	15

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

List of Exercise/Experiments:

1.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.

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

3. 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.

UNIT V	JDBC CONNECTIVITY	15

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

List of Exercise/Experiments:

- Mini Project (using JDBC)

	TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand the object oriented programming concepts and fundamentals of Java.

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

CO3: Build Java applications with I/O streams, threads andgenerics programming.

CO4: Apply strings and collections in developing applications.

CO5: Implement the concepts of JDBC.

TEXT BOOKS:
1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2019.

REFERENCES:
1. Cay S. Horstmann, Gary Cornell, "Core Java Volume – I Fundamentals", 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/ toc/lex_29959473947367270000_shared/overview

LIST OF EQUIPMENTS:
Java and Eclipse / NetBeans IDE or Equivalent

22CS203	**DATABASE MANAGEMENT SYSTEM** **(Common to CSE/ ADS/CSE(CS))**	**L**	**T**	**P**	**C**
		3	0	2	4

OBJECTIVES:
The Course will enable learners to:
- To understand the basic concepts of Data modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To learn relational algebra, calculus and normalization.
- To know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.
- To understand query processing, efficient data querying and advanced databases.

UNIT I	**DATABASE CONCEPTS**	**15**

Concept of Database and Overview of DBMS - Characteristics of databases - Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces - Introductions to data models types - ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

List of Exercise/Experiments:
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements

UNIT II	**STRUCTURED QUERY LANGUAGE**	**15**

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

List of Exercise/Experiments:
1. Database Querying – Simple queries, Nested queries, Sub queries and Joins

2. Views, Sequences, Synonyms		
3. Database Programming: Implicit and Explicit Cursors		
UNIT III	**RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION**	**15**

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) – Multivalued Dependency and 4NF – Joint Dependencies and 5NF - De-normalization.

List of Exercise/Experiments:
1. Procedures and Functions
2. Triggers

UNIT IV	**TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE**	**15**

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery – Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

List of Exercise/Experiments:
1. Exception Handling
2. Database Design using ER modeling, normalization and Implementation for any application
3. Database Connectivity with Front End Tools

UNIT V	**QUERY OPTIMIZATION AND ADVANCED DATABASES**	**15**

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.

Distributed Database Concepts – Design – Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

List of Exercise/Experiments:
1. Case Study using real life database applications anyone from the following list
a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance
● Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
● Apply Normalization rules in designing the tables in scope.
● Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
● Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
● Ability to showcase ACID Properties with sample queries with appropriate settings

	TOTAL: 75 PERIODS
OUTCOMES:	

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

CO1: Map ER model to Relational model to perform database design effectively.

CO2: Implement SQL and effective relational database design concepts.

CO3: Apply relational algebra, calculus and normalization techniques in database design.

CO4: Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.

CO5: Apply query optimization techniques and understand advanced databases.

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.

REFERENCES:

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.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.

7. Database Management System Part – 1 https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666 7282022456_shared/overview

8. Database Management System Part – 2 https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127673 005629194241_shared/overview

9. Online Resources: https://infyspringboard.onwingspan.com/web/en/page/home

LIST OF EQUIPMENTS:

1. MySql and Eclipse / NetBeans IDE or Equivalent

22GE211	PRODUCT DEVELOPMENT LAB - 2 (Common to All Branches)	L	T	P	C
		0	0	2	1

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The student batches should study the device/system/component and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the conceptual design skills and the process to develop a product.

OBJECTIVES:

The Course will enable learners to:
- Use the innovative design methodology to articulate the product concepts.
- Summarize the requisite Engineering Principles for transforming concepts into products.
- Conduct basic tests to extract the qualitative and quantitative performance factors.

List of Exercise/Experiments
1. Study of Basic Engineering Design Concepts.
2. Conduct a literature survey on the implementation of the design concepts.
3. Prepare the design concepts for an identified literature gap.
4. Present the Product Idea Presentation – Phase II.

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Understand the working and capacity of various engineering systems.
CO2: Infer the outcomes in the product development process.
CO3: Perform basic engineering and material characterization tests.
CO4: Demonstrate the ability to provide conceptual design strategies for a product.
CO5: Implement the Science, Engineering, Technology and Mathematics (STEM) for product design.

LIST OF EQUIPMENTS:

		L	T	P	C
22CH104	**ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)**	**2**	**0**	**0**	**MC**

OBJECTIVES:
The Course will enable learners to:
- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

UNIT I	NATURAL RESOURCES	7

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - Types - Forest resources: Use and over-exploitation, deforestation and its impacts, Food resources: effects of modern agriculture, organic farming, Renewable energy sources - Solar, Wind, Geothermal, Tidal, OTE and Biomass.
Field activity -Tree plantation

UNIT II	POLLUTION AND WASTE MANAGEMENT	7

Pollution - Definition –causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards - nuclear accidents and holocaust -Role of an individual in prevention of pollution –Case studies.
Waste management- Municipal solid wastes, e- waste, plastic waste.
Field study – Solid waste management of the institution

UNIT III	BIODIVERSITY AND ITS CONSERVATION	6

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: In-situ and ex-situ method.
Field study – Biodiversity of the institution

UNIT IV	SUSTAINABILITY AND MANAGEMENT	5

Sustainability-concept, needs and challenges-Circular economy -Sustainable Development Goals- Concept ofCarbon footprint, Environmental Impact Assessment, Clean Development Mechanism, solutions.
Field study – Carbon footprint of the institution

UNIT V	HUMAN POPULATION	5

Introduction - Population growth, variation among nations,population explosion, Environment and human health – endemic/epidemic/pandemic– Role of information technology in environment and human health.
Case Study – Pandemics of 21st century

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Investigate and use conservational practices to protect natural resources.
CO2: Identify the causes of pollutants and illustrate suitable methods for pollution abatement.
CO3: Adapt the values of biodiversity and its conservation methods.
CO4: Recognize suitable sustainable development practices and apply it in day-to-day life.
CO5: Assess the impacts of human population and suggest suitable solutions.

TEXT BOOKS:
1. Anubha Kaushik and C.P. Kaushik, "Perspectives in environmental studies",New Age International Publishers,2nd edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 2017.
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 3rd edition, Pearson Education, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Third Edition, Universities Press(I) Pvt. Ltd., Hyderabad, 2021.

REFERENCES:
1. William P.Cunningham & Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, —Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

22GE301	TAMILS AND TECHNOLOGY (Common to All Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES:
The Course will enable learners to:
- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangam age.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

	TOTAL: 15 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Identify the role of weaving and ceramic technology in ancient Tamil Culture.
CO2: Assess the design and construction technology ideas in the current Tamil society.

CO3: Identify the different types of manufacturing technology used in Tamil society and their significance.

CO4: Classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

CO5: Discuss the fundamentals of scientific Tamil and Tamil computing.

TEXT BOOKS & REFERENCE BOOKS:
1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu   Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

22MA301	DISCRETE MATHEMATICS (Common to CSE, CSE(CS), ADS)	L	T	P	C
		3	2	0	4

OBJECTIVES:
The Course will enable learners to:
- Describe the arguments using connectives and rules of inference.
- Introduce the basic concept of counting and generating functions.
- Define the graphs and it's models.
- Understand the concept of group theory, 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 - Strong induction and well ordering The basics of counting - The pigeonhole principle - Permutations and combinations - Recurrence relations - Solving linear recurrence relations - Generating functions - Inclusion and exclusion principle and

	its applications.	
UNIT III	**GRAPHS**	**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 - Homomorphism's - 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 - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra.

TOTAL: 75 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Validate the arguments using connectives and rule of inference.
CO2: Solve linear recurrence relations.
CO3: Determine Euler's path and Hamilton paths.
CO4: Identify algebraic structures of groups, rings, and fields.
CO5: Interpret lattices as algebraic structures.

TEXT BOOKS:
1. Rosen, K.H., "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2021.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2017.

REFERENCES:
1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2014.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

LIST OF EQUIPMENTS:

22GE302	**Universal Human Values 2: Understanding Harmony**	**L**	**T**	**P**	**C**
		2	**1**	**0**	**3**

OBJECTIVES:

The Course will enable learners to:
- 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 30 lectures (2 lecture hours) and 15 practice sessions (1 Tutorial hour) in 5 Units:

UNIT I	Course Introduction - Need, Basic guidelines, Content and Process for Value Education	9

• 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!	9

• 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	9

• 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**	9
• 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**	9
• 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: **Upon completion of the course, the students will be able to:** **CO1:** Would become more aware of themselves, and their surroundings (family, society, nature). **CO2:** Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.		

CO3: Would have better critical ability.

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

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

TEXT BOOK:

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

REFERENCES:

1.   A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.

2.   E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.

3.   A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, Third Edition 2020.

4.   Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.

5.   Mahatma Gandhi, "Hind Swaraj or Indian Home Rule", Maheswari Publications, Delhi 2020.

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

7.   Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.

8.   Heaton, Dennis P. "The story of stuff." (2010): 553-556.

9.   Gandhi, Mohandas Karamchand, "The story of my experiments with truth: An autobiography", Om Books International, 2018.

10.   Andrews, Cecile, "Slow is beautiful: new visions of community, leisure, and joie de vivre", New society publishers, 2006.

11.   Kumarappa, Joseph Cornelius, "The economy of permanence. CP", All India Village Industries Assn., 1946.

12.   Vivekananda-Romain Rolland (English)

13.   Gandhi-Romain Rolland (English)

22CS301	ADVANCED JAVA PROGRAMMING (Common to CSE, CSE(CS)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To use the functionalities of Collections and IO Streams
- To use the functionalities of Java Stream API and unit testing framework using Junits.
- To provide a framework to map object-oriented domain models to relational databases for web applications using ORM Hibernate tool.
- To provide infrastructure support using Spring Framework.

	• To Implement Model – View – Controller design pattern using Spring MVC.	
UNIT I	**COLLECTIONS AND IO STREAMS**	**9+6**

The NavigableSet interface, the Queue interface, the Dequeue interface – The Collection classes – PriorityQueue – ArrayDeque – EnumSet – Comparators – More Utility Classes –StringTokenizer - Date – Calendar – Comparable interface – Observer Interface – Streams Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierachy – Random Access File class - the java.io.Console Class – Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing.

List of Exercises
4. Write a Java program to create an ArrayList of integers and add elements to it. Display the contents of the ArrayList.
5. Write a Java program to create a HashSet of strings and perform various operations like adding, removing, and checking the presence of elements.
6. Write a program to copy the contents of one file to another file using FileInputStream and FileOutputStream.

UNIT II	**STREAM API AND JUNIT**	**9+6**

Count -Parallel Streams - Declarative/Functional Style Approach - Stream Pipeline – Iterating with stream - Max, Min & Comparators - Distinct and Collectors.toSet() - Filtering and Transformations - Find Any Vs Find First - Reduce and Flatmap - Joining Strings Implementation of Stream in API". Junit - Introduction to JUnit, JUnit with Eclipse, Assert method, Annotations, Parameterized tests, Test suite, Test runner.

List of Exercises
1. Write a Java program to filter out the even numbers from a list of integers using the Stream API.
2. Create a program that uses the Stream API to find the average of a list of floating-point numbers.
3. Implement a Java program that uses the Stream API to count the number of occurrences of a specific word in a given text file.
4. Write a JUnit test case to check if a given string is palindrome or not.
5. Create a JUnit test case to verify the correctness of a method that calculates the factorial of a given number.
6. Implement a JUnit test case to ensure that a specific exception is thrown when invalid input is provided to a method.

UNIT III	**HIBERNATE FRAMEWORK**	**9+6**

Hibernate Framework - Hibernate - Mapping Types - Hibernate Inheritance Mapping - Collections Mappings - Association mapping - HCQL (Hibernate Criteria Query Language) – Hibernate Query Language (HQL) - Caching in Hibernate - Log4j in Hibernate.

List of Exercises

1. Write a Java program to create a Hibernate configuration file (hibernate.cfg.xml) and establish a database connection.
2. Implement a Java program to perform CRUD operations (Create, Read, Update, Delete) using Hibernate.
3. Develop a Java program to implement a one-to-many relationship between two entity classes using Hibernate mappings.
4. Write a Java program to perform transaction management using Hibernate, including rollback and commit operations.
5. Develop a Java program to configure and use Hibernate caching mechanisms for optimizing database access.
6. Write a Java program to integrate Hibernate with Spring framework and develop a web application with database operations.

UNIT IV	SPRING FRAMEWORK	9+6

Spring Framework - Dependency Injection by Constructor Example - Autowiring in Spring - Constructor Injection with Collection - Spring DAO - Inheriting Bean in Spring Dependency Injection by setter method.

List of Exercises
1. Create a basic Spring application that demonstrates dependency injection using constructor injection.
2. Write a program to demonstrate the use of Spring annotations like @Autowired, @Component, and @Configuration.
3. Implement a Spring bean that uses setter injection to inject dependencies.

UNIT V	SPRING MVC	9+6

Spring MVC - Spring Java Mail - Spring Security- Aspect Oriented Programming (AOP) - Web Services – postman - Design Patterns in Java

List of Exercises
1. Write a Spring MVC program to create a simple registration form with fields like name, email, and password, and validate the form inputs.
2. Implement a Spring MVC program that retrieves data from a database and displays it on a web page using the Model-View-Controller pattern.
3. Build a Spring MVC application that implements user authentication and authorization using Spring Security.

		TOTAL: 75 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Apply collections and IO Streams to efficiently manage and process data structures and perform input/output operations in Java.
CO2: Apply Java Stream API and Junits to streamline data manipulation and perform unit testing for robust code development.
CO3: Develop a Seamlessly integrate object-oriented programming with database operations for web applications using hibernate.
CO4: Construct the power of the Spring Framework to provide a solid foundation

for building scalable and maintainable applications.

CO5: Organize application logic, user interface, and data flow using the Spring MVC framework for efficient and modular development.

TEXT BOOKS:

3. "Spring in Action",5th Edition by Craig Walls

4. "Spring MVC: A Tutorial" by Paul Deck

REFERENCES:

5. "Java Generics and Collections" by Maurice Naftalin and Philip Wadler

6. "Effective Java" by Joshua Bloch

7. "Java 8 in Action: Lambdas, Streams, and functional-style programming" by Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft

8. "Java Persistence with Hibernate" by Christian Bauer and Gavin King

9. "Spring MVC: Beginner's Guide" by Amuthan G.8.

10. "JUnit in Action" by Petar Tahchiev, Felipe Leme, Vincent Massol, and Gary Gregory

LIST OF EQUIPMENTS:

Java Development Kit (JDK), IO classes, JUnit library, Spring Framework libraries and dependencies (such as spring-core, spring-context, spring-beans, Spring MVC framework.

22CS302	COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CSE, ADS and CSE(CS))	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Describe the basic principles and operations of digital computers.
- Design arithmetic and logic unit for various fixed and floating point operations
- Construct pipeline architectures for RISC processors.
- Explain various memory systems & I/O interfacings
- Discuss parallel processor and multi-processor architectures

UNIT I	COMPUTER FUNDAMENTALS	9

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

UNIT II	COMPUTER ARITHMETIC	9

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

UNIT III	BASIC PROCESSING UNIT AND PIPELINING	9

Basic Processing Unit: Concepts - Instruction Execution - Hardware Components -

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

UNIT IV	I/O AND MEMORY	9

Input/Output Organization: Bus Structure - Bus Operation - Arbitration - The Memory
System: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct
Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations -
Virtual Memory - Memory Management Requirements - Secondary Storage.

UNIT V	PARALLEL PROCESSING AND MULTICORE COMPUTERS	9

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

TOTAL: 45 PERIODS

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

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

TEXT BOOKS:

1.Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata
McGraw Hill, Sixth edition, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The
Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.

REFERENCES:

1.John P.Hayes, Computer Architecture and Organization, Third Edition, TataMcGraw
Hill, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The
Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.

3.John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate
Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.

LIST OF EQUIPMENTS:

-

22CS303	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE,ADS and CSE(CS))	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- Critically analyse the efficiency of alternative algorithmic solutions for the same
problem
Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization
problems
- Examine the limitations of algorithmic power and handling it in different problems.

UNIT I	INTRODUCTION	6+6

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

List of Exercise/Experiments:
1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

UNIT II	BRUTE FORCE AND DIVIDE AND CONQUER	6+6

Brute Force - String Matching - Exhaustive Search - Knapsack Problem - Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

List of Exercise/Experiments:
1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.
3. Write a program to sort the elements using quick sort and find time complexity.
4. Write a program to sort the elements using heap sort

UNIT III	DYNAMIC PROGRAMMING	6+6

Dynamic programming – Principle of optimality – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

List of Exercise/Experiments:
1. Solve Floyd's algorithm
2. Write a program to find optimal binary search tree for a given list of keys.
3. Solve the multi-stage graph to find shortest path using backward and forward approach
4. Write a program to find the longest common subsequence

UNIT IV	GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT	6+6

Greedy Technique – Prim's algorithm and Kruskal's Algorithm – Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - The Stable marriage Problem

List of Exercise/Experiments:
1. Write a program to find minimum spanning tree using Prim's algorithm
2. Implement Kruskal's algorithm to find minimum spanning tree
3. Write a program to solve maximum flow problem

UNIT V	BACKTRACKING AND BRANCH AND BOUND	6+6

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

List of Exercise/Experiments:
1. Write a program to implement sum of subset problem.
2. Write a program to solve N-Queen problem

| | 3. Solve the assignment problem using branch and bound technique |
| | 4. Solve knapsack problem using branch and bound technique |

	TOTAL: 60 PERIODS

OUTCOMES:

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

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

CO2: Design and Analyse the efficiency of divide and conquer and transform and conquer algorithmic techniques

CO3: Implement and analyse the problems using dynamic programming

CO4: Solve the problems using and greedy technique and iterative improvement technique for optimization

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

TEXT BOOKS:
1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

REFERENCES:
1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
3. http://nptel.ac.in/

LIST OF EQUIPMENTS:
Standalone PC with C/C++/Java

		L	**T**	**P**	**C**
22CY301	**OPERATING SYSTEMS USING LINUX**	2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To understand the basic concepts of operating systems and process.
- To understand threads and analyse various CPU scheduling algorithms.
- To analyse process synchronization and understand the concept of deadlocks.
- To analyse various memory management schemes.
- To understand various file system implementation.
- To be familiar with the basics of Linux System.

UNIT I	**INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES**	**15**

Introduction to OS –Computer system organization - architecture – Resource management - Protection and Security; Operating System Structures -Services - User and Operating-System Interface - System Calls - System programs -Design and

Implementation – System Boot – Process Concept - Process Scheduling - Operations on Processes – Inter process Communication - IPC in Shared-Memory Systems - IPC in Message-Passing Systems. Case Study- Design principles, Kernel modules, Inter process communication in Linux.

Lab Exercise

a) Basics of Linux commands, Understand and practice Linux permissions, special permissions and authentication (various options of chmod, setuid , setgid)

b)   Shell   Programming.

c) Write programs using the following system calls of LINUX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.

d) Implementation of Shared memory.

UNIT II	THREADS AND CPU SCHEDULING	15

Threads: Overview - Multicore Programming - Multithreading Models - Thread Libraries - Implicit Threading - Threading Issues - CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multi-Processor Scheduling- Real-Time CPU Scheduling. Case Study - Process management and scheduling in Linux

Lab Exercise:

a) Write C program to implement Threading and Synchronization applications.

b) Write C programs to implement the various CPU Scheduling Algorithms

UNIT III	PROCESS SYNCHRONISATION AND DEADLOCKS	15

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

Lab Exercise:

    a) Implement mutual exclusion by Semaphores.

    b) Implementation of Bankers Algorithm for Deadlock Detection and Avoidance

UNIT IV	MEMORY MANAGEMENT	15

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of a page table – Segmentation; Virtual Memory – Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames – Thrashing- Allocating Kernel Memory. Case Study-Memory Management in Linux.

Lab Exercise:

    a) Implementation of the following Memory Allocation Methods for fixed partition
          a) First Fit b) Worst Fit c) Best Fit

    b) Implementation of the following Page Replacement Algorithms
          a) FIFO b) LRU c) LFU

UNIT V	STORAGE MANAGEMENT	15

Mass Storage system — Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File System Interface - Concepts - Access Methods- Directory Structure - Mounting –Sharing, Protection ; File System Implementation – Directory Implementation – Allocation Methods – Free-Space Management . Case Study-File Systems in Linux.

Lab Exercise:

Implement the following File Allocation Strategies using C programs

   a) Sequential b) Indexed c) Linked

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Implement the basic concepts of operating systems and process.

CO2: Analyse various CPU scheduling algorithms and thread mechanism.

CO3: Implement the concepts of process synchronization and deadlocks.

CO4: Compare and contrast various memory management schemes.

CO5: Understand the functionality of file systems**.**

CO6: Perform administrative tasks on Linux systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons, Inc., 10th Edition, 2021.

2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

18. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

19. Achyut S.Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016.

LIST OF EQUIPMENTS: (30 Students per Batch)

30 Linux systems.
Programs can be implemented in C.

22CS313	PRODUCT DEVELOPMENT LAB – 3 (Design and Analysis Phase) (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:
The Course will enable learners to:
- To provide an adequate understanding of project/product concepts and creative design process.
- Create a methodology to develop solutions to complex systems.

The students can form a team of 3 or 4 to work on the approved topic by the faculty in-charge. All approved product/process topics should have the following stages as listed under activities. The faculty in-charge conducts a periodic review to endorse the work process and during the review, the faculty shall provide suggestions/ideas to improvise the project towards completion. An interim report (consisting of literature, photographs, proof of the work done, etc..) for all listed activities should be submitted by the team during periodic review for evaluation. A final project report is required at the end of the semester for evaluation.

LIST OF ACTIVITIES:
1. Develop the design stage for a product from the concept.
   - Researching it in-depth.
   - Ideating possible solutions.
   - Selecting a promising solution.
   - Make a mock-up model
   - Comprehend the design features of the mock-up model.
2. Evaluate the pros-cons of the mock-up (& with the existing product).
3. Generate the Design for Manufacturing and Assembly (DFMA) process route for the product with necessary interdisciplinary collaborations.

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Enhance their skills in design concepts, rules and procedures.
CO2: Develop their cognitive strategy to think, organize, learn and behave.
CO3: Demonstrate the ability to provide conceptual design strategies for a product.
CO4: Describe the procedure for designing a Mock-up model.
CO5: Recognize and apply appropriate interdisciplinary and integrative strategies for solving complex problems

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
1. CNC Router - 1 No
2. 3D Printer - 1 No
3. 3D Scanner - 1 No
4. Laser cutting Machine - 1 No
5. Centre lathe - 2 Nos
6. Arc welding transformer with cables and holders - 2 Nos
7. Plumbing tools - 2 Sets
8. Carpentry tools - 2 Sets
9. Multimeter - 10 Nos
10. Drilling Machine - 1 No
11. Solder Stations - 5 Sets
12. Desoldering Machine - 1 No

13. PCB Milling Machine - 1 No
14. Variable Power Supply - 1 No
15. Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. - 10 Sets
16. Personal Desktop Computers - 30 Nos
17. 3D Modelling software – Creo/ AutoCAD/ etc., - 30 Licence

22CS311	APTITUDE AND CODING SKILLS – I (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:
- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- 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:

Upon completion of the 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.

22MA403	LINEAR ALGEBRA AND NUMBER THEORY (Lab Integrated)	L	T	P	C
		3	0	2	4

OBJECTIVES:

  ✓ To illustrate the basic notions associated with vector spaces and its properties.
  ✓ To interpret the concept of linear transformations and diagonalization.
  ✓ To understand the basic concepts in number theory.
  ✓ To examine the key questions in the theory of numbers.
  ✓ To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I	VECTOR SPACES	15

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

Experiments using SCILAB:
1. Creating and operating with vectors.
2. Check for linear independence and dependence of a set of vectors.
3. Find the basis and dimension of a vector space spanned by a set of vectors.

UNIT II	LINEAR TRANSFORMATION AND DIAGONALIZATION	15

Linear transformation – Null spaces and ranges – Rank nullity Dimension theorem – Matrix representation of a linear transformations – Eigenvalues and eigenvectors – Diagonalizability**.**

Experiments using SCILAB:
1. Finding the rank and nullity of a matrix.
2. The matrix representation of a linear transformations..
3. Finding eigen values and eigen vectors of a matrix.

UNIT III	DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS	15

Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM

Experiments using SCILAB:
1. **Finding prime and composite numbers.**
2. Finding GCD by Euclidean algorithm
3. Finding LCM.

UNIT IV	DIOPHANTINE EQUATIONS AND CONGRUENCES	15

Linear Diophantine equations – Congruence's – Linear Congruence's – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems

Experiments using SCILAB:
1. **Solving congruences.**
2. Implement CRT algorithm.
3. Solving 2 x 2 linear systems.

UNIT V	CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS	15

Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions – Tau and Sigma functions.

Experiments using SCILAB:
1. **Problem with** Wilson's theorem
2. Implement Euler's theorem.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Determine the dimension and bases of the vector spaces
CO2: Compute the matrix representation of the linear transformation under the given basis
CO3: Demonstrate accurate and efficient use of Divisibility theory and decompositions.
CO4: Demonstrate their mastery by solving non - trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.
CO5: Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011
2. Koshy, T., ―Elementary Number Theory with Applications‖, Elsevier Publications, New Delhi, 2002.

REFERENCES:

1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Niven, I., Zuckerman H. S., and Montgomery, H. L., An Introduction to Theory of Numbers, John Wiley and Sons , Singapore, 2004.
3. San Ling and Chaoping Xing, Coding Theory – A first Course, Cambridge Publications, Cambridge, 2004.

22CS401	DISTRIBUTED AND CLOUD COMPUTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- ✓ To articulate the concepts and models underlying distributed computing
- ✓ To maintain consistency and perform efficient coordination in distributed systems through the use of logical clocks, global states, and snapshot recording algorithms.
- ✓ To learn different distributed mutual exclusion algorithms.
- ✓ To develop the ability to understand the cloud infrastructure and virtualization that help in the development of cloud.

✓ To explain the high-level automation and orchestration systems that manage the virtualized infrastructure.	

UNIT I	INTRODUCTION	6 + 6

Definition - Relation to computer system components - Message-passing systems versus shared memory systems - Primitives for distributed communication - Synchronous versus asynchronous executions. A model of distributed computations: A distributed program - A model of distributed executions - Models of communication networks - Global state of a distributed system.

List of Exercise/Experiments:
4. Implement a simple distributed program that communicates between two nodes using Java's RMI (Remote Method Invocation) API.
5. Develop a distributed program that uses Java's messaging API (JMS) to communicate between nodes. Explore the different messaging paradigms (pub/sub, point-to-point) and evaluate their performance and scalability.
6. Develop a model of a distributed program using Java's concurrency and synchronization primitives.

UNIT II	LOGICAL TIME, GLOBAL STATE, AND SNAPSHOT ALGORITHMS	6 + 6

Logical time – Scalar Time – Vector Time - Efficient implementations of vector clocks – Virtual Time. Global state and snapshot recording algorithms: System model - Snapshot algorithms for FIFO channels and non-FIFO channels.

List of Exercise/Experiments:
1. Develop a program in Java that implements vector clocks to synchronize the order of events between nodes in a distributed system.
2. Implement a snapshot algorithm for recording the global state of the distributed system using vector clocks, for both FIFO and non-FIFO channels. Test the algorithm by recording snapshots at various points in the system's execution and analyzing the resulting global state.

UNIT III	DISTRIBUTED MUTUAL EXCLUSION ALGORITHMS	6 + 6

Introduction - Lamport's algorithm - Ricart–Agrawala algorithm - Quorum-based mutual exclusion algorithms - Maekawa's algorithm - Suzuki–Kasami's broadcast algorithm.

List of Exercise/Experiments:
4. Implement Lamport's algorithm for mutual exclusion in a distributed system using Java's RMI API.
5. Develop a program in Java that implements Maekawa's algorithm for mutual exclusion in a distributed system.
6. Implement Suzuki-Kasami's broadcast algorithm in Java to achieve reliable message delivery in a distributed system.

UNIT IV	CLOUD INFRASTRUCTURE AND VIRTUALIZATION	6 + 6

Data Center Infrastructure and Equipment – Virtual Machines – Containers – Virtual Networks - Virtual Storage.

List of Exercise/Experiments:		

List of Exercise/Experiments:
4. Set up a virtualized data center using a hypervisor like VMware or VirtualBox and create multiple virtual machines (VMs) on it. Configure the VMs with different operating systems, resources, and network configurations, and test their connectivity and performance.
5. Deploy a containerized application on a virtual machine using Docker or Kubernetes.

UNIT V	**AUTOMATION AND ORCHESTRATION**	**6 + 6**

Automation - Orchestration: Automated Replication and Parallelism - The MapReduce Paradigm: The MapReduce Programming Paradigm – Splitting Input – Parallelism and Data size – Data access and Data Transmission – Apache Hadoop – Parts of Hadoop – HDFS Components – Block Replication and Fault Tolerance – HDFS and MapReduce - Microservices.

List of Exercise/Experiments:
3. Set up and configure a single-node Hadoop cluster.
4. Run the word count program in Hadoop.
5. Deploy a microservices architecture using a container orchestration tool like Kubernetes or Docker Swarm.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Articulate the main concepts and models underlying distributed computing.

CO2: Learn how to maintain consistency and perform efficient coordination in distributed systems through the use of logical clocks, global states, and snapshot recording algorithms.

CO3: Learn different distributed mutual exclusion algorithms

CO4: Develop the ability to understand the cloud infrastructure and virtualization that help in the development of cloud.

CO5: Explain the high-level automation and orchestration systems that manage the virtualized infrastructure.

TEXT BOOKS:
3. Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2011. (Unit 1, 2, 3)
4. Douglass E. Comer, "The Cloud Computing Book: The future of computing explained", CRC Press, 2021. (Unit 4, 5)

REFERENCES:
4. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-on Approach", Universities Press Private Limited, 2014.

5. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2017.

6. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

7. Hagit Attiya, Jennifer Welch, "Distributed Computing: Fundamentals, Simulations and Advanced Topics", John Wiley & Sons, Inc., 2004.

LIST OF EQUIPMENTS:

Java, VMWare/VirtualBox, Hadoop, AWS/GCP/Azure/Any cloud platform, Eclipse/Equivalent IDE.

22CY401	CYBER SECURITY ESSENTIALS	L	T	P	C
		3	0	2	4

OBJECTIVES:

TheCoursewillenablelearnersto:

- Understand the field of digital security and concepts of access control mechanisms.
- To introduce keywords and jargons involved in securing browser
- Understanding network basic and familiarize on security of network protocols
- Awareness and understanding on cyber-attacks and data privacy

UNIT I	BASICS OF DIGITAL SECURITY	15

Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials.

List of Exercise/Experiments
Protecting Remote Access

- Setting Password Policies
- Capturing the Network Traffic Using Wireshark
- Creating a TCP Outbound Rule
- Creating an ICMP Outbound Rule

UNIT II	CREDENTIAL SECURE PROTOCOL	15

In keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction.

List of Exercise/Experiments
Understanding Network Servers

- Monitoring the Denial of Service (DoS) Attack
- Viewing the Application, Security, and System Logs
- Scanning Vulnerabilities Using Microsoft Baseline Security Analyzer

	• Adding Users or Groups in a Linux Distribution	
UNIT III	**DESIGNING LARGE SCALE LANs**	**15**

Networking basics (home network and large-scale business networks), Networking protocols, Security of protocols, sample application hosted on-premises.

List of Exercise/Experiments

Understanding the Environment

- Examining Browsing History Options
- Configuring Pop-up Blocker Settings
- Accessing the Security Settings in Internet Explorer
- Adding a Site to a Security Zone

UNIT IV	**DATABASE SECURITY**	**15**

Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.

List of Exercise/Experiments

Understanding Tools and Utilities by

- Using the Nslookup and Tracert Utilities
- Capturing Packet Using Wireshark
- Scanning Network Using Nmap
- Using the Ipconfig and Ping Command

UNIT V	**SECURITY POLICY AND MANAGEMENT**	**15**

Implementing operational security : evaluate security frameworks and guidelines and incorporatedocumentation, implement security strategies, manage data security processes, implement physical controlsAddressing security incidents : troubleshoot common security issues, respond to securityincidents, investigate security incidents.

List of Exercise/Experiments

Protecting Data Moving Through the Internet Using MD5 Hash Algorithms

- Identifying and Defending Against Vulnerabilities by Creating a New Software Restriction Policy

TOTAL:75PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentswill beable to:

CO1: Apply a solid foundation in digital security and measures taken to protect device from threats.

CO2:Learning access control mechanism and understand how to protect servers

CO3:Understand the importance of a network basics and brief introduction on security of network protocols.

CO4: To understand cyber-attacks and learn data privacy issues and preventive measures.

CO5: To understand cyber safety Identifying the Devices You Use, and Where You Use them.
CO6: To study the requirements, modelling, design testing and validation procedures that ensure security.

TEXTBOOKS:
11. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobiledevice safety made easy. Elsevier, 2016.

REFERENCES:
1. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.
2. Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc . 5th Edition, 2015.
3. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short.
4. Cybersecurity essentials. John Wiley & Sons, 2018.

List of Software:

- SiteLock.
- SolarWinds Security Event Manager.
- Heimdal Security.
- Wireshark.
- Nagios.
- Nessus Professional.

22AI301	ARTIFICIAL INTELLIGENCE (Lab Integrated)	L	T	P	C
		3	0	2	4

OBJECTIVES:
- To understand the various Intelligent agents and search strategies in AI.
- To learn about different problem-solving strategies using heuristic function.
- To learn about knowledge-based agents and first order logics.
- To understand knowledge representation and planning.
- To know about the expert system.

UNIT I	ARTIFICIAL INTELLIGENCE AND INTELLIGENT AGENTS	9+6

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

Lab Programs:
1. Implement basic search strategies – 8-Puzzle, 8 - Queens problem.
2. Implement Breadth First Search & Depth first Search Algorithm
3. Implement Water Jug problem.
4. Solve Tic-Tac-Toe problem.

UNIT II	PROBLEM SOLVING	9+6

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

Lab Programs:
1. Implement A* and memory bounded A* algorithms.
2. Implement Minimax algorithm & Alpha-Beta pruning for game playing.
3. Constraint Satisfaction Problem
4. Mini Project – Chess. Sudoku.

UNIT III	LOGICAL AGENTS	9+6

Knowledge-based agents – Logic - Propositional logic – Propositional theorem proving – Propositional model checking – Agents based on propositional logic

First-Order Logic – Syntax and semantics – Using First-Order Logic - Knowledge representation and engineering – Inferences in first-order logic – Propositional Vs First-Order Inference - Unification and First-Order Inference - Forward chaining – Backward chaining – Resolution.

Lab Programs:
1. Implement Unification algorithm for the given logic.
2. Implement forward chaining and backward chaining using Python.

UNIT IV	KNOWLEDGE REPRESENTATION AND PLANNING	9+6

Ontological engineering – Categories and objects – Events – Mental objects and modal logic – Reasoning systems for categories – Reasoning with default information

Classical planning – Algorithms for classical planning – Heuristics for planning – Hierarchical planning – non-deterministic domains – Time, schedule, and resources – Analysis

Lab Programs:
1. Implementation of object detection.
2. Implement classical planning algorithms.

UNIT V	LEARNING AND EXPERT SYSTEMS	9+6

Forms of Learning – Developing Machine Learning systems – Statistical Learning - Deep Learning: Simple feed-forward network - Neural Networks – Reinforcement Learning: Learning from rewards – Passive and active Reinforcement learning.

Expert Systems: Functions – Main structure – if-then rules for representing knowledge – developing the shell – Dealing with uncertainty

Lab Programs:
1. Develop an Expert system.
2. Mini-Project – Develop Machine Learning based classification Models.

	TOTAL: 45+30 = 75 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
CO1: Illustrate the structure of agents and to implement various Intelligent agents.
CO2: Apply search strategies in problem solving and game playing using heuristic function.
CO3: Implement logical agents and first-order logic problems.
CO4: Apply problem-solving strategies with knowledge representation mechanism for solving hard problems.
CO5: Demonstrate the basics of expert systems and to develop models using machine learning techniques.

TEXT BOOKS:

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

REFERENCES:

1. Elaine Rich, Kevin Knight and B.Nair, Artificial Intelligence 3rd Edition, McGraw Hill, 2017.
2. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans. Series: Pelican Books, 2020
3. Ernest Friedman-Hill, Jess in Action, Rule-Based Systems in Java, Manning Publications, 2003
4. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems,1st Edition by Patterson, Pearson, India, 2015.
6. NPTEL Courses:
    a. An Introduction to Artificial Intelligence - https://onlinecourses.nptel.ac.in/noc23_cs05/preview
    b. Artificial Intelligence: Knowledge Representation And Reasoning - https://onlinecourses.nptel.ac.in/noc23_cs09/preview

22CS413	PRODUCT DEVELOPMENT LAB - 4 (Prototype Phase) (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:
The Course will enable learners to:
- Analyze the real-time problems in product development from an engineering perspective.
- Implement the DFMA process route to make and assemble the product.
- Test and qualify the product or a system with acquired knowledge.
- Identify the business opportunities for the developed product or process.

The student batch of PDD Lab 3 shall continue their product/ process design work under the guidance of the faculty incharge. All batches should cover the following stages of prototyping work as listed under activities. The faculty incharge shall conduct periodic reviews to endorse the work progress and during the review, the faculty shall provide suggestions/ideas to improvise the project towards completion. An interim report (consisting of BoM, Stages of Prototyping, photographs, proof of work done, etc..) for all listed activities should be submitted by the team during periodic review for evaluation. A final project report is required at the end of the semester and the evaluation is based on an oral presentation in front of the examiner panel constituted by the Head of the Department.

LIST OF ACTIVITIES:
1. Develop Engineering BoM for the approved industrial Mock-up from Phase III. Transform the Engineering BoM to develop a Prototype.
2. Devise / Plan an economically efficient manufacturing process to make the Prototype and testing.
3. Deliberation of the Product / Process outcome – Phase IV.
   Preparation and submission of a project report.

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1 Identify the real-time problems through literature.
CO 2 Develop feasible solutions for the problems.
CO 3 Evaluate the methods to develop solutions to the problem.
CO 4 Analyze the business opportunities for a new product.
CO 5 Prepare a detailed report for the experimental dissemination.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1. CNC Router - 1 No
2. 3D Printer - 1 No
3. 3D Scanner - 1 No
4. Laser cutting Machine - 1 No
5. Centre lathe - 2 Nos
6. Arc welding transformer with cables and holders - 2 Nos
7. Plumbing tools - 2 Sets
8. Carpentry tools - 2 Sets
9. Multimeter - 10 Nos
10. Drilling Machine - 1 No
11. Solder Stations - 5 Sets
12. Desoldering Machine - 1 No
13. PCB Milling Machine - 1 No
14. Variable Power Supply - 1 No
15. Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. - 10 Sets
16. Personal Desktop Computers - 30 Nos
17. Numerical Simulation Tools - 30 Licence
18. Test bench:
    Mech: Digital Micrometre/ Vernier/ Bore gauge/ etc EEE : (Based on the electrical components)
    ECE : (Based on the electronic components) - 5 Nos

22CS411	APTITUDE AND CODING SKILLS – II (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:
The Course will enable learners to:
● Develop advanced vocabulary for effective communication and reading skills.
● 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:
Upon completion of the 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.

22CS412	MINI PROJECT AND DESIGN THINKING LAB	L	T	P	C
		0	0	2	1

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

LIST OF EXERCISES:

UNIT 1

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

Identification (6)

UNIT 2

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

Case Study: Analysing the Identified Problem. (6)

UNIT 3

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

Case Study: Prototyping the solution. (6)

UNIT 4

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

UNIT 5

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

TOTAL: 30 PERIODS

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

ELECTIVE VERTICALS
CYBER SECURITY

22CS904	WEB SECURITY	L	T	P	C
		2	0	2	3

OBJECTIVES:
 The Course will enable learners to:
- **To understand the overview of web security**
- **To Understand Recent Advances in Access Control and securing web applications**
- **To Understand database security and privacy policies**

UNIT I	INTRODUCTION WEB SECURITY	12

The Web Security, The Web Security Problem, Risk Analysis and Best Practices Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital

Identification (Password, Biometrics and Digital Signatures)

List of Exercise/Experiments
Steganalysis - Stego Watch- Stego Detection Tool, StegSpy.

UNIT II	WEB PRIVACY	12

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications

List of Exercise/Experiments
How to Detect Trojans by using – Netstat, fPort, TCPView, CurrPorts Tool, Process Viewer.

UNIT III	DATABASE SECURITY	12

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

List of Exercise/Experiments
Lan Scanner using look@LAN, wireshark.

UNIT IV	PHISHING METHODS AND ATTACKS	12

Phishing: Methods, Process, Attacks Types (Man-in-the-Middle Attacks, URL Obfuscation Attacks, Hidden Attacks, Client-side Vulnerabilities, Deceptive Phishing, Malware-Based Phishing, DNS Based Phishing, Content-Injection Phishing, Search Engine Phishing). **Denial-of Service Attacks**: Types of Attacks (Smurf Attack, Buffer Overflow Attack, Ping of Death Attack, Teardrop Attack, SYN Attack, SYN Flooding), DDoS Attack (Distributed DoS Attack.), Session Hijacking, Spoofing v Hijacking, TCP/IP hijacking, CAPTCHA Protection

List of Exercise/Experiments
Understanding DoS Attack Tools- Jolt2 , Bubonic.c, Land and LaTierra, Targa, Nemesy Blast, Panther2, Crazy Pinger, Some Trouble, UDP Flood, FSMax.

UNIT V	VULNERABILITY MANAGEMENT	12

IP Security, Firewalls: Types, Operation, Design Principles, Trusted Systems. Computer Forensics, Need, Objectives, Stages & Steps of Forensic Investigation in Tracking Cyber Criminals, Incident Handling. Hacking, Classes of Hacker (Black hats, grey hats, white hats, suicide hackers), Foot printing, Scanning (Types-Port, Network, Vulnerability), E-Mail Spiders, Overview of System Hacking Cycle.

List of Exercise/Experiments
Forensic Investigation Tools- Disk analysis: Autopsy/the Sleuth Kit, Image creation: FTK imager, Mobile forensics: Cellebrite UFED

	TOTAL: 60 PERIODS

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

CO1: Understanding the concepts of Web security				

CO1: Understanding the concepts of Web security

CO2: Ability to understand Web Privacy and security for server

CO3: Ability to set up database security and access control

CO4: Understanding the various phishing methods and attacks

CO5: Understanding the concepts of IP Security and Computer Forensics

TEXT BOOKS:

1. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia
3. Carl Endorf, Eugene Schultz, Jim Mell "INTRUSION DETECTION & PREVENSION" TMH

REFERENCES:

1. Malcolm Mcdonald, Web Security for Developers: Real Threats, Practical Defense, 2020, No Starch Press

LIST OF Software/Tools:

Software Requirement:

Virtual Machine
Trojan
Keylogger
Wireshark
Nmap
ZenMap
Nessus

Tools Required:

SUCURI
Qualys
Quttera
UpGuard Web Scan
SiteGuarding
Mozilla Observatory
Web Cookies Scanner
Detectify
Tinfoil Security
Pentest Web Server Scanner

22CS902	SOCIAL NETWORK SECURITY	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- Learn the Concepts of Social Network Security

- Understand the methods of Social Network Anonymization
- Learn the techniques for security and privacy in social networks
- Learn the security challenges in social networks
- Explore the Tools to learn about the social network security implementation

UNIT I	INTRODUCTION TO SOCIAL NETWORK SECURITY	6+6

Introduction – Social Networking Applications – Social media Websites – Social Network Representation –Building Social Authority –Privacy and Information sharing – Controlling Application privacy – Cybercrime – Information Leakage – False information – Content Management in Social Networks

List of Exercise/Experiments:
1. Explore a Social network analysis tools to learn about the users and networks
2. Learn a program / tool to illustrate information leakage

UNIT II	SOCIAL NETWORK ANONYMIZATION	6+6

Social Networks - Privacy in Social Networks – Social Network Representation – Social Network Analysis - Data Anonymization – Challenges in Anonymization – Privacy preservation – Social Network Anonymization Factors – Anonymization Algorithms – Link Anonymization techniques –Background Knowledge Attacks – Anonymity in Modern Social Networks

List of Exercise/Experiments:
1. Experiment a link anonymization technique
2. Explore ARX anonymization tool

UNIT III	ANALYZING AND SECURING SOCIAL NETWORKS	6+6

Supporting Technologies - Aspects of Analyzing and Securing Social Networks - Techniques and Tools for Social Network Analytics - Social Network Analytics and Privacy Considerations - Access Control and Inference for Social Networks - Social Media Integration and Analytics Systems - Social Media Application Systems - Secure Social Media Systems - Secure Social Media Directions.

List of Exercise/Experiments:
1. Implement a program for network access control to illustrate malware attacks
2. Create a simple social network application to show authentication mechanisms
3. Create an application for the following scenario: "Social networking users are presented with two apparently similar emails or websites. They must first identify the differences between them and then decide which one is a scam attempting to steal their information or money."

UNIT IV	SECURITY CHALLENGES IN SOCIAL NETWORKS	6+6

Identity manipulation – Threats from third party applications - Trust in Social Networking Sites - Viruses, Phishing Attacks and Malwares–Tracking users – Privacy of Data – Identity Federation Challenges –Social media threats – Location disclosure – Spoofing – Profile cloning – Fake product sale – Cyber bullying – Prevention Strategies

List of Exercise/Experiments:
1. Implement a program in python to estimate trust of social network users group
2. Write a SQL injection program in python/JAVA to handle session hijacking

3.	Create an application using any social network platform to demonstrate profile cloning concept.	
UNIT V	**SOCIAL NETWORK SECURITY TOOLS**	**6+6**

Analysis Tools for Social Media - AutoMap – Gephi – ORA Lite – ORA Pro – Wolfram Alpha – Social Media Data Collection –Blog Trackers –Crowd Tangle – MalTego – Pulse – SCRAAWL – Fact and Image Trackers – Google Fact Check Tools – Bot Mitigation – BotSlayer – Social Cyber Security

List of Exercise/Experiments:
1. Perform fact checking of social networking content using google fact checking tools
2. Explore a tool that helps protect websites from bot traffic and bot attacks.
3. Create a fake news tracker program to collect, detect and help visualize fake news data from any social network

TOTAL:60 PERIODS

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

CO1: Develop security applications of social networks.
CO2: Implement data anonymization techniques
CO3: Analyze and secure social networks
CO4: Handle security challenges in social networks
CO5: Develop security tools for social networks
CO6: Create newer social networking applications

TEXTBOOKS:
4. Brij B. Gupta, Somya Ranjan Sahoo, "Online Social Networks Security-Principles, Algorithm, Applications, and Perspectives", First Edition, 2021.
5. Bhavani Thuraisingham, SatyenAbrol, Raymond Heatherly, Murat Kantarcioglu, Vaibhav Khadilkar, Latifur Khan, "Analyzing and Securing Social Networks", First Edition, 2020.
2. B. K. Tripathy, Kiran Baktha, "Security, Privacy, and Anonymization in Social Networks: Emerging Research and Opportunities", IGI Global Publication, 2019.
3. Michael Cross, "Social Media Security, Leveraging Social Networking While Mitigating Risk", Elsevier Publication, First Edition, 2013.

REFERENCES:
2. El-Sayed M. El-Alfy ; Mohamed Eltoweissy ;Errin W. Fulp ; Wojciech Mazurczyk, "Nature-Inspired Cyber Security and Resiliency: Fundamentals, Techniques and Applications", IET Publication, 2019.
3. https://sites.google.com/view/social-cybersec/tools?pli=1
4. Yaniv Altshuler, "Security and Privacy in Social Networks", Springer , 2013.

LIST OF EQUIPMENTS:
1. **Software Required:**
    Python
2. **Software Tools Required:**
    Shield Square
    BotSlayer
    GOOGLE FACT CHECK TOOLS
    ORA-PRO

CLOUD COMPUTING

22CS907	CLOUD FOUNDATIONS	L	T	P	C
		2	0	2	3

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

UNIT I	INTRODUCTION TO CLOUD	6+6

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

List of Exercise/Experiments:
1. Install and configure cloud SDK.
2. Connect to computing resources hosted on Cloud via Cloud Shell.

UNIT II	COMPUTE AND STORAGE	6+6

Compute options in the cloud - Exploring IaaS with Compute Engine - Configuring elastic apps with autoscaling - Exploring PaaS - Event driven programs - Containerizing and orchestrating apps - Storage options in the cloud - Structured and unstructured storage in the cloud - Unstructured storage using Cloud Storage - SQL managed services - NoSQL managed services.

List of Exercise/Experiments:
1. Create virtual machine instances of various machine types using the Cloud Console and the command line. Connect an NGINX web server to your virtual machine.
2. Create a small App Engine application that displays a short message.
3. Create, deploy, and test a cloud function using the Cloud Shell command line.
4. Deploy a containerized application.
5. Create a storage bucket, upload objects to it, create folders and subfolders in it, and make objects publicly accessible using the Cloud command line.

UNIT III	APIs AND SECURITY IN THE CLOUD	6+6

The purpose of APIs – API Services - Managed message services - Introduction to security in the cloud - The shared security model - Encryption options - Authentication and authorization with Cloud IAM - Identify Best Practices for Authorization using Cloud IAM.

List of Exercise/Experiments:
1. Deploy a sample API with any of the API service.
2. Publish messages with managed message service using the Python client library.
3. Create two users. Assign a role to a second user and remove assigned roles associated with Cloud IAM. Explore how granting and revoking permissions works from Cloud Project Owner and Viewer roles.

UNIT IV	NETWORKING, AUTOMATION AND MANGAEMENT TOOLS	6+6

Introduction to networking in the cloud - Defining a Virtual Private Cloud - Public and private IP address basics - Cloud network architecture - Routes and firewall rules in the cloud - Multiple VPC networks - Building hybrid clouds using VPNs - Different options for load balancing - Introduction to Infrastructure as Code - Terraform - Monitoring and management tools.

List of Exercise/Experiments:
1. Create several VPC networks and VM instances and test connectivity across networks.
2. Create two nginx web servers and control external HTTP access to the web servers using tagged firewall rules.
3. Configure a HTTP Load Balancer with global backends. Stress test the Load Balancer and denylist the stress test IP.
4. Create two managed instance groups in the same region. Then, configure and test an Internal Load Balancer with the instances groups as the backends.
5. Monitor a Compute Engine virtual machine (VM) instance with Cloud Monitoring by creating uptime check, alerting policy, dashboard and chart.

UNIT V	BIG DATA AND MACHINE LEARNING SERVICES	6+6

Introduction to big data managed services in the cloud - Leverage big data operations - Build Extract, Transform, and Load pipelines - Enterprise Data Warehouse Services - Introduction to machine learning in the cloud - Building bespoke machine learning models with AI Platform - Pre-trained machine learning APIs.

List of Exercise/Experiments:
1. Create a cluster, run a simple Apache Spark job in the cluster, then modify the number of workers in the cluster.
2. Create a streaming pipeline using one of the cloud service.
3. Set up your Python development environment, get the relevant SDK for Python, and run an example pipeline using the Cloud Console.

4. Use cloud-based data preparation tool to manipulate a dataset. Import datasets, correct mismatched data, transform data, and join data.
5. Utyilize a cloud-based data processing and analysis tool for data exploration and use a machine learning platform to train and deploy a custom TensorFlow Regressor model for predicting customer lifetime value.

	TOTAL: 60 PERIODS

OUTCOMES:

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

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

CO2: Discover the different compute options in Cloud and implement a variety of structured and unstructured storage models.

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

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

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

REFERENCES:

8. https://cloud.google.com/docs

9. https://www.cloudskillsboost.google/paths/36

10. https://nptel.ac.in/courses/106105223

11. Anthony J. Sequeira, "AWS Certified Cloud Practitioner (CLF-C01) Cert Guide", First Edition, Pearson Education, 2020.

12. AWS Documentation (amazon.com)

13. AWS Skill Builder

14. AWS Academy Cloud Foundations Course - https://www.awsacademy.com/vforcesite/LMS_Login

LIST OF EQUIPMENTS:

GCP / CloudSkillBoost Platform/AWS Console /AWS Academy Learner Lab.

22CS908	CLOUD ARCHITECTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners:

- To make architectural decisions based on AWS architectural principles and best practices.
- To describe the features and benefits of Amazon EC2 instances, and compare and contrast managed and unmanaged database services.
- To create a secure and scalable AWS network environment with VPC, and

configure IAM for improved security and efficiency.
- To use AWS services to make infrastructure scalable, reliable, and highly available.
- To use AWS managed services to enable greater flexibility and resiliency in an infrastructure.

UNIT I	INTRODUCING CLOUD ARCHITECTING AND STORAGE LAYER	6+6

Cloud architecting - The AWS Well-Architected Framework - AWS global infrastructure - Amazon S3 - Amazon S3 Versioning - Storing data in Amazon S3 - Moving data to and from Amazon S3 - Amazon S3 Transfer Acceleration - Choosing Regions for your architecture.

List of Exercise/Experiments:
1. Creating a Static Website for the Café.
2. Configure an S3 bucket to automatically encrypt all uploaded objects.
3. Set up a cross-region replication configuration for an S3 bucket.

UNIT II	COMPUTE LAYER AND DATABASE LAYER	6+6

Adding compute with Amazon EC2 - Choosing an Amazon Machine Image (AMI) to launch an Amazon EC2 instance - Selecting an Amazon EC2 instance type - Using user data to configure an EC2 instance - Adding storage to an Amazon EC2 instance - Amazon EC2 pricing options - Amazon EC2 considerations - Database layer considerations - Amazon Relational Database Service (Amazon RDS) - Amazon DynamoDB - Database security controls - Migrating data into AWS databases.

List of Exercise/Experiments:
1. Creating a Dynamic Website for the Café.
2. Creating an Amazon RDS database.
3. Migrating a Database to Amazon RDS.
4. Create a web application that stores data in a managed database using EC2 instances and Amazon RDS.

UNIT III	CREATING AND CONNECTING NETWORKS	6+6

Creating an AWS networking environment - Connecting your AWS networking environment to the internet - Securing your AWS networking environment - Connecting your remote network with AWS Site-to-Site VPN - Connecting your remote network with AWS Direct Connect - Connecting virtual private clouds (VPCs) in AWS with VPC peering - Scaling your VPC network with AWS Transit Gateway - AWS Transit Gateway - Connecting your VPC to supported AWS services. Securing User and Application Access: Account users and AWS Identity and Access Management (IAM) - Organizing users - Federating users - Multiple accounts.

List of Exercise/Experiments:
1. Creating a Virtual Private Cloud.
2. Creating a VPC Networking Environment for the Café.

	3. Creating a VPC Peering Connection.	
	4. Configure a VPC with subnets, an internet gateway, route tables, and a security group, and connect an on-premises network to the VPC.	
UNIT IV	**RESILIENT CLOUD ARCHITECTURE**	**6+6**

Scaling your compute resources - Scaling your databases - Designing an environment that's highly available – Monitoring - Reasons to automate - Automating your infrastructure - Automating deployments - AWS Elastic Beanstalk - Overview of caching - Edge caching - Caching web sessions - Caching databases.

List of Exercise/Experiments:
1. Controlling Account Access by Using IAM.
2. Creating Scaling Policies for Amazon EC2 Auto Scaling.
3. Creating a Highly Available Web Application.
4. Creating a Scalable and Highly Available Environment for the Café.
5. Streaming Dynamic Content Using Amazon CloudFront.

| **UNIT V** | **BUILDING DECOUPLED ARCHITECTURES, MICROSERVICES AND SERVERLESS ARCHITECTURE** | **6+6** |

Decoupling your architecture - Decoupling with Amazon Simple Queue Service (Amazon SQS) - Decoupling with Amazon Simple Notification Service (Amazon SNS) - Sending messages between cloud applications and on-premises with Amazon MQ. Introducing microservices - Building microservice applications with AWS container services - Introducing serverless architectures - Building serverless architectures with AWS Lambda - Extending serverless architectures with Amazon API Gateway - Orchestrating microservices with AWS Step Functions - Disaster planning strategies - Disaster recover patterns.

List of Exercise/Experiments:
1. Breaking a Monolithic Node.js Application into Microservices.
2. Implementing a Serverless Architecture on AWS.
3. Implementing a Serverless Architecture for the Café.
4. Creating an AWS Lambda Function and explore using AWS Lambda with Amazon S3.

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of this course, the students will be able to:

CO1: Make architectural decisions based on AWS architectural principles and best practices

CO2: Describe the features and benefits of Amazon EC2 instances, and compare and contrast managed and unmanaged database services.

CO3: Create a secure and scalable AWS network environment with VPC, and configure IAM for improved security and efficiency.

CO4: Use AWS services to make infrastructure scalable, reliable, and highly available

CO5: Use AWS managed services to enable greater flexibility and resiliency in an infrastructure

REFERENCES:

1. AWS Certified Solutions Architect Official Study Guide by Joe Baron, Hisham Baz, Tim Bixler
2. Architecting the Cloud by Michael Kavis.
3. [AWS Documentation (amazon.com)](amazon.com)
4. AWS Skill Builder
5. AWS Academy Cloud Architecting Course - https://www.awsacademy.com/vforcesite/LMS_Login

LIST OF EQUIPMENTS:

AWS Console Account/AWS Academy Learner Lab.

FULL STACK DEVELOPMENT

22CS913	UI/UX DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners:
- Explain the principles of User Interface (UI) in order to do design with intention.
- Define the User eXperience (UX) and the psychology behind user decision making.
- Discuss about UX process and user Psychology.
- Apply technology for designing web applications with multimedia effects.
- Create a wireframe and prototype.

UNIT I	INTRODUCTION TO UI	6+6

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

UNIT II	USER OBSERVATION AND EXPERIENCE	6+6

User Research - Subjective Research - Objective Research - Sample size - Three Basic Types of Questions. Observe a user: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.
List of Exercise/Experiments:
1. Design UI for a mobile.
2. Explore the Look and Feel of the new Project developed in Ex1.

UNIT III	INTRODUCTION TO UX	6+6

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

List of Exercise/Experiments:		
1. Design a mascot for an imaginary brand.		
2. Create a Sample Pattern Library for a product (Mood board, Fonts, Colors based on UI principles).		
UNIT IV	**WEB INTERFACE DESIGN**	**6+6**

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

List of Exercise/Experiments:
1. Design a mock-up website for a service sector company.
2. Create a brainstorming feature for proposed product.

UNIT V	**WIREFRAMING, PROTOTYPING AND TESTING**	**6+6**

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

List of Exercise/Experiments:
1. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.
2. Design a mobile mock-up website for an online store.

TOTAL: 60 PERIODS

OUTCOMES:

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

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

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

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

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

CO5: Create Wireframe and Prototype.

TEXT BOOKS:

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

REFERENCES:

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

SOFTWARE REQUIREMENTS:

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

22CS914	MERN FULL STACK DEVELOPMENT	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- Design applications using Node .JS
- Create architecture involving Express and graphQL
- Develop applications using mongoDB
- Apply the concepts of React Components and State
- Build web applications using React Router, Forms and Bootstrap

UNIT I	INTRODUCTION TO MERN and NODE JS	12

Introduction - MERN Components - Node JS: Introduction to Node JS, Setting up Node.js, Node.js Modules - HTTP Servers and Clients - Request Handling - Database connectivity - Data Storage and Retrieval - Dynamic Client/Server Interaction with Socket.IO

List of Exercise/Experiments:
1. Create your own modules and return Current date and time.
2. Create the HTTP server using createServer() method that listens to server ports and gives a response back to the client.

UNIT II	EXPRESS	12

Express - Routing - Request Matching - Route parameters - Route Lookup - Handler Function - Request Object - Response Object - Middleware - REST API - GraphQL - About API - List API - List API Integration - Custom Scalar Types - Create API Integration - Query Variables - Input Validations - Displaying Errors

List of Exercise/Experiments:
1. Create an application using Express.js to print Hello world on the Homepage.
2. Build a Simple Node.js/Express server that handles GET and POST request and returns data in JSON format.

UNIT III	MongoDB	12

MongoDB Basics - CRUD Operations - NODE.js driver - Schema Initialization - Reading from MongoDB - Writing to MongoDB - UI Server - Multiple Environments - Proxy-based Architecture - ESLint - ESLint for Front End - React PropTypes - Back End Modules - Front End Modules and Webpack - Transform and bundle - Libraries Bundle - Module Replacement - Debugging - Defineplugin - Product Optimization.

List of Exercise/Experiments:
1. Build an application to perform Basic CRUD operation in MongoDB using Node/Express.
2. Building the MongoDB database for the My To-do List app.

UNIT IV	REACT COMPONENTS AND STATE	12

React Components- Issue Tracker - React Classes - Composing Components - Passing Data - Dynamic Composition - React State - Hooks - Event handling - Stateless Components - Designing Components.

List of Exercise/Experiments:
1. Write a program to create a simple calculator Application using React JS
2. Build a simple React application that displays the list of items and allows the user to add new items to the list.

UNIT V	REACT ROUTER, FORMS AND BOOTSTRAP	12

React Router - Simple Routing - Route Parameters - Query Parameters - Links - Programmatic Navigation - Nested Routes - React Forms - Controlled Components - Specialized Input Components - Update API - Delete API - React Bootstrap - Buttons - Navigation - Panels -Tables - Forms - Grid - Inline Forms - Horizontal Forms - Validation Alerts - Toasts – Modals.

List of Exercise/Experiments:
1. Create a Simple Login form using React JS.
2. Build an application for E-Commerce platform.
3. Build a full-stack MERN app that allows the user to register, login, and create a list of items that are stored in a MongoDB database. The app should also display the list of items using React components.

	TOTAL: 60 PERIODS

OUTCOMES:
 Upon completion of the course, the students will be able to:
- Develop applications using Node .js
- Handle queries using GraphQL with Express server
- Create applications based on mongoDB CRUD operations
- Learn about dynamic composition and event handling
- Implement React Forms and Bootstrap

TEXT BOOKS:
1. Vasan Subramanian, Pro MERN Stack - Full stack web app development, 2nd Edition, Apress, 2019 (Unit 2 to 5)
2. David Herron , Node.js Web Development - Fourth Edition, Packt Publishing, 2018. (Unit 1)

REFERENCES:
1. Adam Freeman, Essential TypeScript, Apress, 2019.
2. Shama Hoque, Full-Stack React Projects, 2nd edition, Apress,2022
3. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the-little-mongodb-book.
4. https://aws.amazon.com/education/awseducate/
5. http://packaging.ubuntu.com/html/packaging-new-software.html
6. https://www.tutorialspoint.com/nodejs/nodejs_express_framework.htm

LIST OF EQUIPMENTS:
 Node, Express, MongoDB, React

DATA SCIENCE

22AI302	DATA SCIENCE USING PYTHON	L	T	P	C
		2	0	2	3

OBJECTIVES:
 The Course will enable learners to:
- To learn the fundamentals of Data Science.
- To experiment and implement python libraries for data science Learn the tools and packages in Python for Data Science.

- To apply and implement basic classification algorithms
- To apply clustering and outlier detection approaches.
- To present and interpret data using visualization libraries in Python

UNIT I	INTRODUCTION	6+6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data.

List of Exercise/Experiments:
1. Download, install and explore the features of R/Python for data analytics
   - Installing Anaconda
   - Basic Operations in Jupiter Notebook
   - Basic Data Handling

UNIT II	PYTHON LIBRARIES FOR DATA SCIENCE	6+6

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Ndarray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins- Pivot Tables - String operations – Working with time series – High performance Pandas.

List of Exercise/Experiments:
1. Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create Two arrays and perform the concatenation among the arrays.
2. Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection Operations, Data indexing operations like: loc, iloc, and ix, operations of handling the missing data like None, Nan, Manipulate on the operation of Null Vaues (is null(), not null(), dropna(), fillna()).
3. Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).
4. Use any data set compute the mean ,standard deviation, Percentile.

UNIT III	CLASSIFICATION	6+6

Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Model Evaluation and Selection.
Bayesian Belief Networks – Classification by Backpropagation – Support Vector Machines – Associative Classification – K-Nearest-Neighbor Classifiers – Fuzzy Set Approaches - Multiclass Classification - Semi-Supervised Classification.
List of Exercise/Experiments:
1. Apply Decision Tree algorithms on any data set.
2. Apply SVM on any data set
3. Implement K-Nearest-Neighbor Classifiers

UNIT IV	CLUSTERING AND OUTLIER DETECTION	6+6

Cluster Analysis – Partitioning Methods – Evaluation of Clusters – Probabilistic Model-Based Clustering – Outliers and Outlier Analysis – Outlier Detection Methods – Statistical

Approaches – Clustering and Classification-Based Approaches.

List of Exercise/Experiments:
1. Apply K-means algorithms for any data set.
2. Perform Outlier Analysis on any data set.

UNIT V	DATA VISUALIZATION	6+6

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

List of Exercise/Experiments:
1. Basic plots using Matplotlib.
2. Implementation of Scatter Plot.
3. Construction of Histogram, bar plot, Subplots, Line Plots.
4. Implement the three dimensional potting.
5. Visualize a dataset with Seaborn.

TOTAL:30+30 = 60 PERIODS

OUTCOMES:

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

CO1: Explain the fundamentals of data science
CO2: Experiment python libraries for data science
CO3: Apply and implement basic classification algorithms
CO4: Implement clustering and outlier detection approaches
CO5: Present and interpret data using visualization tools in Python

TEXT BOOKS:
1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit 1)
2. Ashwin Pajankar, Aditya Joshi, Hands-on Machine Learning with Python: Implement Neural Network Solutions with Scikit-learn and PyTorch, Apress, 2022.
3. Jake VanderPlas, "Python Data Science Handbook – Essential tools for working with data", O'Reilly, 2017.

REFERENCES:
1. Roger D. Peng, R Programming for Data Science, Lulu.com, 2016
2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.
3. Samir Madhavan, Mastering Python for Data Science, Packt Publishing, 2015
4. Laura Igual, Santi Seguí, "Introduction to Data Science: A Python Approach to Concepts,
5. Techniques and Applications", 1st Edition, Springer, 2017
6. Peter Bruce, Andrew Bruce, "Practical Statistics for Data Scientists: 50 Essential
7. Concepts", 3rd Edition, O'Reilly, 2017
8. Hector Guerrero, "Excel Data Analysis: Modelling and Simulation", Springer International Publishing, 2nd Edition, 2019
9. NPTEL Courses:
   a. Data Science for Engineers - https://onlinecourses.nptel.ac.in/noc23_cs17/preview
   b. Python for Data Science - https://onlinecourses.nptel.ac.in/noc23_cs21/preview

22AI502	DATA EXPLORATION, FEATURE ENGINEERING AND VISUALIZATION	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- To outline an overview of exploratory data analysis and phases involved in data analytics
- To understand the basics of feature engineering on different types of data.
- To experiment the data visualization
- To describe the methods of time series analysis
- To explain the basics of tree and hierarchical representation of big data

UNIT I	EXPLORATORY DATA ANALYSIS	6+6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA.
Visual Aids For EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques -Descriptive Statistics-types of kurtosis, quartiles, Grouping Datasets-data aggregation, group wise transformation.

List of Exercise/Experiments
1. Install the following Data Mining and data Analysis tool: Weka, KNIME, Tableau Public.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.

UNIT II	FEATURE ENGINEERING	6+6

Text Data – Visual Data – Feature-based Time-Series Analysis – Data Streams – Feature Selection and Evaluation.

List of Exercise/Experiments
1. Implement document embeddings for fake news identification.
2. Implement feature based representations of time series
3. Implement feature selection algorithm for data streams

UNIT III	VISUALIZING DATA	6+6

The Seven Stages of Visualizing Data, Processing-load and displaying data – functions, sketching and scripting, Mapping-Location, Data, two sided data ranges, smooth interpolation of values over time - Visualization of numeric data and non numeric data.

List of Exercise/Experiments
1. Perform text mining on a set of documents and visualize the most important words in a visualization such as word cloud.
2. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
3. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.

UNIT IV	TIME SERIES ANALYSIS	6+6

Overview of time series analysis-showing data as an area, drawing tabs, handling mouse

input, Connections and Correlations – Preprocessing-introducing regular expression, sophisticated sorting, Scatterplot Maps-deployment issues.

List of Exercise/Experiments
1. Perform Time Series Analysis with datasets like Open Power System Data.
2. Build a time-series model on a given dataset and evaluate its accuracy.

UNIT V	TREES, HIERARCHIES, AND RECURSION	6+6

Treemaps - treemap library, directory structure, maintaining context, file item, folder item, Networks and Graphs-approaching network problems-advanced graph example, Acquiring data, Parsing data.

List of Exercise/Experiments
1. Use a case study on a data set and apply the various visualization techniques and present an analysis report.
2. Mini-Project:- Create a Dashboard for a dataset with a visualization tool.

TOTAL: 30+30 = 60 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Explain the overview of exploratory data analysis and phases involved in data analytics.
CO2: Understand the basics of feature engineering on different types of data.
CO3: Apply the visualization techniques in data.
CO4: Describe the methods of time series analysis.
CO5: Represent the data in tree and hierarchical formats.

TEXT BOOKS:
1. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-on Exploratory Data Analysis with Python", Packt Publishing , First Edition, March 2020.
2. Guozhu Dong, Huan Liu, "Feature Engineering for Machine Learning and Data Analytics", First Publication, CRC Press, First edition, 2018.
3. Ben Fry, "Visualizing Data", O'reilly Publications, First Edition, 2007.

REFERENCES:
1. Danyel Fisher & Miriah Meyer, "Making Data Visual: A Practical Guide To Using Visualization For Insight", O'reilly publications, 2018.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. EMC Education Services, "Data Science and Big data analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2015.
4. Tamara Munzner, "Visualization Analysis and Design", A K Peters/CRC Press; 1st edition, 2014.
5. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

LIST OF EQUIPMENTS:
1. Systems with Python/R, Tableau Public / PowerBI

ADVANCED SECURITY

22CY903	CYBER PHYSICAL SYSTEMS	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- To impart the foundation knowledge of cyber physical system.
- To understand the components that defines the physical and cyber aspects of real-world technologies.
- To explore the processing units applicable for cyber physical system.
- To foster understanding through real-world applications related to cyber physical systems.
- Explore the Tools to learn about the cyber physical system.

UNIT I	INTRODUCTION	15

Introduction to Cyber-Physical System-Key Features of CPS-Application Domains of CPS-Basic principles of design and validation of CPS - Challenges in CPS. Significance of CPS-Hybrid System Vs. CPS - Multi dynamical System-Components of CPS-Physical-Cyber and Computational components.
List of Exercise/Experiments
3. Development of competence on cyber-physical production processes and systems for implementation in learning environment
4. Familiarity to Embedded and robot platform

UNIT II	CPS PLATFORM COMPONENTS	15

CPS HW platforms- Processors, Sensors and Actuators -CPS Network -Wireless, CAN, Automotive Ethernet-Scheduling Real Time CPS Tasks- Network criteria designs - Importance of sensors - causality - sensor reliability-memory requirement-computational complexity - redundant sensors Synchronous Model and Asynchronous Model-Case study
List of Exercise/Experiments
3. Familiarity to Embedded C and hardware interfacing.
4. Experiment based on sensors using Embedded C

UNIT III	SYNCHRONOUS AND ASYNCHRONOUS MODEL	15

Reactive Components-Components Properties-Components Composing-Synchronous Designs and Circuits-Asynchronous Processes and operations-Design Primitives in Asynchronous Process-Coordination Protocols in Asynchronous Process-Leader Election-Reliable Transmission.

List of Exercise/Experiments
4. Implementation of line robot
5. Implementation of open loop system stability using MAT LAB

UNIT IV	SECURITY OF CYBER-PHYSICAL SYSTEMS	15

Introduction to CPS Securities-Basic Techniques in CPS Securities-Cyber Security Requirements-Attack Model and Countermeasures -Advanced Techniques in CPS Securities-conveyor belt Automation-Timed automation process.

List of Exercise/Experiments

4. Write a program in MATLAB to implement timed automation. 5. Write a program in MATLAB to implement conveyor belt automation. 6. Write a program in MATLAB to implement PID controllers for drones.		
UNIT V	**CYBER PHYSICAL SYSTEMS APPLICATION**	**15**
Health care and Medical Cyber-Physical Systems-Smart grid and Energy Cyber-Physical Systems-WSN based Cyber-Physical Systems-Smart Cities-Case Study **List of Exercise/Experiments** 4. Implement a machine learning algorithm for an autonomous robotics (CPS) 5. Study the machine learning in smart grids and monitoring. 6. Study the machine learning in Health care monitoring		

TOTAL:60PERIODS

OUTCOMES:

Uponcompletionofthecourse, thestudentswill beable to:

CO1: The learners will be able to describe the basic concepts of cyber physical

System with an emphasis on concept map.

CO2: Gain knowledge on utilization of sensors & actuators

CO3: Identify the types of cyber components with its implementation strategies.

CO4: Elucidate the architecture with the aid of working principle for various operational units.

CO5: Propose practices for managing cyber physical-systems risk

CO6: Implement techniques for defending cyber-physical systems

TEXTBOOKS:

1. E. A. Lee and S. A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2011.
2. R. Alur, "Principles of Cyber-Physical Systems," MIT Press, 2015.
3. Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber-Physical Systems", Addison-Wesley, 2017
4. Fei Hu, "Cyber-Physical Systems", CRC Press 2013.

REFERENCES:

5. P.Marwedel, Embedded System Design: Embedded Systems Foundation of Cyber- Physical Systems, vol.16, 2020.
6. Wolf, Marilyn. Computers as components: principles of embedded computing system design. Elsevier, 2017.
7. P.Ashok, G.Krishnamoorthy, and D. Tesar, "Guidelines for managing sensors in cyber physical systems with multiple sensors", J.Sensors, vol.20, 2011.

LIST OF SOFTWARE:

3. **Software required:**
   Python (Jupyter Note book or Py charm)
   Embedded C

4. **Software Tools required:**
   Sci Lab
   MAT Lab/Simulink
   Arduino Uno

22CY904	AI IN CYBER SECURITY	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- Learn the Concepts of AI in Cybersecurity.
- Understand the methods of Cybersecurity Arsenal
- Learn the techniques for security threats with AI
- Protect the sensitive information and assets.
- Explore the Tools and Applications to learn about the AI in Cybersecurity.

UNIT I	INTRODUCTION TO AI IN CYBERSECURITY	15

Introduction – Applying AI in cyber security - Evolution from expert systems to data mining and AI- The different forms of automated learning - Characteristics of algorithm training and optimization - Beginning with AI via Jupyter Notebooks - Introducing AI in the context of cyber security.

List of Exercise/Experiments
1. Explore Jupyter notebooks.

UNIT II	AI FOR CYBER SECURITY ARSENAL	15

Classification – Regression - Dimensionality reduction – Clustering - Speech recognition - Video anomaly detection - Natural language processing (NLP) - Large-scale image processing - Social media analysis.

List of Exercise/Experiment

1. To study and explore Preprocessing of text (Tokenization, Filtration, Script, Validation, Stop word Removal, Stemming)
2. Explore Social media analysis

UNIT III	CYBER SECURITY THREATS WITH AI	15

Detection of Spam with Perceptron - Image spam detection with support vector machines - Phishing detection with logistic regression and decision trees- Spam detection with Naive Bayes - Spam detection adopting NLP

List of Exercise/Experiments
1. Implement a program for network access control to illustrate malware attacks.
2. Implement Naïve Bayes Scratch Implementation using Python.
3. Design a Spam detection algorithm.

UNIT IV	PROTECTING SENSITIVE INFORMATION AND ASSETS	15

Authentication abuse prevention - Account reputation scoring - User authentication with keystroke recognition -Biometric authentication with facial recognition

List of Exercise/Experiments
1. Explore keystroke recognition using NLP.
2. Implement Real-time Facial Recognition Software powered by AI.
3. Explore Image Based Recognition using Software powered AI.

UNIT V	APPLICATIONS	15

22CS921	INDUSTRIAL IoT	L	T	P	C
		2	0	2	3

OBJECTIVES:
The Course will enable learners to:
- Introduce how IoT has become a game changer in the new economy where the customers are looking for integrated value.
- Get insights over architecture and protocols of IIoT
- Know the various sensors and interfacing used in IIoT.
- Bring the IoT perspective in thinking and building solutions.

UNIT I	INTRODUCTION	6+6

Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, People Process, Hype cycle, IOT Market, Trends, future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining Manipulation, Thinking about Prototyping – Costs versus ease of prototyping, prototyping and Production, open source versus Closed Source, Role of IIOT in Manufacturing Processes, Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges, Benefits in implementing IIOT

List of Exercise/Experiments:
1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1sec after every 2seconds.

UNIT II	ARCHITECTURE AND PROTOCOLS	6+6

Overview of IOT components; Various Architectures of IOT and IIOT, Advantages &disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT; Need for protocols, Wi-Fi, Zigbee, Bacnet, IIOT protocols –COAP, MQTT, 6LoWPAN, LWM2M, AMPQ

List of Exercise/Experiments:
1. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
2. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
3. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
4. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to ThingSpeak cloud.

UNIT III	SENSORS AND INTERFACING	6+6

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial,Parallel, Ethernet, BACNet , Current, M2M, Prototyping online Components – Getting Started with an API, Writing a New API, Real Time Reactions.
List of Exercise/Experiments:

1.	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.	
2.	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.	

UNIT IV	**CLOUD, SECURITY AND GOVERNANCE**	**6+6**

IIOT cloud platforms: Overview of cots cloud platforms, predix, thingworks, azure,. Data analytics, cloud services, Business models: Saas, Paas, Iaas; Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity; Management aspects of cyber security.

List of Exercise/Experiments:
1. To install MySQL database on Raspberry Pi and perform basic SQL queries.
2. Write a program on Arduino/Raspberry Pi to publish and subscribe temperature data to MQTT broker.

UNIT V	**IOT ANALYTICS AND APPLICATIONS**	**6+6**

IOT Analytics : Role of Analytics in IOT, Data visualization Techniques, Statistical Methods; IOT Applications : Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Plant Automation, Real life examples of IIOT in Manufacturing Sector**.**

List of Exercise/Experiments:
1. Mini Project – Home Automation,Vehicle Tracking, Agriculture Applications, Healthcare applications

	TOTAL: 60 PERIODS

OUTCOMES:
 Upon completion of the course, the students will be able to:
CO1: Describe IOT, IIOT
CO2: Understand various IoT Layers and their relative importance
CO3: Interpret the requirements of IIOT sensors and understand the role of actuators.
CO4: Study various IoT platforms and Security
CO5: Design various applications using IIoT in manufacturing sector and realize the importance of Data Analytics in IoT

TEXT BOOKS:
1. Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications,1st Edition, Wiley Publications, 2013
2. Dieter Uckelmann , Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer-Verlag Berlin Heidelberg 2011 Industry 4.0: The Industrial Internet of Things

REFERENCES:
1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", CISCO Press, 2017.
3. Sudip Misra, Anandarup Mukherjee, Arjit Roy, "Introduction to IoT", Cambridge University Press, 2021.
4. HakimaChaouchi,The Internet of Things Connecting Objects to the Web Willy Publications.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition,Wiley Publications
6. https://onlinecourses.nptel.ac.in/noc20_cs69/preview

LIST OF EQUIPMENTS:

1. Arduino Uno With USB Cable
2. Bread Board (GL-840)
3. LED (3 Color Each-5)
4. Resistor (10Ω,10KΩ)
5. Hookup Wire
6. RGB LED
7. Push Button
8. IR-Sensor
9. Buzzer
10. Piezo Sensor
11. Potentiometer (10KΩ)
12. Temperature Sensor
13. Bluetooth Module
14. 7 Segment Display
15. DC Toy Motor
16. Ultrasonic Sensor
17. WiFi Module
18. System With Internet Connection

22AI933	GPU COMPUTING (Lab Integrated)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Understand the basics of GPU Architectures and CUDA Programming.
- Learn synchronization using CUDA.
- Discuss memories and its impact on performance.
- Understand the various parallel algorithms on GPU.
- Learn the basics of OPENCL.

UNIT I	GPU ARCHITECTURES AND CUDA PROGRAMMING	6+6

Heterogeneous Parallel Computing – Architecture of a modern GPU – Parallel Programming languages and models – GPU Computing – Introduction to Data Parallelism and CUDA C: Data Parallelism – CUDA Program Structure – A vector additional Kernel – Device Global Memory and Data Transfer – Kernel functions and Threading.

List of Exercise/Experiments

1. Write and execute simple CUDA C programs.
2. Write and execute CUDA C program to add two arrays.

UNIT II	MULTI-DIMENSIONAL DATA & SYNCHRONIZATION	6+6

CUDA Thread Organization - Mapping Threads to Multi-Dimensional Data – Synchronization and Transparent Scalability – Assigning resources to Blocks – Querying Device Properties – Thread Scheduling and Latency Tolerance.

List of Exercise/Experiments

1. Implement Matrix-Matrix Multiplication using threads.
2. Optimize Matrix transpose using CUDA.

UNIT III	CUDA MEMORIES & PERFORMANCE	6+6

CUDA Memories – Memory Access Efficiency – CUDA Device Memory Types – Reducing global Memory Traffic – Performance Considerations - Warps and Thread Execution – Global Memory Bandwidth – Dynamic Partitioning of Execution Resources – Instruction Mix and Thread Granularity.

List of Exercise/Experiments
  1. Implement Tiled Matrix-Matrix Multiplication.
  2. Write a matrix multiplication kernel function that increases thread granularity.		

UNIT IV	**ALGORITHMS ON GPU**	**6+6**

Parallel Patterns: Convolution – Prefix Sum – Sparse Matrix – Vector Multiplication.
List of Exercise/Experiments
  1. Implement 1D Parallel Convolution Algorithm
  2. Implement Parallel scan algorithm to generate the sum of N values.		

UNIT V	**OPENCL BASICS**	**6+6**

Introduction – OpenCL Platform Model – Execution Model – Programming model – Memory Model – OpenCL Runtime.
List of Exercise/Experiments
  1. Vector Addition Using an OpenCL C++ Wrapper.
  2. Implement Image rotation using OpenCL.
Mini Project:
  • Apply CUDA and OpenGL to accelerate the performance of various image processing operations.		

		TOTAL: 30+30 = 60 PERIODS
OUTCOMES: **Upon completion of the course, the students will be able to:** **CO1:** Understand the basics of GPU Architectures and implement simple CUDA Programs. **CO2:** Learn synchronization using CUDA. **CO3:** Explain CUDA memories and its impact on performance. **CO4:** Apply various parallel algorithms on GPU. **CO5:** Apply OpenCL to solve programs and improve performance.		
TEXT BOOKS:		
1. David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors – A hands-on Approach, Morgan Kaufmann, Second Edition, 2013. 2. Benedict Gaster,Lee Howes, David R. Kaeli , "Heterogeneous Computing with OpenCL", Third Edition, Morgan Kaufman, 2012.		
REFERENCES:		
1. David Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, "Heterogeneous Computing with OpenCL 2.0", Third Edition, Morgan Kaufman, 2015. 2. John L.Hennessy and David A. Patterson, "Computer Architecture - A Quantitative Approach", Sixth Edition, Morgan Kaufman, 2017. 3. NPTEL Courses: a. GPU Architectures And Programming - https://onlinecourses.nptel.ac.in/noc23_cs61/preview		
LIST OF EQUIPMENTS:		
1. Systems with CUDA Toolkit, OpenCL		