PANIMALAR
ENGINEERING COLLEGE

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

B.E - COMPUTER SCIENCE AND ENGINEERING

REGULATION 2021

CURRICULUM & SYLLABUS

PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123.

Department of Computer Science and Engineering
B.E- Computer Science and Engineering

CURRICULUM AND SYLLABUS

REGULATION-2021

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To provide an academically conducive environment for individuals to develop as technologically superior, socially conscious and nationally responsible citizens.

MISSION

M1: To develop our department as a center of excellence, imparting quality education,generating competent and skilled manpower.

M2: To prepare our students with high degree of credibility, integrity, ethical standards and social concern.

M3: To train our students to devise and implement novel systems based on Education and Research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: Employment/Higher studies: To impart and disseminate sound knowledge to the students on the fundamentals of mathematics and advanced fields of computer science and interrelated disciplines to solve simple and complex engineering problems and train them to achieve sustainable growth in their professional career.

PEO 2: Discipline Knowledge: To enhance the ability of students to evaluate the specific requirements of software industry and provide innovative engineering solutions and efficient product designs.

PEO 3: Individual Skills: To facilitate the students to make use of their technical competency to identify and develop appropriate product design, development, testing, maintenance, analysis of problems and provide corrective measures.

PEO 4:3P's -Professional, Personality and Presentation: To enable the students to develop strong leadership qualities with aggressive optimism, multidisciplinary skills, excellent communication skills and function as effective and reliable team members giving importance to professional and ethical principles.

PEO 5: Environment: To inculcate in the students to associate in social networking, pursue continued learning of the latest developments in Computer Science and involve in higher research and contribute to the development of software industry and related engineering fields.

PROGRAM OUTCOMES (PO)

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, research literature, and analyze complex engineering problem 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 memberor 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 (Life-long learning): Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1 (Professional Skills): To inculcate technical skills to analyze, design and implement software's related to algorithms, networking, web services, multimedia, big data analytics and recent topics of varying complexity.

PSO 2 (Problem-Solving Skills): To develop the capability to comprehend and solve the interdisciplinary problems through appropriate technology with the understanding of contemporary business environment

PSO 3 (Successful Career and Entrepreneurship): To develop an ability to utilize the latest technology and platforms to become a triumphant professional, successful entrepreneur and an urge for pursuing higher studies.

PANIMALAR ENGINEERING COLLEGE
(An Autonomous Institution, Affiliated to Anna University, Chennai)
B.E. COMPUTER SCIENCE AND ENGINEERING
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI - R 2021

SEMESTER I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21HS1101	Communicative English & Language Skills Lab I Integrated	HS	5	3	0	2	4
2.	21MA1101	Engineering Mathematics - I	BS	4	3	1	0	4
3.	21PH1101	Engineering Physics	BS	3	3	0	0	3
4.	21CY1101	Engineering Chemistry	BS	3	3	0	0	3
5.	21ES1101	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	21ES1102	Engineering Graphics	ES	5	3	0	2	4
PRACTICALS								
7.	21ES1111	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	21BS1111	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	31	18	1	12	25

SEMESTER II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21HS1201	Communicative English & Language Skills Lab II Integrated	HS	5	3	0	2	4
2.	21MA1201	Engineering Mathematics - II	BS	4	3	1	0	4
3.	21ES1201	Basic Electrical, Electronics and Measurements Engineering	ES	3	3	0	0	3
4.	21CS1201	Programming and Data Structures	PC	3	3	0	0	3
5.	21CS1202	Web Application Development (Lab Integrated)	PC	5	3	0	2	4
6.		Mandatory Course - I	MC	2	2	0	0	0
PRACTICALS								
7.	21CS1211	Programming and Data Structures Laboratory	PC	4	0	0	4	2
8.	21ES1211	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	30	17	1	12	22

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA1301	Discrete Mathematics	BS	4	3	1	0	4
2.	21CS1301	Digital Logic and Design	ES	3	3	0	0	3
3.	21CS1302	Computer Architecture and Microprocessors	PC	3	3	0	0	3
4.	21CS1303	Software Engineering	PC	3	3	0	0	3
5.	21IT1304	Object Oriented Programming	PC	3	3	0	0	3
6.		Mandatory Course - II	MC	2	2	0	0	0
PRACTICALS								
7.	21CS1311	Digital Logic and Design Laboratory	ES	4	0	0	4	2
8.	21IT1312	Object Oriented Programming Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**17**	**1**	**8**	**20**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA1401	Probability and Queuing Theory	BS	4	3	1	0	4
2.	21CS1401	Database Management Systems	PC	3	3	0	0	3
3.	21CS1402	Design and Analysis of Algorithms	PC	3	3	0	0	3
4.	21CS1403	Computer Networks	PC	3	3	0	0	3
5.	21IT1302	Operating Systems (Lab Integrated)	PC	5	3	0	2	4
6.		Open Elective I	OE	3	3	0	0	3
PRACTICALS								
7.	21CS1411	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	21CS1412	Networks Laboratory	PC	4	0	0	4	2
			TOTAL	**29**	**18**	**1**	**10**	**24**

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA1501	Algebra and Number Theory	BS	4	3	1	0	4
2.	21MG1401	Organizational Behaviour and Ethical Practices	HS	3	3	0	0	3
3.	21CS1501	Object Oriented Analysis and Design (Lab Integrated)	PC	5	3	0	2	4
4.	21CS1502	Internet Programming	PC	3	3	0	0	3
5.	21CS1503	Theory of Computation	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	21CS1511	Internet Programming Laboratory	PC	4	0	0	4	2
8.	21CS1512	Socially Relevant Mini Project	EEC	2	0	0	2	1
			TOTAL	**27**	**18**	**1**	**8**	**23**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS1601	Cloud Computing and Big Data Technologies	PC	3	3	0	0	3
2.	21CS1602	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
3.	21CS1603	Compiler Design (Lab Integrated)	PC	5	3	0	2	4
4.		Professional Elective II	PE	3	3	0	0	3
5.		Open Elective II	OE	3	3	0	0	3
PRACTICALS								
6.	21CS1611	Cloud Computing and Big Data Technologies Laboratory	PC	4	0	0	4	2
7.	21CS1612	Artificial Intelligence and Machine Learning Laboratory	PC	4	0	0	4	2
8.	21EEC001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	6	0	0	6	3
			TOTAL	**31**	**15**	**0**	**16**	**23**

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21CS1701	Cryptography and Network Security	PC	3	3	0	0	3
2.	21CS1702	Mobile Application Development (Lab Integrated)	PC	5	3	0	2	4
3.	21CS1703	Data Science and Analytics	PC	3	3	0	0	3
4.		Professional Elective III	PE	3	3	0	0	3
5.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
6.	21CS1711	Data Science and Analytics Laboratory	PC	4	0	0	4	2
7.	21CS1712	Cryptography and Network Security Laboratory	PC	4	0	0	4	2
			TOTAL	**25**	**15**	**0**	**10**	**20**

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY & PROJECT								
1.		Professional Elective V	PE	3	3	0	0	3
2.		Professional Elective VI	PE	3	3	0	0	3
3.	21CS1811	Project Work	EEC	16	0	0	16	8
			TOTAL	**22**	**6**	**0**	**16**	**14**

TOTAL NO. OF CREDITS: 171

SUMMARY OF CREDITS

S.NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	PERCENTAGE (%)
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Sciences (HS)	4	4			3				11	6.43
2.	Basic Sciences (BS)	12	4	4	4	4				28	16.37
3.	Engineering Sciences (ES)	9	5	5						19	11.11
4.	Professional Core (PC)		9	11	17	12	14	14		77	45.03
5.	Professional Elective (PE)					3	3	6	6	18	10.53
6.	Open Elective (OE)				3		3			6	3.51
7.	Employment Enhancement Courses (EEC)					1	3		8	12	7.02
8.	Mandatory Courses (MC) (Non Credit)	-	-	-	-	-	-	-	-	-	-
	TOTAL	25	22	20	24	23	23	20	14	171	100.00

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

PROFESSIONAL ELECTIVES : VERTICALS

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media Technologies	Vertical VI Emerging Technologies	Vertical VII Artificial Intelligence Techniques	Vertical VIII Networking
Exploratory Data Analysis	Open Source Technologies	Cloud Tools and Techniques	Ethical Hacking	Augmented Reality/Virtual Reality	Augmented Reality/Virtual Reality	Knowledge Engineering	Communication Theory
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	Soft Computing	Network Design And Programming
Neural Networks and Deep Learning	Cloud Services Management	Cloud Services Management	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning	Neural Networks and Deep Learning	Wireless Technologies
Text and Speech Analysis	UI and UX Design	Storage Technologies	Modern Cryptography	UI and UX Design	Cyber Security	Text and Speech Analysis	Network Management
Business Analytics	Software Testing and Automation	Site Reliability Engineering	Engineering Secure Software Systems	Digital Marketing	Quantum Computing	Optimization Techniques in Machine Learning	Wireless Adhoc And Sensor Networks
Image and Video Analytics	Web Application Security	Stream Processing	Cryptocurrency and Blockchain Technologies	Visual Effects	Cryptocurrency and Blockchain Technologies	Game Theory	Protocols And Architectures For Wireless Sensor Networks
Computer Vision Techniques	DevOps	DevOps	Cyber Physical Systems Security	Game Development	Game Development	Cognitive Science	Next Generation Networks
Data Visualization	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Multimedia Data Compression and Storage	3D Printing and Design	Ethics And AI	Software Defined Networks

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL 1: DATA SCIENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21AD1901	Exploratory Data Analysis	PE	3	3	0	0	3
2.	21AD1902	Recommender Systems	PE	3	3	0	0	3
3.	21AD1918	Neural Networks and Deep Learning	PE	3	3	0	0	3
4.	21AD1919	Text and Speech Analysis	PE	3	3	0	0	3
5.	21AD1920	Business Analytics	PE	3	3	0	0	3
6.	21AD1906	Image and Video Analytics	PE	3	3	0	0	3
7.	21AD1921	Computer Vision Techniques	PE	3	3	0	0	3
8.	21AD1922	Data Visualization	PE	3	3	0	0	3

VERTICAL 2: FULL STACK DEVELOPMENT

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21IT1901	Open Source Technologies	PE	3	3	0	0	3
2.	21IT1902	App Development	PE	3	3	0	0	3
3.	21CS1903	Cloud Services Management	PE	3	3	0	0	3
4.	21IT1903	UI and UX Design	PE	3	3	0	0	3
5.	21IT1904	Software Testing and Automation	PE	3	3	0	0	3
6.	21IT1905	Web Application Security	PE	3	3	0	0	3
7.	21IT1906	DevOps	PE	3	3	0	0	3
8.	21IT1907	Principles of Programming Languages	PE	3	3	0	0	3

VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS1901	Cloud Tools and Techniques	PE	3	3	0	0	3
2.	21CS1902	Virtualization	PE	3	3	0	0	3
3.	21CS1903	Cloud Services Management	PE	3	3	0	0	3
4.	21CS1904	Storage Technologies	PE	3	3	0	0	3
5.	21CS1905	Site Reliability Engineering	PE	3	3	0	0	3
6.	21CS1906	Stream Processing	PE	3	3	0	0	3
7.	21IT1906	DevOps	PE	3	3	0	0	3
8.	21CS1907	Security and Privacy in Cloud	PE	3	3	0	0	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21IT1908	Ethical Hacking	PE	3	3	0	0	3
2.	21IT1909	Digital and Mobile Forensics	PE	3	3	0	0	3
3.	21IT1910	Social Network Security	PE	3	3	0	0	3
4.	21IT1911	Modern Cryptography	PE	3	3	0	0	3
5.	21IT1912	Engineering Secure Software Systems	PE	3	3	0	0	3
6.	21IT1913	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
7.	21IT1914	Cyber Physical Systems Security	PE	3	3	0	0	3
8.	21CS1907	Security and Privacy in Cloud	PE	3	3	0	0	3

VERTICAL 5: CREATIVE MEDIA TECHNOLOGIES

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS1908	Augmented Reality/Virtual Reality	PE	3	3	0	0	3
2.	21CS1909	Multimedia and Animation	PE	3	3	0	0	3
3.	21CS1910	Video Creation and Editing	PE	3	3	0	0	3
4.	21IT1903	UI and UX Design	PE	3	3	0	0	3
5.	21CS1911	Digital Marketing	PE	3	3	0	0	3
6.	21CS1912	Visual Effects	PE	3	3	0	0	3
7.	21CS1913	Game Development	PE	3	3	0	0	3
8.	21CS1914	Multimedia Data Compression and Storage	PE	3	3	0	0	3

VERTICAL 6: EMERGING TECHNOLOGIES

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS1908	Augmented Reality/Virtual Reality	PE	3	3	0	0	3
2.	21CS1915	Robotic Process Automation	PE	3	3	0	0	3
3.	21AD1918	Neural Networks and Deep Learning	PE	3	3	0	0	3
4.	21IT1915	Cyber security	PE	3	3	0	0	3
5.	21CS1916	Quantum Computing	PE	3	3	0	0	3
6.	21IT1913	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
7.	21CS1913	Game Development	PE	3	3	0	0	3
8.	21CS1917	3D Printing and Design	PE	3	3	0	0	3

VERTICAL 7: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21AD1923	Knowledge Engineering	PE	3	3	0	0	3
2.	21AD1903	Soft Computing	PE	3	3	0	0	3
3.	21AD1918	Neural Networks and Deep Learning	PE	3	3	0	0	3
4.	21AD1919	Text and Speech Analysis	PE	3	3	0	0	3
5.	21AD1924	Optimization Techniques in Machine Learning	PE	3	3	0	0	3
6.	21AD1916	Game Theory	PE	3	3	0	0	3
7.	21AD1917	Cognitive Science	PE	3	3	0	0	3
8.	21AD1907	Ethics And AI	PE	3	3	0	0	3

VERTICAL 8: NETWORKING

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS1918	Communication Theory	PE	3	3	0	0	3
2.	21CS1919	Network Design and Programming	PE	3	3	0	0	3
3.	21IT1916	Wireless Technologies	PE	3	3	0	0	3
4.	21IT1917	Network Management	PE	3	3	0	0	3
5.	21CS1920	Wireless Adhoc and Sensor Networks	PE	3	3	0	0	3
6.	21IT1918	Protocols and Architectures for Wireless Sensor Networks	PE	3	3	0	0	3
7.	21CS1921	Next Generation Networks	PE	3	3	0	0	3
8.	21IT1919	Software Defined Networks	PE	3	3	0	0	3

OPEN ELECTIVES

SEMESTER IV
OPEN ELECTIVE I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CE1010	Air Pollution and Control Engineering	OE	3	3	0	0	3
2.	21CE1001	Energy Conservation and Management	OE	3	3	0	0	3
3.	21GE1004	Hospital Waste Management	OE	3	3	0	0	3
4.	21CY1001	Industrial Nanotechnology	OE	3	3	0	0	3
5.	21EE1003	Logic and Distributed Control Systems	OE	3	3	0	0	3
6.	21EC1011	TeleHealth Technology	OE	3	3	0	0	3

SEMESTER VI
OPEN ELECTIVE II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21EE1001	Basic Circuit Theory	OE	3	3	0	0	3
2.	21CY1002	Energy Technology	OE	3	3	0	0	3
3.	21EC1004	Electronic Devices						
4.	21CE1009	Environmental and Social Impact Assessment	OE	3	3	0	0	3
5.	21GE1003	Hospital Management	OE	3	3	0	0	3
6.	21EC1002	Medical Electronics	OE	3	3	0	0	3
7.	21EC1006	Signals and Systems	OE	3	3	0	0	3
8.	21ME1006	Systems Engineering	OE	3	3	0	0	3
9.	21ME1008	Supply Chain Management	OE	3	3	0	0	3
10.	21CY1003	Waste Water Treatment	OE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CS1512	Socially Relevant Mini Project	EEC	2	0	0	2	1
2.	21EEC001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	6	0	0	6	3
3.	21CS1811	Project Work	EEC	16	0	0	16	8

MANDATORY NONCREDIT COURSES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21MC1001	Environmental Science	MC	2	2	0	0	0
2.	21MC1002	Constitution of India	MC	2	2	0	0	0
3.	21MC1003	Human Values	MC	2	2	0	0	0
4.	21MC1004	Energy Studies	MC	2	2	0	0	0
5.	21MC1005	Essence of Indian Traditional Knowledge	MC	2	2	0	0	0
6.	21MC1006	Soft Skills and Personality Development	MC	2	2	0	0	0
7.	21MC1007	Value Education, Human Rights And Legislature Procedure	MC	2	2	0	0	0

		L	T	P	C
21HS1101	**COMMUNICATIVE ENGLISH & LANGUAGE SKILLS LAB I INTEGRATED**	3	0	2	4

OBJECTIVES: To impart Knowledge on the following topics:

- To induce the basic reading and writing skills among the first year engineering and technology students.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications.
- To succor the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments.

UNIT - I   INTRODUCING ONESELF   9

Listening: Listening and filling details, Listening to Speeches by Specialists and Completing Activities such as Answering Questions, Identifying the Main Ideas, Style, etc.
Speaking: Introducing Oneself - Introducing Friend/ Family.
Reading: Descriptive Passages (From Newspapers / Magazines).
Writing: Writing a Paragraph (Native Place, School Life), Developing Hints.
Grammar: Noun, Pronoun & Adjective.
Vocabulary Development: One Word Substitution.

UNIT - II   DIALOGUE WRITING   9

Listening: Listening to Conversations (Asking for and Giving Directions).
Speaking: Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays, and Dialogues.
Reading: Reading a Print Interview and Answering Comprehension Questions.
Writing: Writing a Checklist, Dialogue Writing.
Grammar: Tenses and Voices.
Vocabulary Development: Prefix & Suffix, Word formation.

UNIT - III DRAFTING OFFICIAL COMMUNICATIONS 9

Listening: Listening for specific information.
Speaking: Giving Short Talks on a given Topic.
Reading: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open – Ended and Closed Questions).
Writing: Writing Formal Letters / Emails. Grammar: Adverb, Prepositions & Conjunctions.
Vocabulary Development: Collocations - Fixed Expressions.

UNIT -IV WRITTEN COMMUNICATION 9

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making.
Speaking: Small Group Discussion, Giving Recommendations.
Reading: Reading Problem – Solution Articles/Essays Drawn From Various Sources.
Writing: Making Recommendations Note Making - Complaint Letters.
Grammar: Subject-Verb Agreement, Framing Questions.
Vocabulary Development: Connectives, Reference Words, Technical Vocabulary.

UNIT -V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9

Listening: Listening to a Product Description (Labeling and Gap Filling) Exercises. **Speaking:** Describing a Product and Comparing and Contrasting it with Other Products.
Reading: Reading Graphical Material for Comparison (Advertisements).
Writing: Writing Definitions (Short and Long)-Compare and Contrast Paragraphs, Essay writing.
Grammar: Phrasal Verbs - Cause and Effect Sentences –Compound Nouns
Vocabulary Development: Use of Discourse Markers.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. The students will be able to comprehend conversations and short talks delivered in English.
2. Participate effectively in informal conversations; introduce themselves and their friends and express opinions English
3. Read articles of a general kind in magazines and newspapers
4. Write short essays of a general kind and personal letters and emails in English
5. Recognize the use of grammar in speech and writing

TEXT BOOKS:

1. N P Sudharshana & C Savitha. English for Technical Communication Delhi: CUP, 2019.
2. Board of Editors English for Engineers and Technologists Volume 1 Orient Black Swan Limited, 2020.

REFERENCES:

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black Swan Limited, 2017
2. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
3. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning ,USA:2007
5. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005.

WEB REFERENCES:

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/wordformation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES:

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316 21.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

<div align="center">

LANGUAGE SKILLS LAB
</div>

List of exercises : MINIMUM OF EXERCISES TO BE CONDUCTED   15

1. Reading: Different text type
2. Reading: Predicting content using pictures and title.
3. Reading: Use of graphic organizers to review
4. Reading: Aid comprehension.
5. Reading: Understanding reference words.
6. Reading: Use of connectors in a passage.
7. Reading: Speed reading Techniques.

8. Reading and Comprehending the passages in the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments.
9. Reading: Sentence Completion: Exercises used in competitive exams.
10. Writing: Error Detection:
11. Writing: Spotting and reasoning the errors found from the passages in competitive exams
12. Writing: Email writing

13. Writing: Job Application: Resume
14. Writing: Elements of a good essay-
15. Writing: Types of essays- Descriptive-Narrative- issue based.
16. Writing: Statement of Purpose
17. Writing: Letter of recommendation
18. Writing: Vision statement
19. Writing: Verbal Analogy,
20. Writing Phrases, and Idioms associated with competitive exams

TOTAL: 30 PERIODS

SOFTWARE REQUIRED

Globarena

REFERENCES:
1. Suresh Kumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
2. Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge UniversityPress: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000

		L	T	P	C
21MA1101	**ENGINEERING MATHEMATICS- I**	3	1	0	4

OBJECTIVES: To impart Knowledge on the following topics:

- Matrix transforms are very useful within the world of computer graphics. A matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view.
- The aim of this course to get depth knowledge about calculus.
- Familiarize the functions of two variables and finding its extreme points.
- To make the students understand various techniques of integration.
- Apply multiple integral ideas in solving areas, volumes and other practical problems

UNIT - I   **MATRICES**   **9 + 3**

Eigen values and Eigen vectors of a real matrix —Rank of the matrix – Characteristic equation - Properties of Eigenvalues and Eigen vectors — Cayley Hamilton theorem — Diagonalization of matrices– Reduction of a quadratic form to canonical form by orthogonal transformation and similarity transformation –Nature of quadratic forms.

UNIT - II   **DIFFERENTIAL CALCULUS**   **9 + 3**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) - Maxima and Minima of functions of one variable-Rolle's theorem- Mean value theorem.

UNIT - III   **FUNCTIONS OF SEVERAL VARIABLES**   **9 + 3**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables -Lagrange's method of undetermined multipliers.

UNIT -IV   **INTEGRAL CALCULUS**   **9 + 3**

Definite and Indefinite integrals – Substitution rule – Techniques of Integration – Integration by parts - Bernoulli's formula- Trigonometric integrals - Trigonometric substitutions – Integration of rational functions by partial fraction – Integration of irrational functions - Improper integrals.

UNIT -V   **MULTIPLE INTEGRALS**   **9 + 3**

Double integrals in modelling and polar coordinates - Change of order of integration in modelling coordinates- Area enclosed by plane curves - Change of variables in double integrals - Triple integrals -Volume of Solids.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:

1. Able to find eigen values and eigen vectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices.
2. Apply limit definition and rules of differentiation to differentiate functions.
3. Understand familiarity in the knowledge of Maxima and Minima, Jacobian, Taylor series and apply the problems involving Science and Engineering
4. Understand the knowledge of Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction.
5. Understand the knowledge of Area enclosed by plane curves, Change of variables in double integrals, Triple integrals, Volume of Solids

TEXT BOOKS:

1. Grewal B.S., ‾Higher Engineering Mathematics‖, Khanna Publishers, NewDelhi,43rdEdition, 2014.
2. James Stewart, ‾Calculus: Early Transcendentals‖, Cengage Learning,7thEdition, NewDelhi, 2015.
3. Bali N., Goyal M. and Walkins C., ‾Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2009.

REFERENCES:

1. Anton, H, Bivens, I and Davis, S, ‾Calculus‖, Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., ‾Advanced Engineering Mathematics‖, Narosa Publications, NewDelhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., ‾Calculus‖ Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007
4. Srimantha Pal and Bhunia, S.C, ‾Engineering Mathematics‖ Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, ‾Thomas Calculus‖, 12th Edition, Pearson India, 2016.
6. B.V. Ramana, ‾ Higher Engineering Mathematics‖, McGraw Hill Education, India.
7. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley sons,10thedition,2015.

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma60/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma58/preview

	L	T	P	C
21PH1101 **ENGINEERING PHYSICS**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT - I	**MECHANICS**	**9**

System of particles: centre of mass in one and two dimensions - rotational motion of continues system- torque – moment of inertia – conservation of angular momentum – Newton's laws for rotation – equations of rotational motion – work energy theorem for rotational motion. Stress, strain, Hooke's law and elastic moduli - twisting couple per unit twist for solid and hollow cylinders - torsional pendulum theory - bending moment of beam - cantilever and non-uniform bending theory - uniform bending theory - I shape girder.

UNIT - II	**ELECTROMAGNETIC THEORY**	**9**

Divergence - curl - integral calculus - Gauss divergence theorem - Stoke's theorem – equation of continuity – displacement current – Maxwell's equations – Gauss's laws - Faraday's law -Ampere- Maxwell law - mechanism of electromagnetic wave propagation - Hertz observation - production and detection of electromagnetic wave – electromagnetic waves in free space and matter – energy carried by electromagnetic wave – momentum and radiation pressure – properties of electromagnetic waves.

UNIT - III	**THERMAL PHYSICS**	**9**

Mode of heat transfer: conduction, convection and radiation - thermal expansion of solids - bimetallic strips - thermal conductivity - heat conduction through compound media (series & parallel) - Forbe's and Lee's disc method; theory and experiment - thermal insulation – applications – heat exchangers – refrigerators, solar water heater.

UNIT -IV	**OSCILLATORY MOTION, LASERS AND FIBER OPTICS**	**9**

Spring mass system – differential equation-simple harmonic motion-damped oscillation-forced oscillation -analogy with LCR circuits and mechanical oscillation - plane wave equation – equations of wave motion in a rope and velocity of wave. Population of energy levels, Einstein's A and B coefficients derivation – optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction - components and principle of fiber optics – numerical aperture and acceptance angle derivation - types of optical fibers (material, refractive index, mode) - losses associated with optical fibers - fiber as pressure and displacement sensors.

Blackbody radiation - Planck's hypothesis and derivation - wave particle duality of light: concepts of photon – Compton effect: theory and experiment – de Broglie hypotheses - concept of wave function and its physical significance - Schrodinger's wave equation – time independent and time dependent equations – particle in a one-dimensional box - tunnelling (qualitative) - scanning tunnelling microscope.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Upon completion of this course, the students will understand the basics of mechanics and especially elastic properties of materials.

2. Upon completion of this course, the students will gain knowledge on the basic concepts of electromagnetic waves and its properties..

3. Upon completion of this course, the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in heat exchangers

4. Upon completion of this course, the students will acquire knowledge on the concepts of oscillations, lasers and fiber optics and their technological applications

5. Upon completion of this course, the students will get knowledge on advanced physics concepts of quantum theory and its applications in modelling microscopes.

TEXT BOOKS:
1. Gaur, R.K. & Gupta, S.L. ‾Engineering Physics‖. Dhanpat Rai Publishers, 2012.

2. Santhosam, K. Russel Raj, K. & Maheswaran, A. ‾Engineering Physics, KRAM Publications, 2021

3. Pandey, B.K. & Chaturvedi, S. ‾Engineering Physics‖. Cengage Learning India, 2012.

REFERENCES:
1. Halliday, D., Resnick, R. & Walker, J. ‾Principles of Physics‖. Wiley, 2015.
2. Tipler, P.A. & Mosca, G. ‾Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
3. Arthur Beiser, ‾Concepts of Modern Physics‖, Mc Graw Hill, Sixth edition, 1994.
   Douglas. C., Giancoli. ‾Physics: Principles with applications‖, Pearson, 2014.

WEB REFERENCES:

1. https://kluniversity.in/physics/pdfs/crypdf.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/FIBER%20OPTICAL%20COMMUNICATIONS.pdf
3. https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec01.pdf
4. https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec19.pdf
5. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture- notes/MIT8_04S16_LecNotes3.pdf
6. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture- notes/MIT8_04S16_LecNotes5.pdf

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/115/102/115102023/
2. https://nptel.ac.in/courses/115/106/115106066/

	L	T	P	C

21CY1101   **ENGINEERING CHEMISTRY**   L T P C
                                                3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To know about the importance of Chemistry in Engineering domain.
- To understand the Chemistry background of industrial process.
- To apply Chemistry knowledge for Engineering disciplines.

UNIT - I   WATER TECHNOLOGY   9

Hardness -Types of hardness – Estimation by EDTA method – Boiler troubles-scale, sludge, priming, foaming, caustic embrittlement, Boiler corrosion - Internal Conditioning - Carbonate, phosphate, Calgon conditioning - External Conditioning – Zeolite and Demineralization process - Desalination, Reverse Osmosis Method – Domestic water treatment.

UNIT - II   HIGH POLYMERS AND NANOCHEMISTRY   9

Polymers – Introduction – Classification of Polymers (Origin/Source, Structure, Monomers, Inter- molecular Forces, Synthesis) – Commercial Polymers (Poly Vinyl Chloride (PVC), Polytetrafluoroethylene (PTFE), Nylon-6 6, Nylon-6, Polyethylene Terephthalate (PET) - Conducting Polymers - Polyaniline, Polythiophene, Trans-Polyacetylene - Basic definition - FRP - General Engineering applications of FRP (Civil Engineering Structures). **Nanomaterials –** Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nanomaterials: Top-down and bottom-up approaches, Chemical Synthesis – Co precipitation, Sol-Gel process and Chemical vapor deposition, Nanoscale materials: Fullerenes, Carbon nanotubes and 8odellin – Characterization, properties and applications. Green synthesis of Nanoparticles.

UNIT - III   INSTRUMENTAL METHODS AND ANALYSIS   9

Introduction to Spectroscopy – Types of spectroscopy – Absorption spectra – Emission spectra - Wave length and Wave number- Electromagnetic radiation - Flame Photometry, Atomic Absorption Spectroscopy, UV-Visible spectrum. Introduction – basic principles – Instrumentation& Applications – Infrared Spectroscopy. Chromatographic methods - Types (column, Thin layer, paper, Gas, High Performance Liquid Chromatographic methods) - principle- Separation and quantification of Organic compounds by GC and HPLC. Conductometric Titrations: Instrumentation – Advantages – Applications Potentiometric Titrations: Instrumentation -Advantages-Applications. Measurement of pH: pH metry - Instrumentation - Applications.

UNIT -IV   ELECTROCHEMISTRY AND CORROSION   9

Introduction- Electrode potentials-Electrochemical series-Electrochemical cell-redox reaction – measurement and applications – Nernst Equation Derivation- Electrochemical extraction of metals – Electrolytic refining of metals -Nano electrochemical Sensors. Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) - Corrosion Control, Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Biocorrosion. Protective Coatings – Paints, Constituents, Functions- Surface preparation for metallic coatings, Electroplating and Electroless Plating.

UNIT -V   ENERGY SOURCES AND STORAGE DEVICES   9

Introduction – Nuclear energy – Nuclear fission – Controlled Nuclear fission – Nuclear Fusion – Differences – Nuclear chain reactions -Nuclear Reactor – Classification of Nuclear Reactor - Light Water Nuclear Reactor, Breeder Reactor - Solar Energy, Conversion, Solar Cells – Wind Energy.
Batteries and Fuel Cells – Types of batteries — Zinc – carbon dry cell -Lead Storage battery- Nickel- Cadmium Battery - Lithium battery - Battery Engineering - Battery hazards - Biological Batteries. Fuel Cells - Hydrogen-Oxygen Fuel Cell - Hondas cell- Supercapacitors (elementary idea)

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Analyze the water quality parameters in purification and significance in industries, daily life.
2. Explain the types, fabrication and engineering applications of polymers. Develop economically ne methods of synthesizing nanomaterials and their applications.
3. Demonstrate the knowledge of analytical techniques using spectroscopy.
4. Relate the electrode potential for its feasibility in electrochemical reaction. Illustrate the causes, co corrosion and to achieve its protection.
5. Compare the economic and efficient usage of non-conventional and conventional energy source and various storage devices.

TEXT BOOKS:
1. P.C.Jain and Monika Jain, ‾Engineering Chemistry, Dhanpat Rai Publishing Company(P) LTD., New Delhi.
2. S. S. Dara and S.S. Umare, ‾A Textbook of Engineering Chemistry‖ S. Chand and Company Ltd, New Delhi.
3. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, ‾Polymer Science‖, New Age International P (Ltd.,), Chennai, 2006
4. P. Kannan and A. Ravikrishnan, ‾Engineering Chemistry‖, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009. 16

5. S. Vairam, P. Kalyani and Suba Ramesh, ¯Engineering Chemistry‖, Wiley India, 2011.

REFERENCES:
1. Friedrich Emich, ¯Engineering Chemistry, Scientific International Pvt. Ltd., NewDelhi
2. Prasantha Rath, ¯Engineering Chemistry, Cengage Learning India Pvt., Ltd., Delhi
3. P.W. Atkins and de Paula Julio, ¯Physical Chemistry, Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
4. K. K. Rohatgi-Mukherjee, ¯Fundamental of Photochemistry, New Age International (P) Ltd., New Delhi, 1986
5. G.A. Ozin and A.C. Arsenault, ¯Nanochemistry: A Chemical Approach to Nanomaterials, RSC Publishing, 2005 Nanomaterials, B.Viswanathan, Alpha Science , ISBN: 9781842654941

WEB REFERENCES:
1. http://www.mhhe.com/engcs/compsci/forouzan/dcn/student/olc

ONLINE COURSES / RESOURCES:
1. https://nptel.ac.in/courses/103/108/103108100
2. https://nptel.ac.in/courses/121/106/121106014
3. https://nptel.ac.in/courses/104/105/104105039
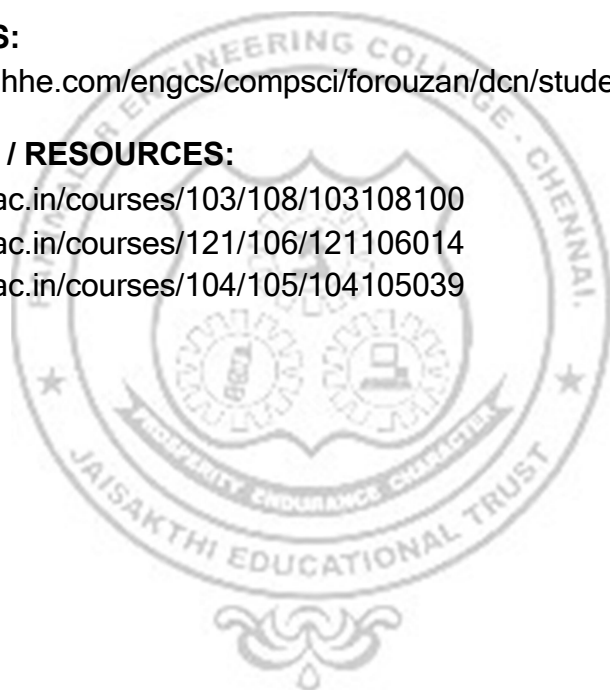
21ES1101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To know the basic programming constructs -data types, decision structures, and control structures in python
- To know how to use libraries for string manipulation
- To Use python data structures - Lists, Tuples and Dictionary
- To know the basic concepts of Object-Oriented Programming
- To learn about input/output with files in Python

UNIT - I	ALGORITHMIC PROBLEM SOLVING	9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language); Python: Data types, variables, expressions, precedence of operators, algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

SUGGESTED ACTIVITIES:

1. Developing Pseudo codes and flowcharts for real life activities such as railway ticket Booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
2. Developing algorithms for basic mathematical expressions using arithmetic Operations
3. Installing Python
4. Simple programs on print statements, arithmetic operations

SUGGESTED EVALUATION METHODS:

1. Quizzes on algorithm and basic python
2. Assignments on illustrative problems
3. Quizzes on simple python programs

UNIT - II	CONTROL FLOW, STRINGS & FUNCTIONS	9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; functions, function definition and use; Fruitful functions: return values, parameters and arguments, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

SUGGESTED ACTIVITIES:

1. Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions
2. Developing simple applications like calculator, calendar, phone directory, to-do lists etc.
3. Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals

4. Recursion vs. Iteration

SUGGESTED EVALUATION METHODS:
1. Quizzes on strings.
2. Assignments on illustrative problems.
3. Quizzes on control flow and functions.

| UNIT - III | LISTS, TUPLES, DICTIONARIES | 9 |

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Lists as arrays. Illustrative programs: selection sort, insertion sort, merge sort, histogram.

SUGGESTED ACTIVITIES:
1. Implementing python program using lists, tuples, sets for the following scenario
2. Simple sorting techniques
3. Student Examination Report
4. Billing Scheme during shopping
5. Implementing any application using List and Tuple data structures

SUGGESTED EVALUATION METHODS:
1. Quizzes on list slices
2. Assignments on illustrative problems
3. Quizzes on tuples and dictionaries

| UNIT -IV | OBJECT ORIENTED PROGRAMMING WITH PYTHON | 9 |

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data 11odelling; persistent storage of objects – inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block. Illustrative programs: demonstrate the concept of class and objects

SUGGESTED ACTIVITIES:
1. Features of OOP.
2. Persistent storage of objects
3. Operators and its usage
4. Simple programs using OOP concepts

SUGGESTED EVALUATION METHODS:
1. Quizzes on basic OOP concepts
2. Assignments on illustrative problems
3. Quizzes on inheritance and exception handling

| UNIT -V | FILES, MODULES, PACKAGES | 9 |

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

SUGGESTED ACTIVITIES:
1. Developing modules using Python to handle files and apply various operations on files
2. Usage of exceptions, multiple except blocks – for applications that use delimiters like age, range of numerals etc.
3. Implementing Python program to open a non-existent file using exceptions

SUGGESTED EVALUATION METHODS:
1. Quizzes on basic file operations
2. Assignments on illustrative problems
3. Quizzes on packages and modules

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:

1. Develop algorithmic solutions to simple computational problems
2. Write and execute simple Python programs
3. Familiarize with python string handling techniques and user defined functions
4. Represent compound data using Python lists, tuples and dictionaries
5. Understand the concept of object oriented programming techniques
6. Read and write data from/to files in Python Programs

TEXT BOOKS:
1. Reema Thareja, ``Problem Solving and Programming with Python", 2nd edition, OXFORD University Press, New Delhi, 2019.(UNIT 1,2,3,4(Exception Handling) and 5).
2. Bill Lubanovic, ‾Introducing Python-Modern Computing in Simple Package‖, 2nd edition, O'REILLY, 2019.(UNIT 4(Object Oriented Programming)).

REFERENCES:
1. Steven F. Lott, ‾Modern Python Cookbook", 2nd Edition, O'REILLY, 2020.
2. Ryan Marvin, Mark Ng'ang'a, Amos Omondi, ‾Python Fundamentals, Packt Publishing., 2018.
3. Paul J. Deitel, Python for Programmers, Pearson India Education Services Pvt. Ltd,2020.
4. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education; Fourth edition, 2018.

WEB REFERENCES:
1. https://freecomputerbooks.com/An-Introduction-to-Python-Guido-van- Rossum. html#downloadLinks
2. http://marvin.cs.uidaho.edu/Teaching/CS515/pythonTutorial.pdf

ONLINE COURSES / RESOURCES:
1. https://docs.python.org/3/tutorial/

2. https://www.w3schools.com/python/

3. https://www.tutorialspoint.com/python/index.htm

4. https://www.javatpoint.com/python-tutorial=

5. https://nptel.ac.in/courses/

	L	T	P	C

21ES1102   **ENGINEERING GRAPHICS**   **L T P C**
                                                                                       3 0 2 4

OBJECTIVES: To impart Knowledge on the following topics:
- Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
- Drawing orthographic projections of lines and planes.
- Drawing orthographic projections of solids.
- Drawing development of the surfaces of objects
- Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)   **2**

Importance of graphics in engineering applications - Use of drafting instruments. BIS conventions and specifications. Size, layout and folding of drawing sheets - Lettering and dimensioning. Introduction to drafting packages like CAD and demonstration of their use in engineering fields.

UNIT - I   **PLANE CURVES AND FREEHAND SKETCHING**   **14**

Basic Geometrical constructions, Curves used in engineering practices-Conics: Construction of Ellipse, Parabola and Hyperbola by eccentricity method – Construction of cycloid, Involutes of square, pentagon and circle – Drawing of tangents and normal to the above curves. Free Hand sketching-Orthographic projection – Orthographic views of simple three-Dimensional objects

UNIT - II   **PROJECTION OF POINTS, LINES AND PLANE**   **15**
                                            SURFACES

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

UNIT - III   **PROJECTION OF SOLIDS**   **15**

Projection of simple solids like prisms, pyramids, cylinder, and cone when the axis is inclined to one principle planes by rotating object method and auxiliary plane method.

UNIT -IV   **PROJECTION OF SECTIONED SOLIDS AND**   **15**
                                      DEVELOPMENT OF SURFACES

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple solids and frustum and truncated solids – Prisms, pyramids cylinders and cones.

UNIT -V   **ISOMETRIC AND PERSPECTIVE PROJECTIONS**   **14**

Principles of isometric projection – isometric scale -Isometric projections of simple solids and frustum and truncated solids – Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

OUTCOMES:

On successful completion of the course student will be able to:

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids.
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids

TEXT BOOKS:

1. Natarajan, K. V., ¯A text book of Engineering Graphics‖, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
2. Venugopal, K. and Prabhu Raja, V., ¯Engineering Graphics‖, New Age, 2008

REFERENCES:

1. Bhatt, N.D.,Panchal V M and Pramod R. Ingle, ¯Engineering Drawing‖, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, ¯Engineering Drawing‖, Oxford University Press, 2015
3. Agrawal, B. and Agrawal C.M., ¯Engineering Drawing‖, Tata McGraw, N.Delhi, 2008.

WEB REFERENCES:

1. https://nptel.ac.in/courses/105/104/105104148/
2. https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLDg

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/112/103/112103019/

21ES1111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES: To impart Knowledge on the following topics:

- To write, test, and debug simple Python programs
- To implement Python programs with conditions and loops
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To use OOPS concepts in Python.
- To read and write data from/to files in Python.

LIST OF EXPERIMENTS

1. Basic Python Programs
2. Write programs to demonstrate different number data types in python
3. Develop python programs to demonstrate various conditional statements
4. Implement user defined functions using python
5. Develop python scripts to demonstrate functions
6. Develop python programs to perform various string operations like slicing, indexing & formatting
7. Develop python programs to perform operations on List & Tuple
8. Demonstrate the concept of Dictionary with python programs
9. Develop python codes to demonstrate concept of class and objects
10. Demonstrate OOPS concepts like inheritance and polymorphism with python programs
11. Demonstrate python codes to print try, except and finally block statements
12. Implement python programs to perform file operations
13. Implement python programs using modules and packages
14. Simulate bouncing ball using Pygame

Mini Project :Suggested Topics(but not limited to)
1. Dice roll simulator
2. Guess the number game
3. Sending emails using python
4. Random password generator
5. Alarm clock
6. URL shortener

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. To write, test, and debug simple Python programs
2. To implement Python programs with conditions and loops
3. To use functions for structuring Python programs
4. To represent compound data using Python lists, tuples, dictionaries

5. To use OOPS concepts in Python
6. To read and write data from/to files in Python.

WEB REFERENCES:
1. https://www.programiz.com/python-programming/examples
2. https://www.geeksforgeeks.org/python-programming-examples/
3. https://beginnersbook.com/2018/02/python-programs/
4. https://www.javatpoint.com/python-programs
5. https://www.w3schools.com/python/python_examples.asp
6. https://www.sanfoundry.com/python-problems-solutions/

21BS1111   **PHYSICS AND CHEMISTRY LABORATORY**   **L   T   P   C**
                                                                    0   0   4   2

PHYSICS LABORATORY

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids

LIST OF EXPERIMENTS
(Minimum of experiments to be conducted: 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
   a. Determination of wavelength, and particle size using Laser
   b. Determination of acceptance angle in an optical fiber
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Determination of band gap of a semiconductor
7. Determination of thickness of a thin wire – Air wedge method

                                                              TOTAL: 30 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Apply principles of elasticity, optics and thermal properties for engineering applications

TEXT BOOKS:
1. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016), ISBN 978-93-80386-86-7
2. Harnam Singh, Dr.P.S. Hemne, B.Sc., Practical Physics, S.Chand & Company Ltd, New Delhi, Edition 2011.

WEB REFERENCES:
1. https://www.vlab.co.in/broad-area-physical-sciences
2. https://vlab.amrita.edu/?sub=1

CHEMISTRY LABORATORY

OBJECTIVES: To impart Knowledge on the following topics:

1. To inculcate experimental skills to test basic understanding of water quality parameters such as, alkalinity, hardness, DO and chloride
2. To induce the students to familiarize with electro analytical techniques such as pH metry, potentiometry and conductometry in the determination of aqueous solutions.

LIST OF EXPERIMENTS
(Minimum of experiments to be conducted: 5 Experiments)

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in Water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Determination of DO content of water sample by Winkler"s method
4. Determination of chloride content of water sample by argentometric method
5. Estimation of copper content of the given solution by Iodometry
6. Determination of strength of given hydrochloric acid using pH meter. Determination of strength of acids in a mixture of acids using conductivity meter
7. Estimation of iron content of the given solution using potentiometer
8. Determination of total, temporary & permanent hardness of water by EDTA method
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- 26, Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer
12. Pseudo first order kinetics-ester hydrolysis
13. Corrosion experiment-weight loss method
14. Phase change in a solid

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO
2. To quantitatively analyse the aqueous solution by electro analytical techniques

TEXT BOOKS:
1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

21HS1201	COMMUNICATIVE ENGLISH & LANGUAGE SKILLS LAB II INTEGRATED	L	T	P	C
		3	0	2	4

OBJECTIVES: To impart Knowledge on the following topics:

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
- To improve the relevant language skills necessary for professional communication.
- To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification and developing their speaking skills and to speak fluently in real contexts.
- To Introduce them to life skills, their importance in leading Personal & professional life, key concepts of business communication and Communicative skills.

UNIT - I   INTERPERSONAL COMMUNICATION   9

Listening: Listening to Telephone Conversations.
Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks.
Reading: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting).
Writing: Writing a Short Biography of an Achiever Based on Given Hints.
Grammar: Adjective, Sentence pattern.
Vocabulary Development: Idioms and Phrases

UNIT - II   TECHNICAL COMMUNICATION   9

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. Speaking: Participating in Debates ,TED Talks
Reading: Reading Technical Essays/ Articles and Answering Comprehension Questions
Writing: Summary Writing ,Minutes of the meeting
Grammar: Participle Forms, Relative Clauses
Vocabulary Development: Compound Words, Abbreviations and Acronyms

UNIT - III   PROCESS DESCRIPTION   9

Listening: Listening to a Process Description and Drawing a Flowchart
Speaking: Participating in Group Discussions, Giving Instructions ,Presentation
Reading: Reading Instruction Manuals
Writing: Process Descriptions - Writing Instructions
Grammar: Use of Imperatives, Active and Passive Voice, Sequence Words
Vocabulary Development: Misspelt words , Homophones and Homonyms

UNIT -IV	REPORT WRITING	9

Listening: Listening to a Presentation and Completing Gap-Filling Exercises
Speaking: Making Formal Presentations
Reading: Reading and Interpreting Charts/Tables and iagrams
Writing: Interpreting Charts/Tables and Diagrams, Writing a Report
Grammar: Direct into Indirect Speech, Use of Phrases
Vocabulary Development: Reporting Words, Technical Jargon

UNIT -V	APPLYING FOR JOBS	9

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises
Speaking: Mock Interview, Telephone Interviews, GD
Reading :Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises
Writing: Job Applications and Resumes
Grammar: Conditional Clauses, Modal verbs
Vocabulary Development: Technical Vocabulary, Purpose Statement

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Read and comprehend technical texts effortlessly.
2. Write thoughts and insights of their own
3. Recognize the need for life skills, apply them to different situations, the basic communication practices in different types of communication
4. Gain confidence to communicate effectively in various situations to acquire employability skills
5. Become an active listener of professional contexts

TEXT BOOKS:
1. Board of Editors. English for Engineers and Technologists Volume 2 Orient Black Swan Limited, 2020
2. Richards, C. Jack. Interchange, New Delhi: CUP, 2017

REFERENCES:
1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Raman,Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

5. Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

WEB REFERENCES:
1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/word-formation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES:
1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

LANGUAGE SKILLS LAB
LIST OF EXERCISES (MINIMUM OF EXERCISES TO BE CONDUCTED)   15

1. Listen to lectures - articulate a complete idea as opposed to producing fragmented utterances - Ted talks, Science Fiction – My fair lady
2. Listening to a process information – General Competitive Examinations, GRE
3. Listening for specific information: accuracy and fluency – BEC
4. Listening - following, responding to explanations, giving directions and instructions in academic and business contexts – IELTS, TOEFL
5. Listening to transcripts and answer to the questions
6. Listening: Read aloud in class and gap - filling
7. Listening: Recognizing and interpreting non - verbal cues
8. Listen first, speak second - Having the mindset of a listener
9. Speaking - sharing personal information - Self introduction
10. Speaking - Small talk or Pep Talk
11. Speaking - Group discussion, Visume -visual presentation of resume
12. Speaking - Presentation – Formal and Informal
13. Speaking - Mock interview
14. Speaking - FAQ"S on Job interview
15. Speaking : Simulations - (show and tell)
16. Speaking: News brief - Ripped from today's headlines.
17. Speaking: Who's telling the truth?
18. Speaking: JAM
19. Speaking: Debate
20. Speaking: Story Narration

TOTAL: 30 PERIODS

SOFTWARE REQUIRED:

1. Globarena

TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford:2011.

2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.

2. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014.

3. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.

4. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

5. E. Suresh Kumar et al. Communication for Professional Success, Orient Blackswan: Hyderabad, 2015.

6. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.

	L	T	P	C

21MA1201   **ENGINEERING MATHEMATICS** - **II**   L T P C
                                                              3 1 0 4

OBJECTIVES: To impart Knowledge on the following topics:
- Vectors are very helpful for the engineering students as it will give the insight into how to trace along the different types of curves.
- To develop an understanding of the standard technique of a complex variable theory in Particular of analytics functions and its mapping property.
- Complex integration is an intuitive extension of real integration. Complex variable techniques have been used in a wide variety of areas of engineering. This has been particularly true in areas such as electromagnetic field theory, fluid dynamics, aerodynamics and elasticity.
- To solve the linear differential equations with constant coefficients.
- Laplace Transform is very useful for the electronics students , this gives the basics of how to solve the problems in electronic circuits.

UNIT - I   VECTOR CALCULUS   12
Gradient, divergence and curl - Directional derivative - Irrotational and solenoidal vector fields – Vector integration – Green"s theorem in a plane - Gauss divergence theorem and Stokes" theorem (excluding proofs) - Simple applications involving cubes, rectangular parallelepiped, sphere and cylinder.

UNIT - II   ANALYTIC FUNCTIONS   12
Functions of a complex variable – Analytic functions - Cauchy-Riemann equations - Necessary and sufficient conditions- Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions by Milne Thomson method– Conformal mapping: w =z+c, cz, 1/z, z2 and bilinear transformation.

UNIT - III   COMPLEX INTEGRATIONS   12
Line integrals- Cauchy"s integral theorem-Cauchy"s integral formula - Singularities - Residues- Cauchy"s residue theorem - Taylor"s and Laurent"s series expansions —– Application of residue theorem for evaluation of real definite integrals – Use of circular contour and semi- circular contour (excluding poleson the real axis).

UNIT -IV   ORDINARY DIFFERENTIAL EQUATIONS   12
Higher order linear differential equations with constant coefficients -Method of variation of parameters – Homogenous equation of Euler"s and Legendre"s type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

Line integrals- Cauchy"s integral theorem-Cauchy"s integral formula - Singularities - Residues- Cauchy"s residue theorem - Taylor"s and Laurent"s series expansions —– Application of residue theorem for evaluation of real definite integrals – Use of circular contour and semi- circular contour (excluding poleson the real axis).

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Identify the Gradient, divergence and curl of a vector point function and related identities. Evaluation of line,surface and volume integrals using Gauss, Stokes and Green"s theorems and their verification.
2. Understand analytic functions, harmonic functions, conformal mapping.
3. Determine the types of singularities, residues, contour integration.
4. Apply various techniques in solving differential equations.
5. Able to solve differential equations using laplace transforms.

TEXT BOOKS:
1. Grewel. B.S, ¯Higher Engineering Mathematics‖, 43rd Edition, Khanna Publications, Delhi,2014.
2. B.V. Ramana, ¯Higher Engineering Mathematics‖, McGraw Hill Education, India.
3. Bali N., Goyal M. and Walkins C., ¯Advanced Engineering Mathematics‖, Firewall Media(An imprint of Lakshmi Publications Pvtt. Ltd.,), New Delhi, 7th Edition, 2009.

REFERENCES:
1. Kreyszig Erwin, Advanced Engineering Mathematics‖, John wiley and Sons, 10th Edition,New Delhi.
2. Jain R.K. and Iyengar S.R.K., ¯Advanced Engineering Mathematics‖, Narosa Publications,New Delhi, 3rd Edition, 2007.
3. O"Neil, P.V. ¯Advanced Engineering Mathematics‖, Cengage Learning India Pvt. Ltd, NewDelhi, 2007.
4. Sastry, S.S, ¯Engineering Mathematics‖, Vol.I & II, PHI Learnig Pvt. Ltd, 4th Edition, NewDelhi, 2014.
5. Wyile, R.C. and Barrett, L.C., ¯Advanced Engineering Mathematics ¯Tata McGraw HillEducation Pvt Ltd, 6th Edition, New Delhi, 2012.

ONLINE COURSES / RESOURCES:
1. https://onlinecourses.nptel.ac.in/noc21_ma69
2. https://onlinecourses.nptel.ac.in/noc21_ma57

21ES1201   **BASIC ELECTRICAL, ELECTRONICS AND**
                      MEASUREMENTS ENGINEERING

L	**T**	**P**	**C**
3	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
  - To learn the concepts related with electrical circuits.
  - To study the concept of electrical machines.
  - To understand the utilization of electrical power.
  - To understand the basics of electronic devices.
  - To learn the applications of Op-Amp.
  - To study the concepts of measurement and transducers.

UNIT - I   BASIC ELECTRIC CIRCUITS   9

Current- Voltage- Power- Voltage Source – Current Source- Ohm"s Law - KCL - KVL (Analysis with only independent source) – Resistors in series and parallel – Current Division – Voltage Division- Mesh analysis, nodal analysis, Phasors- RMS value of current and voltage - Active power- Apparent Power- Complex Power - Power Factor - Simple problems.

UNIT - II   ELECTROMAGNETIC THEORY   9

Construction and Working Principle of DC motor, Stepper Motor, BLDC motor, Transformer, Single phase induction motor - Capacitor start and Capacitor run motor.

UNIT - III   UTILIZATION OF ELECTRICAL POWER   9

Principle of wind and solar energy systems. Electrical wiring - Domestic and Industrial Illumination - Fluorescent and LED lamps. Protection- Need for Earthing, fuses and circuit breakers -Energy tariff.

UNIT -IV   BASICS OF ELECTRONICS   9

PN Junction-VI Characteristics of Diode, Zener diode, Transistors configurations – amplifiers. Op amps- Amplifiers, oscillator, rectifiers, differentiator, integrator, ADC, DAC. Regulated power supply using 7805 and 7905.

UNIT -V   MEASUREMENTS AND TRANSDUCERS   9

Fundamentals of moving coil and moving iron meters, Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Smart sensors - Data acquisition systems.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
  1. Summarize the basic laws and concepts related to electrical circuits.
  2. Explain the construction and working of electrical machines.
  3. Discuss the utilization of electrical power.
  4. Discuss the basic concepts of electronics.

5. Learn the applications of Op-Amp.
6. Explain the concepts of measurement and transducers.

TEXT BOOKS:
1. Kothari DP and I.J Nagrath, ¯Basic Electrical and Electronics Engineering‖, McGraw Hill Education, 2014
2. Thomas L. Floyd, „Electronic Devices", 10th Edition, Pearson Education, 2018.
3. John Bird, ¯Electrical Circuit theory and technology‖, Routledge, Fifth edition, 2013.

REFERENCES:
1. William Hayt, Jack Kemmerly, Steven Durbin and Jamie Phillips, :" Engineering Circuit Analysis", McGraw Hill, 2019.
2. Kothari DP and I.J Nagrath, ¯Basic Electrical Engineering‖, McGraw Hill, 2010.
3. A.K. Sawhney, Puneet Sawhney „A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, New Delhi, Edition 2011.
4. B.L.Theraja, A.K. Theraja, "A Text book on Electrical Technology Vol. III & IV", S. Chand publications, Edition 2014.

ONLINE COURSES / RESOURCES:
1. https://nptel.ac.in/courses/108/106/108106172/
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://nptel.ac.in/courses/108/101/108101091/
4. https://nptel.ac.in/courses/108/105/108105153

21CS1201   **PROGRAMMING AND DATA STRUCTURES**   **L   T   P   C**

                                                                 3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce the basics of C programming language.
- To learn the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

UNIT - I   **C PROGRAMMING – FUNDAMENTALS**   **8**

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements - Functions - Recursive Functions - Arrays - Single and Multi-Dimensional Arrays – String Operations.

SUGGESTED ACTIVITIES:
1. Implementing programs using data types, arithmetic operators and basic input/outputoperations.
2. Developing programs using if-else, do-while, while, for, switch, break, continue, enum.
3. Write an application to perform operations like finding the maximum, minimum, average values using single dimensional integer and float arrays.
4. Develop an application to perform matrix operations using multi-dimensional arrays.
5. Create an application that performs operations like concatenation, finding a substring froma given string.

SUGGESTED EVALUATION METHODS:
1. Assignment on conditionals and loops.
2. Evaluation of the programs implemented.

UNIT - II   **C PROGRAMMING - ADVANCED**   **10**

Structures - Union - Enumerated Data Types - Pointers: Pointers to Variables, Arrays and Functions - File Handling - Preprocessor Directives.

SUGGESTED ACTIVITIES:
1. Implementing applications using Structures, Unions, and Enumerations.
2. Demonstration of C programs using pointers to variables, arrays, functions and using addressarithmetic.
3. Demonstration of programs using dynamic memory.
4. Demonstration of real world applications using file operations.

SUGGESTED EVALUATION METHODS:
1. Quizzes on structures & union.
2. Assignments on C programs to implement concepts of pointers and functions.
3. Quizzes on file handling operations

UNIT - III   LINEAR DATA STRUCTURES   9

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly-Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications - Queue ADT - Priority Queues - Queue Implementation - Applications.

SUGGESTED ACTIVITIES:

1. Converting an algorithm from recursive to non-recursive using stack.
2. Demonstrating stack for Towers of Hanoi application.
3. Developing any application using all the linear data structures.

SUGGESTED EVALUATION METHODS:

1. Quizzes on abstract data types.
2. Assignments linked list and stack.
3. Quizzes on queue and applications.

UNIT - IV   NON-LINEAR DATA STRUCTURES   9

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing- Hash Functions –   Graphs - Representation of Graph – Types of graph - Breadth-first traversal – Depth-first traversal - Applications.

SUGGESTED ACTIVITIES:

1. Implementing binary tree and tree traversals.
2. Solving expressions using expression trees by determining infix, prefix and postfix expressions.
3. Implementation of phone directory using hash tables.
4. Implementing graph traversals.

SUGGESTED EVALUATION METHODS:

1. Quizzes on basic tree operations.
2. Assignments on tree traversals and some sample expressions.
3. Assignment on Graphs and applications.

UNIT - V   SORTING AND SEARCHING TECHNIQUES   9

Bubble Sort – Selection Sort - Insertion Sort – Quick Sort – Heap Sort – Merge Sort – Linear Search – Binary Search.

SUGGESTED ACTIVITIES:

1. Implementation of all sorting techniques.
2. Demonstration of searching techniques under best and worst case inputs.

SUGGESTED EVALUATION METHODS:

1. Quizzes on sorting and searching
2. Assignments on insertion sort nd quicksort.
3. Seminar and Quiz on searching methods.

OUTCOMES:

On successful completion of the course student will be able to:

1. Develop simple programs using basic C constructs.
2. Apply advanced features of C in solvingproblems
3. Write functions to implement linear andnon-linear data structure operations.
4. Use appropriate linear and non-linear data structure operations for solving a given problem.
5. Apply appropriate hash functions for data storage and retrieval.
6. Use appropriate sort and search algorithms for a given application.

TEXT BOOKS:

1. Reema Thareja, ``Programming in C"", 2nd edition, OXFORD University Press, New Delhi,2019. (Units 1 and 2)
2. Reema Thareja, ``Data Structures Using C"", 2nd edition, OXFORD University Press, NewDelhi, 2016. (Units 3,4 5)

REFERENCES:

1. Juneja, B. L and Anita Seth, ‾Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011.
2. Paul Deitel and Harvey Deitel, ‾C How to Program‖, Seventh edition, Pearson Publication
3. Stephen G. Kochan, ‾Programming in C‖, 3rd edition, Pearson Education
4. Aho, Hopcroft and Ullman, ‾Data Structures and Algorithms‖, Pearson Education.
5. Fundamentals of Data Structures, Sartaj Sahni, University Press.

WEB REFERENCES:

1. https://www.javatpoint.com/c-programming-language-tutorial
2. https://www.tutorialspoint.com/cprogramming/
3. https://www.w3schools.in/data-structures-tutorial/
4. https://www.javatpoint.com/data-structure-tutorial

ONLINE COURSES / RESOURCES:

1. https://www.Greatlearning.in/Academy/Learn-For-Free/Courses/Data-Structures-In-C
2. https://www.Udemy.Com/Course/Data-Structures-And-Algorithms-In-C/
3. https://nptel.ac.in/Courses/

21CS1202   **WEB APPLICATION DEVELOPMENT**   L   T   P   C
                          (Lab Integrated)   3   0   2   4

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice mark-up languages
- To introduce tools for creating interactive web pages
- To understand and practice web development techniques on client-side.

UNIT - I   **WEB ESSENTIALS**   **9**

Clients, Servers and Communication – The Internet – Understanding the difference between internet and intranet- Basic Internet protocols – World Wide Web – HTTP Request Message - HTTP Response Message - Web Clients - Web Servers.

SUGGESTED ACTIVITIES:
1.   Learn to use Internet and Intranet.
2.   Understand the usage of the protocols used in WWW.

SUGGESTED EVALUATION METHODS:
1.   Assignment on Intranet and Internet
2.   Seminar on Protocols used in WWW.

UNIT - II   **HTML 5.0**   **9**

HTML5 – Tables – Lists – Image – Iframes – HTML5 control elements – Semantic elements – Drag and Drop – Canvas – SVG – Audio – Video controls.

SUGGESTED ACTIVITIES:
1.   Learn to design web pages.
2.   Incorporating multimedia in a webpage.
SUGGESTED EVALUATION METHODS:
1.   Demonstration of having incorporated multimedia in a webpage

UNIT - III   **CASCADING STYLE SHEETS3**   **9**

CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

SUGGESTED ACTIVITIES:
1.   Exploring CSS

SUGGESTED EVALUATION METHODS:
1.   Evaluation of the preparation done in learning CSS syntax

UNIT - IV   **INTRODUCTION TO JAVASCRIPT**   **9**

Introduction -Core features -Data types and Variables -Operators, Expressions, and Statements Functions -Objects -Array, Date and Math Related Objects - Built-in objects.

SUGGESTED ACTIVITIES:

1. Learn to use JavaScript

SUGGESTED EVALUATION METHODS:

1. Evaluation on programs implemented.

UNIT - V   **CLIENT SIDE PROGRAMMING**   **9**

JavaScript DOM Model - Regular Expressions- Exception Handling –- Controlling Windows &Frames and Documents -Form validations -Event Handling.

SUGGESTED ACTIVITIES:

1. Learn to use client side validation for designed web browsers
2. Designing a website

SUGGESTED EVALUATION METHODS:

1. Demonstration of using client side validation for designed web browsers
2. Demonstration of designed WebPages

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the Internet and basic Internet Protocols
2. Design a basic website using HTML
3. Design an attractive webpage using CSS
4. Build dynamic web page with validation using java script objects and by applyingdifferent event handling mechanism
5. Understand the essential client side technologies for website development.
6. Develop interactive websites.

TEXT BOOKS:

1. Scobey, Pawan Lingras, ‾Web Programming and Internet Technologies - An EcommerceApproach‖, Second Edition, Jones & Bartlett Publishers, 2016

REFERENCES:

1. Andreas Maurer, HTML5 & CSS3: A Step-by-Step guide for beginners to build and designresponsive and engaging websites with html5 and css3 , Kindle Edition,2020.
2. Eloquent JavaScript, A Modern Introduction to Programming by Marijn Haverbeke, 3rdEdition, 2018.
3. Deitel and Deitel and Nieto, ‾Internet and World Wide Web - How to Program, PrenticeHall, 5th Edition, 2011.
4. Chris Bates, Web Programming - Building Intranet Applications, 3rd Edition, WileyPublications, 2009.
5. Jeffrey C and Jackson, ‾Web Technologies A Computer Science Perspective, PearsonEducation, 2011.

6. Gopalan N.P. and Akilandeswari J. ̄Web Technology, Prentice Hall of India, 2011.

7. Andreas Maurer, HTML5 & CSS3: A Step-by-Step guide for beginners to build and design responsive and engaging websites with html5 and css3 , Kindle Edition,2020.

WEB REFERENCES:
1. www.w3schools.com
2. www.codecademy.com

ONLINE COURSES / RESOURCES:
1. www.udemy.com/course
2. www.nptel.ac.in/courses

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML
   a. To embed a map in a web page
   b. To fix the hot spots in that map
   c. Show all the related information when the hot spots are clicked.
2. Create a Personal blog design using HTML Multimedia elements and CSS elements
   (Audio, Video, Iframe, Image, External CSS for Look and Feel)
3. Create your own Resume using HTML 5 Tags.
4. Add Styles to your Resume using CSS 3 Properties and add CSS3 Animation to your profile.
5. Create a web page with the following.
   1. Cascading style sheets.
   2. Embedded style sheets.
   3. Inline style sheets. Use our college information for the web pages.
6. Write a JavaScript code
   1. To display the image of creator or inventor of programming language based on person name or programming language input.
      (Hint: Use RegEx eg. ^(filename(\d+))\.png| jpg$)

   2. To search the given word or replace the input string with given word
      (Hint: use match/replace method)
7. Create a Student Registration form for Job Application and validate the form fields using JavaScript.
8. Create a Pan Card Validation form using JavaScript consider the 10th character to be an alphabet.
   -Get the user‟s First Name, Last Name and other required fields as input
   -Assume the last digit of the Pan Number to be an alphabet
   -Validate the PAN Number.

Mini Project : Suggested Topics(but not limited to)

1. Landing Page
2. Survey Form
3. Personal Blog
4. Calculator
5. Javascript Quiz Game

TOTAL: 30 PERIODS

21CS1211	PROGRAMMING AND DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES: To impart Knowledge on the following topics:

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.
- To implement linear and non-linear data structures.
- To get familiarized to sorting and searching algorithms

LIST OF EXPERIMENTS

1. Programs using basic C construct.
2. Programs using strings, pointers, functions, structures in C.
3. Applications using file processing using C.
4. Array implementation of List, Stack and Queue ADTs.
5. Linked list implementation of List, Stack and Queue ADTs.
6. Implementation of Binary Trees and operations of Binary Trees.
7. Implementation of Binary Search Trees.
8. Implementation of Tree Traversals.
9. Implementation of Graph Traversal algorithms.
10. Implement Hashing techniques.
11. Implementation of searching algorithms.
12. Implementation of sorting algorithms.

Mini Project :Suggested Topics(but not limited to)

1. Stack-based Text editor
2. Phone directory application using linked lists
3. Numerical representations with random access lists
4. Search engine for data structures

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:

1. Understand the basic principles of Programming in C language
2. Develop C programs using strings, pointers, functions and structures.
3. Develop file processing applications using C.
4. Implement List, Stack and Queue ADTs.
5. Implement Tree and Graph data structures.
6. Implement sorting and searching algorithms

WEB REFERENCES:

1. https://www.geeksforgeeks.org/c- programming-language/
2. https://www.geeksforgeeks.org/data- structures/
3. https://www.sanfoundry.com/c-programming-examples-data-structures/

21ES1211   **ENGINEERING PRACTICES**   **L   T   P   C**
                      LABORATORY   **0   0   4   2**

OBJECTIVES: To impart Knowledge on the following topics:

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

I   CIVIL ENGINEERING PRACTICES   15

Plumbing Work:

a)   Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b)   Preparing plumbing line sketches.
c)   Laying pipe connection to the suction side of a pump
d)   Laying pipe connection to the delivery side of a pump.
e)   Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

Wood Work:

a)   Introduction to Tools and Equipments.
b)   Simple Planning and sawing practice.
c)   Making Half Lap, Dovetail, Mortise and Tenon joints.

Wood Work Study**:**

a)   Studying joints in door panels and wooden furniture.
b)   Studying common industrial trusses using models.

II   ELECTRICAL ENGINEERING PRACTICES: 15

a)   Residential house wiring using switches, fuse, indicator, lamp and energy meter.
b)   Fluorescent lamp wiring.
c)   Stair case wiring
d)   Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit.
e)   Measurement of energy using single phase energy meter.
f)   Measurement of resistance to earth of electrical equipment.

III   MECHANICAL ENGINEERING PRACTICES   15

Basic Machining Work:

a)   Introduction to Lathe machine, Tools and Equipments
b)   Simple Turning and facing
c)   Step turning
d)   Simple Drilling and Tapping of flat plate

Welding Work**:**

a)   Introduction to Arc welding, Tools and Equipments
b)   Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

Assembly Work**:**

a)   Assembling a centrifugal pump.

b)   Assembling an air conditioner.

Sheet Metal Work:
a)   Demonstrating basic sheet metal operations

Foundry Work**:**
a)   Demonstrating basic foundry operations

IV   ELECTRONICS ENGINEERING PRACTICES   15
a)   Study of Electronic components and equipments – Resistor, colour coding
b)   Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
c)   Study of logic gates AND, OR, EX-OR and NOT.
d)   Generation of Clock Signal.
e)   Soldering practice – Components Devices and Circuits-Using general purpose PCB.
f)   Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1.   Connecting various basic pipe fittings and other components which are commonly used in household and to know about the various tools, Equipments and making different joints.
2.   To know the Lathe machine, Tools and Equipments with machining experiments and have knowledge about Arc welding, Tools and Equipments with making different joints
3.   To carry out basic home electrical works and appliances and measure the electrical quantities.
4.   To analyze the basic electronic circuits and to solder simple components on PCB and test simple electronic circuits.

TEXT BOOKS:
1.   Jeyapoovan T., Saravanapandian M. & Pranitha S., ‾Engineering Practices Lab Manual‖, Vikas Publishing House Pvt.Ltd, (006)
2.   Kannaiah P. & Narayana K.L., ‾Manual on Workshop Practice‖, Scitech Publications, (1999).
3.   Jeyachandran K., Natarajan S. & Balasubramanian S., ‾A Primer on Engineering Practices Laboratory‖, Anuradha Publications, (2007).
4.   S. Gowri & T. Jeyapoovan, ‾Enginering Practices Lab Manual 5/E‖, S. Chand Publishing, 2019

REFERENCES:
1.   K.C. John, "Mechanical workshop practice", Second edition, PHI learning Pvt Ltd, New Delhi
2.   Bawa H.S., ‾Workshop Practice‖, Tata McGraw – Hill Publishing Company Limited, (2007)

WEB REFERENCES:
1.   https://nptel.ac.in/courses/112/107/112107090/
2.   https://nptel.ac.in/courses/112/107/112107084/

	L	T	P	C
21MA1301 **DISCRETE MATHEMATICS**	3	1	0	4

OBJECTIVES: To impart Knowledge on the following topics:
- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT - I **LOGIC AND PROOFS** **12**

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

UNIT - II **COMBINATORICS** **12**

Mathematical induction – Strong induction and well ordering – The Pigeonhole principle – Recurrence relations – Solving linear recurrence relations using generating functions - Inclusion and exclusion principle.

UNIT - III **GRAPHS** **12**

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

UNIT - IV **ALGEBRAIC STRUCTURES** **12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism – Normal subgroup and cosets – Lagrange_s theorem-Definitions and examples of Rings and Fields.

UNIT - V **LATTICES AND BOOLEAN ALGEBRA** **12**

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: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Explain the concept needed to test the logic of a program.
2. Make use of counting principles.
3. Identify the graphs and understand its properties.
4. Apply the concepts and properties of algebraic structures.

5. Determining Boolean functions and simplifies expression using its properties.
6. Construct Homomorphism and isomorphism Structures.

TEXT BOOKS:
1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
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, 2011.
3. Veerarajan. T, Discrete Mathematics: with graph theory and combinatorics, McGraw-Hill Education (India) Pvt.Ltd. 2007.

REFERENCES:
1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition,Pearson Education Asia, Delhi,2007.
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.

		L	T	P	C
21CS1301   **DIGITAL LOGIC AND DESIGN**   **L T P C** / **3 0 0 3**
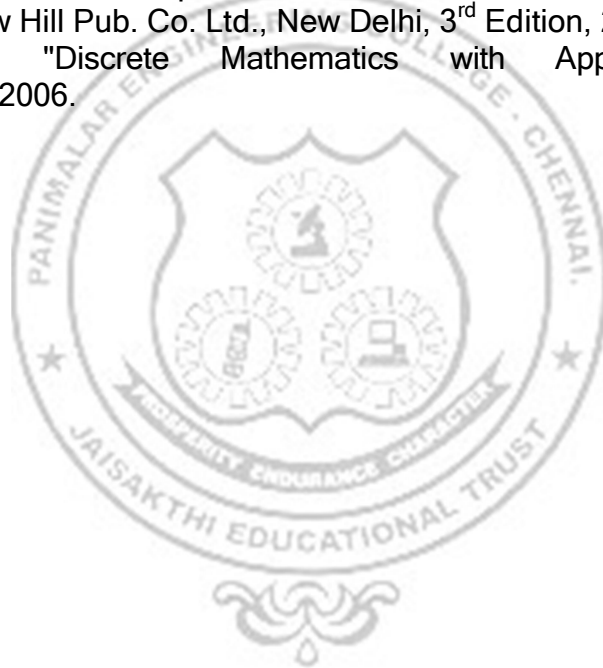
OBJECTIVES: To impart Knowledge on the following topics:
- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT - I   **BOOLEAN ALGEBRA AND LOGIC GATES**   **9**

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

SUGGESTED ACTIVITIES:
- Quine McCluskey Method
- Prime Implicants and Essential Prime Implicants

SUGGESTED EVALUATION METHODS:
- Assignment for Tabulation Method.
- Analysis the Prime Implicants and Essential Prime Implicants from Tabulation Method

UNIT - II   **COMBINATIONAL LOGIC**   **9**

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

SUGGESTED ACTIVITIES:
- Learn to understand the BCD Adder
- Understand the concept of 7- Segment Display

SUGGESTED EVALUATION METHODS:
- Assignment for BCD Adder
- Create model for seven segment display

UNIT - III   **SYNCHRONOUS SEQUENTIAL LOGIC**   **9**

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

SUGGESTED ACTIVITIES:
- Assignment Moore and Mealy model.
- Design and understand the Up and Down Counter.

SUGGESTED EVALUATION METHODS:
- Assignments for Moore and Mealy Model

- Solve the problem based on UP/Down Counter

UNIT - IV   ASYNCHRONOUS SEQUENTIAL LOGIC   9

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

SUGGESTED ACTIVITIES:
- Learn to understand Static Hazards.
- Understand the concepts of Dynamic Hazards.

SUGGESTED EVALUATION METHODS:
- Assignments for Static Hazards
- Solve the problem based on Dynamic Hazards.

UNIT - V   MEMORY AND PROGRAMMABLE LOGIC   9

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

SUGGESTED ACTIVITIES:
- Learn to understand Application Specific Integrated circuits.
- Understand the concepts Programmable Logic Devices.

SUGGESTED EVALUATION METHODS:
- Assignments on Application Specific Integrated Circuits
- Solve the problem based on Programmable Logic Devices

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Represent any given integer number in different bases (such as base 2, 8, 10, and 16).
2. Simplify Boolean functions using KMap
3. Describe the structure and operation of Datapath components such as adder, comparator, ALU, multi-function register.
4. Design and Analyze Combinational and Sequential Circuits
5. Implement designs using Programmable Logic Devices
6. Write HDL code for combinational and Sequential Circuits

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

REFERENCES:
1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2018.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003.

21CS1302	COMPUTER ARCHITECTURE AND MICROPROCESSORS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic structure and operations of a computer.
- To learn the implementation of fixed-point and floating point arithmetic unit.
- To understand the memory hierarchies, cache memories and parallel processing.
- To learn the different ways of communication with I/O devices.
- To learn the architecture of the Intel 8086 microprocessor
- To understand the concept of interfacing in 8086.

UNIT - I   BASIC STRUCTURE OF A COMPUTER   9

Introduction, Basic operational concepts, Performance, operations, operands of the computer hardware, Instructions representation, Decision making, Logical operations, MIPS addressing-Building a Data path.

SUGGESTED ACTIVITIES:
- In Class activity for performance evaluation.
- Writing simple assembly language programs from high level code.
- Study of an Addressing Mode for a standard processor.

SUGGESTED EVALUATION METHODS:
- Assignments on illustrative problems.
- Quizzes on Representing the Instructions.

UNIT - II   ARITHMETIC AND FLOATING POINT OPERATIONS   9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Sub word Parallelism

SUGGESTED ACTIVITIES:
- Study arithmetic operations and its algorithms
- Solving problems on floating point arithmetic operations

SUGGESTED EVALUATION METHODS:
- Assignments on illustrative problems.
- Quizzes

UNIT - III   MEMORY, IO SYSTEMS AND PARALLEL PROCESSING   9

Memory Hierarchy - cache memory - measuring and improving cache performance - Accessing I/O Devices - Interrupts - Direct Memory Access - Bus structure - Bus operation – Arbitration -Parallel processing challenges – Flynn‗s classification – SISD, MIMD, SIMD, SPMD, and Vector Architecture.

SUGGESTED ACTIVITIES:
- Study hit/miss rates for various access patterns.
- Solving problems on Parallel processing challenges.
- Study about Flynn's taxonomy of parallel processing.

SUGGESTED EVALUATION METHODS:
- Assignments on illustrative problems.
- Quizzes

UNIT - IV   THE 8086 MICROPROCESSOR   9

Introduction to 8086 -Basic configuration- Microprocessor architecture – Addressing modes -8086 signals - System bus timing - Instruction set and assembler directives – Assembly language programming - Modular Programming - Stacks - Procedures – Macros-GPU processors.

SUGGESTED ACTIVITIES:
- Study 8086 instructions and addressing modes
- Solve simple programs on the 8086 Microprocessor kit.

SUGGESTED EVALUATION METHODS:
- Assignment programs on assembly language programming
- Quizzes

UNIT - V   IO INTERFACING   9

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller.
Case studies: Traffic Light control, LED display.

SUGGESTED ACTIVITIES:
- Study about Memory and IO Interfacing.
- Case studies

SUGGESTED EVALUATION METHODS:
- Assignment on case studies.
- Quizzes

                                             TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basic structure of computers, operations and instructions.
2. Apply various Arithmetic and Floating Point operations.

3. Understand parallel Processing and analyze the performance of cache memory.
4. Analyze various I/O communication techniques and bus structures
5. Understand the architecture of 8086 microprocessor.
6. Analyze how external processors can be interfaced with an 8086 processor

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Yu-Cheng Liu, Glenn A.Gibson, Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design, Second Edition, Prentice Hall of India, 2007. (Unit -IV, V)

REFERENCES:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012

	L	T	P	C
21CS1303 **SOFTWARE ENGINEERING**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modelling.
- To understand the various software design methodologies, software testing, software process models
- To learn various testing and maintenance measures
- To understand the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects

UNIT - I   **SOFTWARE PROCESS MODELS**   **9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models - Waterfall model - Spiral Model – V shaped model – RAD model – Iterative Model – Prototype model.

SUGGESTED ACTIVITIES:
- Analyze which process model is suitable for a particular project
- Analyze Agile compare with traditional process models
- Estimate activity durations and resources required for a particular project

SUGGESTED EVALUATION METHODS:
- Incremental model compares with Waterfall model
- Assignments on different process models
- Evaluate the software process model is suitable for software concerns in the present scenario.

UNIT - II   **REQUIREMENTS ANALYSIS AND SPECIFICATION**   **9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

SUGGESTED ACTIVITIES:
- Gathering the requirements of the client – functional and non -functional requirements
- Prepare the Software Requirements Specification (SRS) of a particular project (e.g Railway reservation system, Airlines etc)
- Identify customer's needs of a particular project
- Evaluate the system for feasibility (both technically and financially feasible)

SUGGESTED EVALUATION METHODS:
- Establish schedule and constraints for a particular project

- Create system definitions
- Perform economic and technical analysis

UNIT - III   SOFTWARE DESIGN   9

. Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design -Component level Design: Designing Class based components, traditional Components.

SUGGESTED ACTIVITIES:
- Implementing architectural design of a particular software project
- Implementing Interface design of a particular software project
- Implementing Component design of a particular software project
- Implementing Database design of a particular software project

SUGGESTED EVALUATION METHODS:
- Evaluate Questionnaire method for software design
- Assignments on Heuristic evaluation methods applied in design of the software.
- Tabulate the tools used in software design.

UNIT - IV   TESTING AND MAINTENANCE   9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging -Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering - Software Configuration Management.

SUGGESTED ACTIVITIES:
- Develop test cases for any software project
- Enumerate the tools available for software testing
- Enumerate the principles of software testing
- List out the principles of BPR

SUGGESTED EVALUATION METHODS:
- Assignments on test suite.
- Assignments on Black box testing for any software product.
- Assignments on Testing artifacts of a software project

UNIT - V   PROJECT MANAGEMENT   9

Software Project Management: Estimation - LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model - Project Scheduling - Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS-Introduction to Agility: Extreme programming, Scrum, DevOps

SUGGESTED ACTIVITIES:
- How to estimate the size of the software product using LOC or other traditional methods
- Enumerate Earned Value Analysis for a particular project
- Draft the time frame of a particular project using Gantt chart
- Compare traditional process models with agile methods

SUGGESTED EVALUATION METHODS:
- How to fix the size of the software and evaluate the cost of the software project
- Determine the cost of the software project using COCOMO I & II Model
- How to predict the risk of a particular project
- Evaluate how the agile software process model is suitable for software concerns in the present scenario

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Identify the key activities in managing a software project.
2. Compare different process models.
3. Concepts of requirements engineering and Analysis Modeling.
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing and maintenance.
6. Manage project schedule, estimate project cost and effort required.

TEXT BOOKS:
1. Roger S. Pressman, Bruce R.Maxim ̄Software Engineering – A Practitioner's Approach, Eight Edition, McGraw-Hill International Edition, 2015.
2. IanSommerville, ̄Software Engineering, 9th Edition, Pearson Education Asia, 2011.
3. Gene Kim, Jez Humble, Patrick Debois, and John Willis, The DevOps Handbook- How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press,2nd Edition,2016

REFERENCES:
1. Rajib Mall Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009.
2. PankajJalote, ̄Software Engineering, A Precise Approach‖, Wiley India, 2010.
3. Kelkar S.A., ̄Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, ̄Software Engineering, Tata McGraw-Hill Publishing Company Limited,2007.

	L	T	P	C
21IT1304 **OBJECT ORIENTED PROGRAMMING**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To develop a java application with threads and generics classes.
- To design and build simple Graphical User Interfaces.

UNIT - I   **INTRODUCTION TO OOP AND JAVA FUNDAMENTALS**   **10**

Object Oriented Programming - Abstraction – Objects And Classes - Encapsulation- Inheritance - Polymorphism- OOP In Java -Fundamental Programming Structures In Java - Defining Classes In Java - Constructors, Methods -Access Specifiers - Static Members - Arrays , Packages – Defining Packages – Finding Packages And CLASSPATH -Importing Packages - Packages Types , Javadoc comments.

SUGGESTED ACTIVITIES:
- Programs and Demonstration using simple Java programs Using Java Basic Constructs and Arrays
- Understanding JVM

SUGGESTED EVALUATION METHODS:
- Assignment problems
- Quizzes

UNIT - II   **INHERITANCE AND INTERFACES**   **9**

Inheritance – Super classes- sub classes –Protected members - constructors in sub classes- the Object class - abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists– String Handling.

SUGGESTED ACTIVITIES:
- Programs and Demonstration of Java programs – use abstract classes, final methods and classes and interfaces
- Programs and Demonstration of Java programs – using String class, ArrayList , Creating class and objects
- Programs using Inheritance and Interfaces

SUGGESTED EVALUATION METHODS:
- Assignment problems.
- Quizzes

UNIT - III   EXCEPTION HANDLING AND I/O   9

Exceptions - Exception hierarchy - Throwing and Catching exceptions – Built-in exceptions, Creating own exceptions, Stack Trace Elements. Input / Output Basics - Streams - Byte streams and Character streams - Reading and Writing Console - Reading and Writing Files, Standard IDE like NETBEANS / ECLIPSE.

SUGGESTED ACTIVITIES:
- Programs and Demonstration using exception handling and Streams using any standard IDE like NETBEANS / ECLIPSE
- Develop an application threading

SUGGESTED EVALUATION METHODS:
- Demonstration of real-world application using exception handling and Streams
- Assignments

UNIT - IV   MULTITHREADING AND GENERIC PROGRAMMING   8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations

SUGGESTED ACTIVITIES:
- Programs and Demonstration of java program using multithreading and Generic programming

SUGGESTED EVALUATION METHODS:
- Assignment problems.
- Quizzes

UNIT - V   EVENT DRIVEN PROGRAMMING   9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events – AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Windows-Menus- Dialog Boxes- Study of Spring Framework , Hibernate Framework .

SUGGESTED ACTIVITIES:
- Programs and Demonstration using graphics programming and components
- Programs and Demonstration of Mouse, key events, creating interactive forms using AWT/Swing and adding functionality
- Understand AWT and SWING

SUGGESTED EVALUATION METHODS:
- Assignments

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Develop Java programs using OOP principles

2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes
5. Design and build simple Graphical User Interface.
6. Develop interactive Java programs using swings.

TEXT BOOKS:
1. Herbert Schildt, ¯Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, ¯Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2013.

REFERENCES:
1. Paul Deitel, Harvey Deitel, ¯Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.
2. Steven Holzner, ¯Java 2 Black book‖, Dreamtech press, 2011.
3. Timothy Budd, ¯Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000
4. Felipe Gutierrez , Introducing Spring Framework: A Primer 1st ed. Edition, Kindle Edition , 2014

	L	**T**	**P**	**C**
21CS1311 **DIGITAL LOGIC AND DESIGN LABORATORY**	**0**	**0**	**4**	**2**
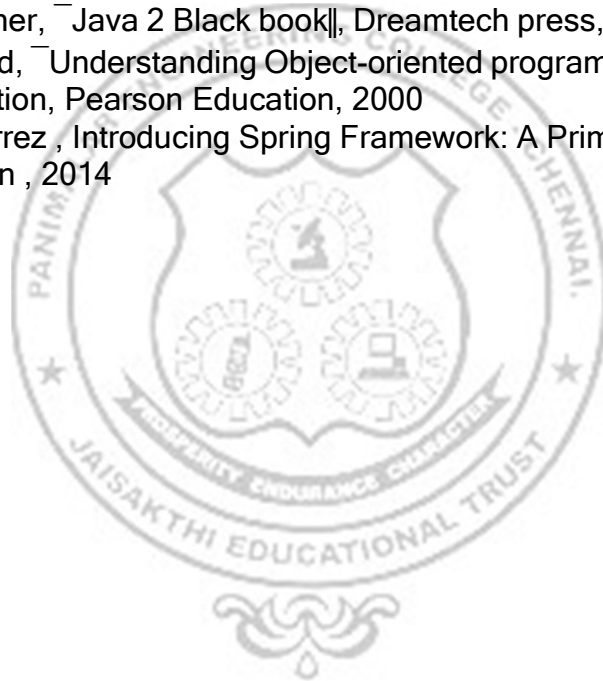
OBJECTIVES: To impart Knowledge on the following topics:
- To understand the various basic logic gates
- To design and implement the various combinational circuits
- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits
- To understand and code with HDL programming

LIST OF EXPERIMENTS

1. Verification of Boolean Theorems using basic gates.
2. Implement the combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and Implement Half/Full Adder and Subtractor
4. Design and Implement combinational circuits using MSI devices:
   - 4 – bit binary adder / Subtractor
   - Parity generator / checker
   - Magnitude Comparator
   - Application using multiplexers
5. Simulate the shift-registers.
6. Design and Implement synchronous counters.
7. Simulate the asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.
10. Design and implementation of a simple digital system (Mini Project).

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Derive basic logic gates, adder, and subtractor using universal gates.
2. Apply the acquired knowledge to simulate and implement small-scale digital circuits
3. Implement simplified combinational circuits using basic logic gates
4. Construct combinational circuits using MSI devices
5. Learn about counters and shift registers
6. Simulate combinational and sequential circuits using HD

		L	**T**	**P**	**C**
21IT1312	**OBJECT ORIENTED PROGRAMMING LABORATORY**	**0**	**0**	**4**	**2**

OBJECTIVES: To impart Knowledge on the following topics:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list
- To understand and apply the concepts of inheritance and polymorphism
- To understand exception handling and file processing.
- To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Write a java program that prints all real solutions to the quadratic equation $ax^2 +bx+c=0$. Read in a, b, c and use the quadratic formula
2. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non-recursive functions.
3. Write a java program for sorting a given list of names in ascending order
4. Write a program that prompts the user for an integer and then prints out all prime numbers up to that integer.
5. Write a Java program to Multiply two given matrices
6. Write a Java program that checks whether a given string is a palindrome or not.
7. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial).
8. 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.
9. 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.
10. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
11. Write a program to perform string operations using Array List. Write functions for the following
    a. Append - add at end
    b. Insert – add at particular index
    c. Search
    d. List all string starts with given letter

12. 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 only the method print Area () that prints the area of the given shape.

13. Write a Java program to implement exception handling.

14. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

15. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

16. Write a java program that correct implements of producer consumer program using the concept of inter thread communication

17. Write a java program to find the maximum value from the given type of elements using a generic function.

18. Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with ‾STOP ‾ or ‾READY‖ or ‾GO‖ should appear above the buttons in selected color. Initially, there is no message shown.

19. Design a calculator using event-driven programming paradigm of Java using Scientific manipulations.

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

ADDITIONAL PROGRAMS

21. Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using constructor. Calculate average of marks of 6 subjects and   calculate attendance percentage.

22. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism.

23. Write a program that creates three threads. First thread displays ‾Good Morning‖ every one second, the second thread displays ‾Hello‖ every two seconds and the third thread displays ‾Welcome‖ every three seconds.

24. Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field. (Hint: use swings).

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
2. Develop and implement Java programs with array list, Strings.
3. Design applications using inheritance and polymorphism
4. Develop and implement Java programs with exception handling and multithreading.
5. Design applications using file processing, generic programming.
6. Develop and implement Java programs using Event Handling

21MA1401   **PROBABILITY AND QUEUEING THEORY**   L T P C
                                                            3 1 0 4

OBJECTIVES: To impart Knowledge on the following topics:
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering
- To understand the basic concepts of probability, one-and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queuing models and apply in engineering.
- To understand the significance of advanced queuing models.

UNIT - I   **RANDOM VARIABLES**   **9 + 3**

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

UNIT - II   **TWO - DIMENSIONAL RANDOM VARIABLES**   **9 + 3**

Joint distributions – Marginal and conditional distributions – Covariance - Correlation and linear regression – Transformation of random variables – Central limit theorem for Independent Identically Distributed random variable (Without Proof).

UNIT - III   **RANDOM PROCESSES**   **9 + 3**

Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain- Chapman Kolmogorov equations-Limiting distributions

UNIT -IV   **QUEUEING MODELS**   **9 + 3**

Markovian queues - Single and multiple server queuing models-Little's formula- Queues with finite waiting rooms-Queues with impatient customers; Balking and reneging.

UNIT -V   **ADVANCED QUEUEING MODELS**   **9 + 3**

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

                                                    TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. Understand the basic concepts of one-dimensional random variables and apply in engineering applications.
3. Understand the basic concepts of two dimensional random variables and apply in engineering applications.
4. Apply the concept random processes in engineering disciplines.
5. Acquire skills in analyzing queuing models
6. Analyze non-Markovian queuing models and networks

TEXT BOOKS:

1. Gross,D.,Shortle,J.F,Thompson,J.MandHarris.C.M.,Fundamentals of Queueing Theory‖, Wiley Student 4thEdition,2014.
2. Ibe, O.C.,Fundamentals of Applied Probability and Random Processes‖, Elsevier,1st Indian Reprint,2007.
3. Veerarajan T, ¯Probability, Statistics and Random Processes with Queueing Theory‖, Mc Graw Hill, 1st Edition, 2018.

REFERENCES:
1. HweiHsu, ¯Schaums Outline of Theory and Problems of Probability,random variables and Random Processes‖, Tata McGraw Hill Edition, New Delhi, 2004.
2. Taha,H.A., ¯Operations Research‖,9th Edition,Pearson India Education Services,Delhi, 2016.
3. Trivedi,K.S., ¯Probability and Statistics with Reliability,Queueing and Computer Science applications‖,2nd Edition, JohnWiley and Sons, 2002.
4. Yates,R.D.andGoodman.D.J., ¯Probability and Stochastic Processes‖,2nd Edition, Wiley India Pvt.Ltd.,Bangalore, 2012.

	L	**T**	**P**	**C**

21CS1401 **DATABASE MANAGEMENT SYSTEMS** **L T P C**
 3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic concepts and the applications of database systems.
- To know the basics of SQL and construct queries using SQL.
- To learn the relational database design principles.
- To understand the basic issues of transaction processing and concurrency control.
- To familiar with database storage structures and access techniques

UNIT - I   DATABASE FUNDAMENTALS   9

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Components and Structure, Database Users and Administrator, History of Database Systems. Data models: ER model, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Enhanced E-R Model.

SUGGESTED ACTIVITIES:
- Developing ER diagrams for Banking application.
- Translating requirements into models
- Comparing Various Data Models and Views

SUGGESTED EVALUATION METHODS:
- Quizzes on History of Database
- Assignments on architecture of Database
- Assignments on ER model

UNIT - II   RELATIONAL DATABASE   9

Relational Data Model - Concept of Relations, Schema-Instance distinction, Keys, Referential integrity and Foreign keys, Relational algebra operators, SQL - Introduction, Data Definition in SQL, Table, Key and Foreign key definitions, Update behaviours. Querying in SQL, Notion of aggregation, Aggregation functions Group by and Having clauses, Embedded SQL.

SUGGESTED ACTIVITIES:
- Simple SQL queries
- Writing PL-SQL programs

SUGGESTED EVALUATION METHODS:
- Quizzes on SQL commands
- Assignments on SQL functions
- Quizzes on control flow and functions.

UNIT - III　　　　　　　DATABASE DESIGN　　　　　9

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decompositions. Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form – Multivalued Dependencies – Fourth Normal Form – Join Dependencies – Fifth Normal Form.

SUGGESTED ACTIVITIES:
- Writing Armstrong's Axioms
- Developing Normal Forms for a requirement
- Applying Decomposition and Functional Dependency

SUGGESTED EVALUATION METHODS:
- Quizzes on Normalization theory.
- Assignments on Normal Forms
- Case study

UNIT –IV　　　　　　TRANSACTION MANAGEMENT　　　　9

Transactions, Transaction Concept, ACID properties, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes. Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

SUGGESTED ACTIVITIES:
- Writing Transaction rules for a database
- Comparing the efficiency of protocols
- Understanding the importance of Recovery

SUGGESTED EVALUATION METHODS:
- Quizzes on Transaction Management
- Assignments on Protocols
- Quizzes on Recovery

UNIT -V　　IMPLEMENTATION TECHNIQUES AND NON-　　9
RELATIONAL MODEL

Data on External Storage – RAID- File Organizations – Indexing and Hashing -Trees – B+ tree and B- Tree index files. Hashing: Static – Dynamic. Query Processing and Query Optimization - Introduction to NoSQL & MongoDB: Advantages, Architecture, Data Models MongoDB Data types and CRUD Operations.

SUGGESTED ACTIVITIES:
- Applying RAID models
- Writing queries for index
- Comparing efficiency of Tree methods

- Writing No-Sql Queries

SUGGESTED EVALUATION METHODS:
- Quizzes on Tree concepts.
- Assignments on Indexing
- Quizzes on Query Optimization.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Remember the Structure of a Database
2. Understand an Entity Relational Model for a database.
3. Apply Relational and Non-Relational database concepts to design a database.
4. Analyse the importance of normalization and functional dependencies in database design
5. Evaluate the working principles of indexing and hashing.
6. Create a database design using both Relational and Non- Relational models

TEXT BOOKS:
1. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw HillIndia Private Limited, 7th edition.
2. MongoDB Complete Guide by Manu Sharma, BPB Publications, ISBN: 9789389898866, July 2021.

REFERENCES:
1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition

21CS1402   **DESIGN AND ANALYSIS OF ALGORITHMS**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand and apply the algorithm analysis techniques.
- To critically analyse the efficiency of alternative algorithmic solutions for the same problem.
- To get accustomed with various programming constructs such as divide-and-conquer, dynamic Programming, Backtracking and Branch and Bound.
- To understand the limitations of Algorithmic power.
- To learn techniques for solving specific problems more efficiently and for analysing space and time requirements.

UNIT - I   **INTRODUCTION**   **9**

Notion of an Algorithm - Fundamentals of Algorithmic Problem Solving -Important Problem Types -Algorithm Design Technique- Fundamentals of the Analysis of Algorithmic Efficiency - Asymptotic Notations and their properties-Analysis Framework - Mathematical analysis for Recursive and Non-recursive algorithms-Randomized algorithms-Las Vegas and Monte Carlo types.

SUGGESTED ACTIVITIES:
- Discussion on role of algorithms in computer science.
- Design of simple problems
- Basic method of calculating time and space complexity
- Design of Induction proof for recursive and non-recursive algorithms.

SUGGESTED EVALUATION METHODS:
- Quizzes on Asymptotic Notations
- Assignments on calculating time complexity using forward and Backward Approach

UNIT - II   **BRUTE FORCE AND DIVIDE-AND-CONQUER**   **9**

Brute Force - String Matching-KMP algorithm - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology - Binary Search - Merge sort - Quick sort – Randomized Quick Sort - Multiplication of Large Integers, Strassen's Matrix Multiplication.

SUGGESTED ACTIVITIES:
- External Learning- Divide and Conquer based algorithms, Hacker rank divide and Conquer algorithms
- Practical : Implementation of Binary Search and Merge Sort
- To calculate time complexity using Master's theorem
- Design of Induction proofs for algorithm verification for Divide and Conquer Algorithms

SUGGESTED EVALUATION METHODS:

- Quizzes on brute force methods
- Assignments on Merge Sort and Multiplication of Large Integers

UNIT - III   DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE   9

Dynamic programming - Principle of optimality - Computing a Binomial Coefficient – Floyd's algorithm - Multi stage graph - Optimal Binary Search Trees - Knapsack Problem. Greedy Technique - Container loading problem - Prim's algorithm and Kruskal's Algorithm - 0/1 Knapsack problems - Huffman Trees.

SUGGESTED ACTIVITIES:
- External Learning- Dynamic Programming based algorithms like Longest common subsequence
- Practical : Implementation of Optimal Binary Search Tree
- External Learning- Greedy Techniques like Prim's and Kruskal's Algorithm
- Practical: Implementation of Huffman Trees.

SUGGESTED EVALUATION METHODS:
- Tutorials on Floyd's Algorithm
- Quizzes on greedy algorithms
- Assignments on Knapsack using Dynamic Programming method and Greedy method

UNIT -IV   ITERATIVE IMPROVEMENT AND BACKTRACKING   9

Iterative Improvement-The Maximum-Flow Problem-Stable marriage Problem-Backtracking - n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Graph Coloring Problem.

SUGGESTED ACTIVITIES:
- External Learning- Maximum-Flow Problem
- External Learning- Backtracking Algorithms like N Queens Problem and Hamiltonian Circuit Problem
- Practical : Implementation of subset sum problem
- Practical : Implementation of Hamiltonian Circuit Problems

SUGGESTED EVALUATION METHODS:
- Tutorials on Hamiltonian Circuit Problem
- Quizzes on Backtracking algorithms

UNIT -V   P, NP CLASSES AND BRANCH AND BOUND   9

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems-Branch and Bound - LIFO Search and FIFO search - Assignment problem - Knapsack Problem - Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems - Travelling Salesman problem - Knapsack problem.

SUGGESTED ACTIVITIES:
- External Learning- NP Completeness
- External Learning- Branch and Bound Algorithms like Knapsack Problem

- Practical : Implementation of Travelling Salesman Problem using Branch and Bound
- External Learning- Approximation Algorithms for NP-Hard Problems
- Practical : Implementation of Travelling Salesman Problem using Approximation Algorithms

SUGGESTED EVALUATION METHODS:
- Tutorials on NP-Hard Problems
- Assignments on NP Completeness
- Quizzes on Knapsack Problems
- Assignments on Travelling Salesman Problem

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand different algorithmic design strategies

2. Articulate the process of problem solving and writing algorithms.

3. Design and implementing the problems using algorithmic design paradigms (divide- and-conquer, greedy method, dynamic-programming and Backtracking, Branch and Bound) and apply when an algorithmic design situation calls for it.

4. Analyze the correctness of algorithms using inductive proofs and invariants

5. Describe the classes P, NP,NP-Hard, NP Complete and appraise to prove that a certain problem is P,NP,BP-Hard, NP-Complete.

6. Designing their theoretical knowledge in practice

TEXT BOOKS:
1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ¯Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. S.Sridhar, DESIGN AND ANALYSIS OF ALGORITHMS, First Edition, Oxford Edition, 2014
3. Anany Levitin, ¯Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.

REFERENCES:
1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ¯Data Structures and Algorithms‖, Pearson Education, Reprint 2006..
3. Harsh Bhasin, ¯Algorithms Design and Analysis‖, Oxford university press, 2015.

	L	T	P	C
21CS1403 **COMPUTER NETWORKS**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer.

UNIT - I   INTRODUCTION AND PHYSICAL LAYER   9

Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Performance — Transmission media — Switching .

SUGGESTED ACTIVITIES:

- Designing Network Topology
- Problems on Performance metrics

SUGGESTED EVALUATION METHODS:

- Quizzes on Performance metrics

UNIT - II   DATA-LINK LAYER & MEDIA ACCESS   9

Introduction — Link-Layer Addressing — Data-Link Layer Protocols — HDLC — PPP — Media Access Control — Wired LANs: Ethernet — Wireless LANs: IEEE 802.11, Bluetooth, Zigbee.

SUGGESTED ACTIVITIES:

- Problems on Error correction and detection

SUGGESTED EVALUATION METHODS:

- Assignment - HDLC
- Quiz on Media access control

UNIT - III   NETWORK LAYER   9

Introduction — Network Layer Protocols: IPV4 , ICMP, IPV6 — Unicast Routing Algorithms— Multicasting Basics .

SUGGESTED ACTIVITIES:

- Problems on IP Addressing- In class
- Problems in Distance Vector Routing , Link State Routing using simulator

SUGGESTED EVALUATION METHODS:

- Assignments on IP Addressing and Routing Protocols

UNIT -IV   TRANSPORT LAYER   9

Introduction — Transport Layer Protocols — User Datagram Protocol — Transmission Control Protocol – SCTP.

SUGGESTED ACTIVITIES:
- Socket Programming on UDP
- Implementation of DNS using UDP

SUGGESTED EVALUATION METHODS:
- Quiz on UDP and TCP applications

UNIT -V   **APPLICATION LAYER**   **9**
WWW and HTTP – FTP – Email -Telnet -SSH – DNS – SNMP .

SUGGESTED ACTIVITIES:
- Seminar on WWW and HTTP

SUGGESTED EVALUATION METHODS:
- Implementation of HTTP using Socket Programming.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basic layers and its functions in computer networks.
2. Evaluate the performance of a network.
3. Understand the basics of how data flows from one node to another.
4. Analyze and design routing algorithms.
5. Design protocols for various functions in the network.
6. Understand the working of various application layer protocols..

TEXT BOOKS:
1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2017(Reprint)
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012

REFERENCES:
1. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013

21IT1302   **OPERATING SYSTEMS (LAB INTEGRATED)**   **L   T   P   C**
                                                              3   0   2   4

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic concepts and functions of operating systems.
- To understand concepts of Processes
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT - I   **OPERATING SYSTEM OVERVIEW**   **9**

Computer System Overview- Instruction Execution, Interrupts, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Operating System Structure and Operations- System Calls, System Programs, Types of Kernels- OS Generation and System Boot- Processes – Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication

SUGGESTED ACTIVITIES:
1. Learn Computer System Overview
2. Understand Operating System overview

SUGGESTED EVALUATION METHODS:
1. Assignment
2. Quiz

UNIT - II   **PROCESS MANAGEMENT**   **9**

CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Process Synchronization – The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

SUGGESTED ACTIVITIES:
1. Programs to implement CPU scheduling
2. Programs to detect and avoid deadlock.

SUGGESTED EVALUATION METHODS:
1. Assignment /quiz.

UNIT - III   **STORAGE MANAGEMENT**   **9**

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

SUGGESTED ACTIVITIES:
  1. Programs and Demonstration of Memory Allocation Techniques
  2. Programs and Demonstration of Page replacement algorithm
SUGGESTED EVALUATION METHODS:
  1. Assignment /Quiz

UNIT -IV   FILE SYSTEMS   9
File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Simulation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery ;Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management

SUGGESTED ACTIVITIES:
  1. Implement File Allocation methods
  2. Implement File Organization
SUGGESTED EVALUATION METHODS:
  1. Assignments / quiz

UNIT -V   CASE STUDY   9
Linux System – Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS -iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

SUGGESTED ACTIVITIES:
  1. Learn Linux System
  2. Learn Mobile OS
SUGGESTED EVALUATION METHODS:
  1. Assignments for CASE STUDY
LABORATORY EXERCISES
  1. Basic Unix commands
  2. System call using Unix
  3. CPU Scheduling Algorithms
  4. Simulation Of Producer-Consumer Problem Using Semaphore
  5. Simulation Of Shared Memory Using IPC
  6. Simulation Of Deadlock Detection.
  7. Simulation Of Memory Allocation Techniques: First Fit, Best Fit And Worst Fit
  8. Simulation Of Paging Techniques
  9. Simulation Of Page Replacement Algorithms
  10 Simulation Of File Organization Techniques
  11 Simulation Of File Allocation Strategies

TOTAL: 45 + 30 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand The basics of Operating System
2. Understand Process, Process scheduling, Process Synchronization ,Deadlock
3. Learn the various memory management schemes.
4. Understand File systems
5. Understand Linux OS
6. Understand Mobile OS like iOS and Android

TEXT BOOKS:
1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ¯Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.
2. William Stallings, Operating Systems: Internals and Design Principles, 9 th Edition by Pearson
3. Neil Smyth, ¯iPhone iOS 4 Development Essentials – Xcode ,Fourth Edition, Payload media, 2011

REFERENCES:
1. Ramaz Elmasri, A. Gil Carrick, David Levine, ¯Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, ¯Operating System, McGraw Hill Education, Third Edition ,2017.
3. Andrew S. Tanenbaum, ¯Modern Operating Systems,Fourth Edition, Pearson Education, 2016.
4. Gary Nutt, ¯Operating Systems, Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel,Paul J Deital,Davis R Choffnes ¯Operating System, Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, ¯Understanding the Linux kernel‖, 3rd edition,O_Reilly, 2005.

21CS1411	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES: To impart Knowledge on the following topics:

- Learn to create and use a database.
- Be familiarized with a query language.
- Have hands on experience on DDL Commands.
- Have a good understanding of DML Commands and DCL Commands.
- Familiarize advanced SQL queries.
- Be exposed to different applications.

- **Tools: Oracle SQL* Plus/No-SQL-MongoDB**

LIST OF EXPERIMENTS

1. Creation of tables for Salesman and Customer Relation with following structure: Salesman Relation:

salesman_id	name	city	commission

Customer Relation:

customer_id	cus_name	city	grade	salesman_id

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Set various constraints like Not Null, Primary Key, Foreign Key and Check constraints.

5. Creating relationship between the databases and retrieve records using joins for the below relations:

Salesman Relation:

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
5003	Lauson Hen	San Jose	0.12

Customer Relation:

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham	London	300	5002
3004	Fabian	Paris	300	5006
3009	Geoff	Rome	100	5007
3003	Jozy	San Jose	300	5003

6. Execute the different types of Joins to find the output for the below:
    1. From the following tables write a SQL query to find the salesperson and customer who reside in the same city. Return Salesman, cust_name and city
    2. From the following tables write a SQL query to find those orders where the order amount exists between 500 and 2000. Return ord_no, purch_amt, cust_name, city.
    3. From the following tables write a SQL query to find the salesperson(s) and the customer(s) he represents. Return Customer Name, city, Salesman, commission
    4. From the following tables write a SQL query to find salespeople who received commissions of more than 12 percent from the company. Return Customer Name, customer city, Salesman, commission
    5. Write a SQL statement to join the tables salesman, customer and orders so that the same column of each table appears once and only the relational rows are returned
    6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
    7. Write a PL/SQL block that handles all types of exceptions.
    8. Creation of Procedures.
    9. Creation of database triggers and functions
    10. Database Connectivity with Front End Tools (Java/Python)

**Mini Project :**
1.   Inventory Control System.
2.   Material Requirement Processing
3.   Hospital Management System.
4.   Railway Reservation System.
5.   Personal Information System.
6.   Timetable Management System.
7.   Hotel Management System

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1.   Understand the Syntax of SQL commands
2.   Remember queries to retrieve records
3.   Apply referential integrity constraints
4.   Analyze the database design using constraints
5.   Evaluate PL/SQL programs to implement triggers, functions, procedures and exceptions
6.   Create front end tools to manipulate information from backend

21CS1412	**NETWORKS LABORATORY**	L	T	P	C
		0	0	4	2
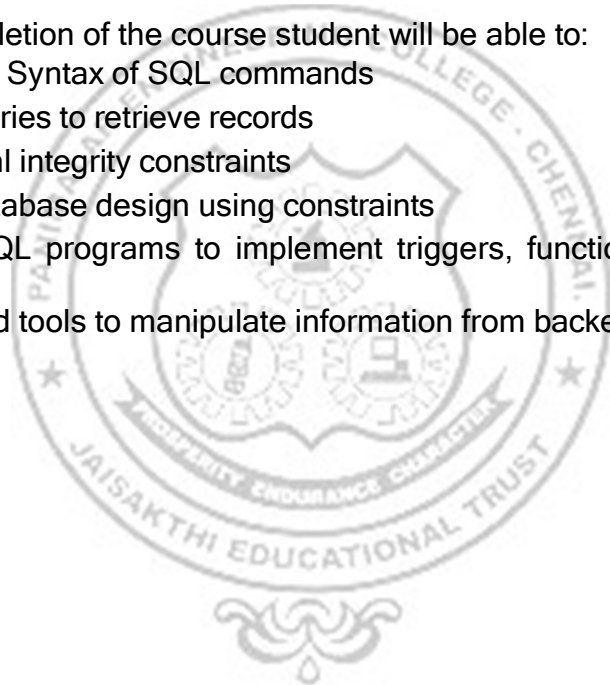
OBJECTIVES: To impart Knowledge on the following topics:

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
   a) Echo client and echo server
   b) Chat
   c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC).

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Implement various protocols using TCP and UDP.
2. Understand the programs using sockets.
3. Compare the performance of different transport layer protocols.
4. Use simulation tools to analyze the performance of various network protocols.
5. Analyze various routing algorithms.
6. Implement error correction codes.

21MA1501	ALGEBRA AND NUMBER THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce the basic notions of rings, fields which will then be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- 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   RINGS AND INTEGRAL DOMAIN   12

Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism

UNIT - II   FINITE FIELDS AND POLYNOMIALS   12

Rings- Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT - III   DIVISIBILITY THEORY AND CANONICAL   12
**   DECOMPOSITIONS**

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

UNIT -IV   DIOPHANTINE EQUATIONS AND CONGRUENCES   12

Linear Diophantine equations - Congruences - Linear Congruences - Modular exponentiation- Chinese remainder theorem - 2 x 2 linear systems

UNIT -V   CLASSICAL THEOREMS AND MULTIPLICATIVE   12
**   FUNCTIONS**

Wilson_s theorem – Fermat_s little theorem – Euler_s theorem – Euler_s Phi functions - Tau and Sigma functions.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Apply the basic notions of rings, fields which will then be used to solve related problems.
2. Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts
3. Demonstrate accurate and efficient use of advanced algebraic techniques
4. Demonstrate their mastery by solving non - trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.

5. 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. N P Sudharshana & C Savitha. English for Technical Communication Delhi: CUP, 2019. 1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007
2. Koshy, T.," Elementary   Number Theory with Application", 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.

21MG1401	ORGANIZATIONAL BEHAVIOUR AND ETHICAL PRACTICES	L	T	P	C
		3	1	0	4

OBJECTIVES: To impart Knowledge on the following topics:

- To provide an overview of theories and practices in organizational behaviour in individual, group and organizational level
- To enable the students to create an awareness on Ethical practices, to instil Moral and Social Values and to appreciate the rights of others

UNIT - I	INDIVIDUAL BEHAVIOUR	12

Organizational Behaviour – Meaning – Contributing Disciplines – Importance. Personality - Types - Factors influencing personality. Perceptions - Importance - Factors influencing perception – Interpersonal perception – Impression Management. Attitudes – Characteristics – Components – Formation – Measurement. Values – Types. Learning – Types of learners – The learning process. Emotional Intelligence – Concepts- Theories

UNIT - II	GROUP BEHAVIOUR	9

Groups in organizations- Influence – Group dynamics. Emergence of informal leaders and working norms. Group decision making techniques - Team building - Interpersonal relations. Communication - Process - Barriers - Effective Communication. Control - Types - Process. Power - Sources - Power Centres - Power and Politics.

UNIT - III	INTRODUCTION TO ETHICS	10

Senses of ‗Ethics‗ - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy – Kohlberg‗s theory – Gilligan‗s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest - Customs and Religion - Uses of Ethical Theories.

UNIT -IV	ENGINEERING AS SOCIAL EXPERIMENTATION	6

Engineering as Experimentation - Engineers as Responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

UNIT -V	RESPONSIBILITIES AND RIGHTS	8

Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR)-Discrimination.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:

1. Understand the complexities associated with management of individual behavior in the organizations.

2. Develop the skill set to manage group behaviour in Organizations
3. Explain the role of ethics in the engineering field
4. Describe how engineering is applied in association with ethics based on engineering experimentation.
5. Apply ethics in society and discuss the ethical issues related to engineering.
6. Understand and realize the responsibilities and rights in the society as an engineer.

TEXT BOOKS:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organisational Behavior‖, Pearson Education, 18th edition, 2018.
2. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, 4e Indian Edition, Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Fred Luthans, Organisational Behavior, McGraw Hill, 12th Edition, 2013.
2. Udai Pareek, Understanding Organisational Behavior, 3rd Edition, Oxford Higher Education, 2011.
3. McShane, Mary V. Glinow, Organizational Behavior, 8th Edition, Tata Mc Graw Hill, 2017.
4. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.
5. Charles B. Fleddermann, Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.
6. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Engineering Ethics – Concepts and Cases‖, Cengage Learning, 2009.

	L	T	P	C

21CS1501   OBJECT ORIENTED ANALYSIS AND DESIGN   **3   0   2   4**
(LAB INTEGRATED)

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the fundamentals of object modeling.
- To understand and differentiate Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification.

UNIT - I   UNIFIED PROCESS AND USE CASE DIAGRAMS   9

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study- The Next Gen POS System - Inception - Use case Modeling - Relating Use cases - Include, Extend And Generalization - When to use Use cases - Requirements Capture and Modeling - Object Analysis classification - Use case Realization.

SUGGESTED ACTIVITIES
- Analyze the OO basic concepts
- Use case modeling for any problem Statement.
- Identify the use case relationship in any problem Statement

SUGGESTED EVALUATION METHODS
- Assignments on Unified Process applied to Next Gen POS System, any problem Statement
- Quiz in Use case Modeling

UNIT - II   STATIC UML DIAGRAMS   9

Class Diagram – Elaboration – Domain Model – Finding conceptual classes and description classes - Associations - Attributes - Domain model refinement - Finding conceptual class Hierarchies - Aggregation and Composition - Relationship between sequence diagrams and use cases - When to use Class Diagrams-CRC cards-Assembling and Analyzing Class diagrams.

SUGGESTED ACTIVITIES
- Identify the Conceptual Classes in any Problem Statement
- Create domain Model for any Problem Statement
- Create Class Diagram for any Problem Statement
- Create CRC cards for any requirement(user story, business rule, or system use case)

SUGGESTED EVALUATION METHODS
- Assignments on Identifying the Conceptual Classes in Library Information System, Hospital Management System etc.
- Assignments on Creating Domain Model for Library Information System, Hospital Management System etc.
- Quiz in CRC cards.

UNIT - III   DYNAMIC AND IMPLEMENTATION UML DIAGRAMS   9

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modeling -When to use State Diagrams - Activity diagram – When to use activity diagrams -Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment Diagrams-Model consistency.

SUGGESTED ACTIVITIES:

- Design Dynamic UML diagrams for the Problem Statement
- Design Implementation UML diagrams for the Problem Statement.

SUGGESTED EVALUATION METHODS:

- Assignments on modeling the system with Dynamic UML diagrams

- Assignments on modeling the system with all UML diagrams.

- Quiz in UML diagram

UNIT -IV   DESIGN PATTERNS   9

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – observer – Applying GoF design patterns - Mapping design to code.

SUGGESTED ACTIVITIES

- Apply Grasp Patterns to Library Information System , Hospital Management System etc.
- Apply GoF patterns to Library Information System , Hospital Management System etc.
- Apply Forward Engineering (Mapping Design to code.) in Library Information System, Hospital Management System etc.

SUGGESTED EVALUATION METHODS

- Assignments on Applying GRASP patterns
- Assignments on Applying GoF patterns.
- Quiz in Mapping design to code

UNIT -V   TESTING OBJECT-ORIENTED SOFTWARE   9

Issues in Testing Object-Oriented Software -An Orthogonal Approach to Test - Intraclass Testing - Testing with State Machine Models - Interclass Testing - Structural Testing of Classes - Oracles for Classes -Polymorphism and Dynamic Binding – Inheritance- Genericity - Exceptions

SUGGESTED ACTIVITIES

    Develop the test cases for testing with State Machine Models,
- Interclass Testing , Infraclass Testing

- Apply OO testing techniques to OO Projects.

SUGGESTED EVALUATION METHODS

- Assignments on testing with State Machine Models, Interclass Testin Intraclass Testing
- Assignments on Structural Testing of Classes.

LIST OF EXPERIMENTS

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

1. Identify a software system that needs to be developed.

2. Document the Software Requirements Specification (SRS) for the identified system.

3. Identify use cases and develop the Use Case model.

4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.

5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams

6. Draw relevant State Chart and Activity Diagrams for the same system.

7. Implement the system as per the detailed design

8. Test the software system for all the scenarios identified as per the usecase diagram

9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.

10. Implement the modified system and test it for various scenarios

SUGGESTED TOPICS FOR MINI-PROJECT

1. Passport automation system.

2. Book bank

3. Exam registration

4. Stock maintenance system.

5. Online course reservation system

6. Airline/Railway reservation system

7. Software personnel management system

8. Credit card processing

9. E-book management system

10. Recruitment system

11. Foreign trading system

12. Conference management system

13. BPO management system

14. Library management system

15. Student information system

TOTAL : 75 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Utilize Unified Process and Use case diagrams for software design

2. Express software design with UML diagrams

3. Design software applications using OO concepts.

4. Identify various scenarios based on software requirements

5. Transform UML based software design into pattern based design using design patterns

6. Understand the various testing methodologies for OO software.

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

2. 2. Ali Bahrami,Object Oriented Systems Development - McGraw Hill International Edition – 1999.

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

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

3. Software Testing and Analysis: Process, Principles, and Techniques , Mauro Pezze University di Milano Bicocca ` Michal Young University of Oregon , 2008 John Wiley & Sons, Inc.

	L	T	P	C

21CS1502   **INTERNET PROGRAMMING**

3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand client-side programming.
- To understand server-side programming.
- To be familiarize on PHP programming.
- To understand XML Essentials.
- To learn web service architecture.

UNIT - I   **CLIENT-SIDE PROGRAMMING**   **9**

Introduction to Web: Server - Client - Communication Protocol (HTTP) - Introduction to Typescript-IDEs- IntelliJ IDEA- Class Decorator - Classes. Configuration and Compilation of all files in Typescript - Bootstrap: Introduction to Bootstrap - Structure of the Page – Typography - Forms and Buttons.

SUGGESTED ACTIVITIES
- Designing a web page using IDEs-IntelliJ IDEA.
- Design a letter form using Typography.

SUGGESTED EVALUATION METHODS
- Assignment on Forms and Buttons.
- Assignment on Communication Protocol HTTP.

UNIT - II   **SERVER-SIDE PROGRAMMING**   **9**

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

SUGGESTED ACTIVITIES
- Create Database Connectivity.
- Develop a JSP Standard Tag Library.

SUGGESTED EVALUATION METHODS
- Assignment on Database Connectivity for a client server communication.
- Quiz on HTML forms by embedding JSP code.

UNIT - III   **PHP**   **9**

An introduction to PHP – PHP - Using PHP - Variables - Program control - Built-in functions- Form Validation - Regular Expressions - File handling - Cookies - Connecting to Database.

SUGGESTED ACTIVITIES:
- Program control in PHP
- Validate the form using Form Validation in PHP

SUGGESTED EVALUATION METHODS:

● Assignment on built in functions using PHP

● Assignment on File handling

UNIT -IV   XML   9

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

SUGGESTED ACTIVITIES
● Analyze XML Data using XML Parsers and Validation
● Present a web page using Schema DOM and Presenting XML

SUGGESTED EVALUATION METHODS
● Assignment on XSL and XSLT Transformation
● Seminar on News Feed (RSS and ATOM).

UNIT -V   INTRODUCTION TO AJAX and WEB SERVICES   9

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

SUGGESTED ACTIVITIES
● Update a Webpage using AJAX.
● Creating, Publishing, Testing and Describing a Web services (WSDL).

SUGGESTED EVALUATION METHODS
● Assignment on Web Services and Basics.
● Seminar on SOAP.

TOTAL : 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
● Build dynamic web pages with validation using Typescript Objects and by applying different classes and methods.
● Develop server-side programs using Servlets and JSP.

● Develop an application using JDBC.
● Construct simple web pages in PHP.
● Represent data in XML format.

- Use AJAX and web services to develop interactive web applications.

TEXT BOOKS:
1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program‖, Prentice Hall, 5th Edition, 2011.
2. Boris Cherny, Programming Typescript, 2021

REFERENCES:
1. Stephen Wynkoop and John Burke ,Running a Perfect Website‖, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, WileyPublications, 2009.
3. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective ,Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India,2011.
5. Josh Goldberg , ‾Learning Typescript,2021.
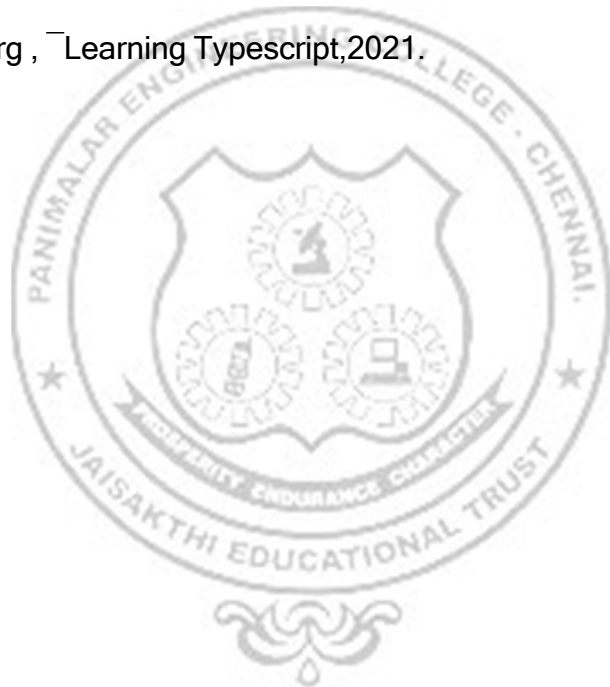
			L	T	P	C

21CS1503   **THEORY OF COMPUTATION**   **3   0   0   3**

OBJECTIVES: To impart Knowledge on the following topics:
- To know about Chomsky hierarchy for organizing languages.
- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- To design grammars and recognizers for different formal languages.
- To understand undecidability and decide on languages that is undecidable.

UNIT - I   **FINITE AUTOMATA**   **9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs -Finite Automata (FA) - Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions – NFA to DFA conversion - Epsilon NFA to DFA conversion-. Applications and Limitation of FA.

SUGGESTED ACTIVITIES
- Defining automata for different types of patterns.
- Tutorial Problem on Conversion of Epsilon NFA into DFA.

SUGGESTED EVALUATION METHODS
- Quiz on Types of Finite Automata
- Assignment on Equivalence of Deterministic and Nondeterministic Finite Automata.

UNIT - II   **REGULAR EXPRESSION AND REGULAR LANGUAGES**   **9**

Definition - Operators of regular expression - Algebraic laws for Regular expressions- Equivalence of FA and Regular Expressions – Minimization of Finite Automata - Pumping Lemma for Regular Languages. Closure properties of Regular Languages / Sets.

SUGGESTED ACTIVITIES
- Flipped Classroom - Regular expression for practical patterns.
- Problems based on Closure properties of Regular Language.

SUGGESTED EVALUATION METHODS
- Quiz on Operators of regular expression.
- Tutorial Problem on Conversion of RE into Minimized DFA.

UNIT - III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA 9

Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Language of a Pushdown Automata – Equivalence of Pushdown Automata and CFG – Pumping Lemma for CFL – Ogden's lemma for CFL - Closure Properties of CFL- Deterministic Pushdown Automata.

SUGGESTED ACTIVITIES:

- Construction of CFG for practical programming.
- Problems based on Ambiguity grammar.

SUGGESTED EVALUATION METHODS:

- Assignment on Simplification of CFGs.
- Quiz on Closure properties of CFL.
- Tutorial Problem on Normal forms for CFGs.

UNIT -IV PROPERTIES OF CONTEXT-FREE LANGUAGES 9

Simplification of Context-free Grammar – Chomsky Normal Form – Greibach Normal Form - TURING MACHINES (TM) - Formal definition and behaviour, Languages of a TM - Turing Machine as a Computing Device and Language Acceptor - Techniques for TM .

SUGGESTED ACTIVITIES

- Conversion of PDA from CFG and CFG from PDA

- Problems on Turing machines as language acceptors and computing devices.

SUGGESTED EVALUATION METHODS

- Design a Push Down Automata
- Quiz on Techniques of Turing Machines

UNIT -V UNDECIDABILITY 9

Recursive and recursively enumerable languages - Halting problem - Introduction to Undecidability and Reducibility - Undecidable problems about TMs - Post correspondence problem (PCP) - Modified PCP -Applications: Programmed grammar.

SUGGESTED ACTIVITIES

     Proofs - In Class
-
- Problems based on PCP, MPCP and conversions

SUGGESTED EVALUATION METHODS
- Assignment on Halting Problem
- Quiz on Programmed grammar

TOTAL : 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Construct finite automata, regular expression for any pattern.
2. Write context free grammar for any construct.
3. Build pushdown automata to recognise a context free language
4. Design Turing machines for any language.
5. Propose computation solutions using Turing Machine
6. Drive whether a problem is decidable or not

TEXT BOOKS:
1. John E. Hopcroft ,Rajeev Motwani, Jeffery D. Ullman, Introduction to AutomataTheory, Languages and Computations, Third Edition, Pearson Education ,2009.
2. Kamala Krithivasan and R. Rama, Introduction to Formal Languages, AutomataTheory and Computation, Pearson Education, Delhi, 2009.

REFERENCES:
1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd, 2003.
2. J. Martin, Introduction to Languages and the Theory of Computation, Third Edition,Tata Mc Graw Hill, New Delhi, 2003.
3. Micheal Sipser, ¯Introduction of the Theory and Computation‖, Thomson Learning,1997.

| | | **L** | **T** | **P** | **C** |

21CS1511   **INTERNET PROGRAMMING LABORATORY**   **0** **0** **4** **2**

OBJECTIVES: To impart Knowledge on the following topics:

- To be exposed to creation of user interfaces using Typescript and Bootstrap.
- To learn to create dynamic web pages using server-side scripting.
- To learn to write Client Server applications.
- To be familiar with PHP programming.
- To be familiar with XML programming
- To be exposed to creating applications with AJAX

LIST OF EXPERIMENTS

1. To create a simple web page using bootstrap.
2. Implementation of Typescript classes and functions.
3. Implementation of Bootstrap Typography.
4. Validate the Registration, user login, user profile and payment by credit

   card pages using Typescript.
5. Write programs in Java using Servlets:

   1. To invoke servlets from HTML forms

   2. Session tracking using hidden form fields and Session tracking for a hit count

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

7. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.

8. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.

9. PHP

   1. Validate the form using PHP regular expressions.

   2. PHP stores the form data into a database.

10. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input an returns the User details by taking the user information from the XML document.

11. Write a web service for finding what people think by asking 500 people's opinions for any consumer product.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Build dynamic web pages with validation using Typescript objects and by applying different bootstrap mechanisms
2. Develop dynamic web pages using server side scripting.
3. To create client server applications.
4. Use PHP programming to develop web applications.
5. Use XML programming to develop Web Applications
6. Construct web applications using AJAX and web services.

21CS1601	CLOUD COMPUTING AND BIG DATA TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES : To impart Knowledge on the following topics:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To know about lead players in cloud.
- To be exposed to big data.
- To understand the usage of Hadoop related tools

UNIT - I   CLOUD ARCHITECTURE, SERVICES AND STORAGE   9

Introduction to Cloud Computing – Definition of Cloud -Evolution of loud Computing - Cloud Characteristics - Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture - Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage as a Service -Advantages of Cloud Storage - Cloud Storage Providers - S3-Google drive - One Drive.

SUGGESTED ACTIVITIES:

- To learn the Cloud Computing Architecture and components.
- Identify different service models and deployment models of cloud.
- To learn about Cloud storage.

SUGGESTED EVALUATION METHODS:

- Quiz on Cloud Computing Architecture and components.
- Quiz on service models and deployment models of cloud.
- Case studies for Different cloud storage providers.

UNIT - II   VIRTUALIZATION AND CLOUD TECHNOLOGIES   9

Basics of Virtualization – Types of Virtualization – Para Virtualization- Full Virtualization- Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms -Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery - Virtual Box - Google App Engine - Programming Environment for Google App Engine - AWS -Open Stack.

SUGGESTED ACTIVITIES:

- Implement Virtualization concept.

- Comparing Virtualization techniques.

    Identify different tools for Virtualization

-

SUGGESTED EVALUATION METHODS:

- Quiz on Virtualization concept and different tools for Virtualization.

- Assignments on Comparing Virtualization techniques.

UNIT - III   CLOUD RESOURCE MANAGEMENT AND SECURITY   9

Inter Cloud Resource Management – Resource Provisioning and Methods- Global Exchange of Cloud Resources – Cloud Migration - Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security - IAM - Security Standards.

SUGGESTED ACTIVITIES:

- To learn about Cloud Resource management.

- Identify Resource Provisioning Methods.

- To learn about Cloud Security and standards.

SUGGESTED EVALUATION METHODS:

- Quiz on Cloud technologies.

- Quiz on Cloud Resource management.

- Case studies on Cloud Security and standards.

UNIT -IV   INTRODUCTION TO BIG DATA   9

What Is Big Data – Why Big Data – Convergence Of Key Trends – Unstructured Data – Industry Examples Of Big Data – Web Analytics – Big Data And Marketing – Fraud and Big Data – Risk And Big Data – Credit Risk Management – Big Data And Algorithmic Trading – Big Data And Healthcare.

SUGGESTED ACTIVITIES:

- To learn about big data.

- Understanding the importance of Big Data Analytics.

- Understanding Big Data Frameworks.

SUGGESTED EVALUATION METHODS:

- Case studies on importance of Big Data Analytics.

- Quiz on Big Data Frameworks.

UNIT -V   UNDERSTANDING BIG DATA AND TECHNOLOGIES   9

Tests with MR Unit - Test Data and Local Tests - Anatomy of Map Reduce Job Run - Classic Map Reduce - YARN - Failures in Classic Map Reduce and YARN – Job Scheduling – Shuffle and Sort – Task Execution – Map Reduce Types – Input Formats - Output Formats-Hadoop Related Tools.

SUGGESTED ACTIVITIES:

- Learn about Map Reduce.

- Understanding the importance of YARN.

- Understanding Hadoop Related tools.

SUGGESTED EVALUATION METHODS:

- Quiz on Map Reduce.

- Case studies on YARN.

- Case studies Hadoop Related tools.

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course, the student will be able to
1. To Apply the concept of cloud computing in different Domain
2. To Discuss   the evolution of cloud from the existing technologies.
3. To be familiar about various issues in cloud computing.
4. To be familiar with the lead players in cloud.
5. To be familiar with exposed to big data Technologies.
6. To be familiar with the usage of Hadoop related tools

TEXT BOOKS:
1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ‾Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
3. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013

REFERENCES:
1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A PracticalApproach, Tata Mcgraw Hill, 2009.
2. George Reese, "Cloud Application Architectures: Building Applications and infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory inPractice)‖, O'Reilly, 2009.
3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012

	L	**T**	**P**	**C**

21CS1602   **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**   **L T P C**
3 0 0 3

OBJECTIVES : To impart Knowledge on the following topics:

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To know about the various applications of AI.
- To understand the need for machine learning and various algorithms in machine learning.

UNIT - I	**INTRODUCTION**	**9**

Introduction-Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents–Typical Intelligent Agents - Problem Solving Approach to Typical AI problems- Search Strategies- Uninformed - Informed-BFS-Greedy best first search-A* search .

SUGGESTED ACTIVITIES:

- Developing PEAS description for agents.
- Comparing Future of AI.
- Different Approach in AI to Real Time Problems

SUGGESTED EVALUATION METHODS:

- Quiz on History of AI.
- Learners to write a letter to self-keeping the future in context.
- Assignment on Problem Solving Approach

UNIT - II	**PROBLEM SOLVING METHODS**	**9**

Problem solving Methods - Heuristics - Iterative Deepening A*- RBFS - Memory Bounded A* – Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems - Constraint Propagation - Backtracking Search – Game Playing –Min Max- Optimal Decisions in Games – Alpha Beta Pruning - Stochastic Games

SUGGESTED ACTIVITIES:

- Participating in Game based activity.
- Basic Structure of Decision Tree to students.
- Searching Techniques for Problem Solving.

SUGGESTED EVALUATION METHODS:

- Designing a decision tree based on the data given.
- Quiz on Searching Techniques
- Students are divided into groups to find different solution for a particular problem and it can discussed in class

UNIT - III KNOWLEDGE REPRESENTATION AND AI APPLICATIONS 9

First Order Predicate Logic - Prolog Programming - Unification - Forward Chaining- Backward Chaining - Resolution - Knowledge Representation - Ontological Engineering- AI applications - Language Models - Information Retrieval- Information Extraction - Natural Language Processing - Machine Translation – Speech Recognition-Robot.

SUGGESTED ACTIVITIES:

- Installing Prolog.
- Game based activity for AI applications.
- Flowchart for Knowledge Representation.

SUGGESTED EVALUATION METHODS:

- Mystery Animal Game (based on Natural Language Processing).

- Assignment on Retrieval and Extraction techniques.

- Quiz on Simple Prolog Programming.

UNIT -IV MACHINE LEARNING AND SUPERVISED LEARNING ALGORITHMS 9

Introduction to Machine Learning (ML) - Essential concepts of ML -Learning a Class from Examples- Linear, Non-linear-Multi-class and Multi-label classification-Decision Trees- ID3-Classification and Regression Trees (CART)-Regression-Linear Regression- Multiple Linear Regression- Logistic Regression- Bayesian Classifier- Bayesian Network.

SUGGESTED ACTIVITIES:

- Developing a framework for real life activities such as decision tree.
- Developing algorithms for basic mathematical expressions using regression tree.
- Simple program on SVM classification.

SUGGESTED EVALUATION METHODS:

- Quizzes on algorithm and basic python.

- Assignments on illustrative problems.

UNIT -V UNSUPERVISED LEARNING AND MACHINE LEARNINGAPPLICATIONS 9

Introduction to clustering, clustering algorithms - Self-Organizing Map - Expectation Maximization - Gaussian Mixture Models - Principal Component Analysis (PCA) - MACHINE LEARNING APPLICATIONS - Image Recognition - Speech Recognition – Email spam and Malware Filtering – Online fraud detection- Medical Diagnosis.

SUGGESTED ACTIVITIES:

- Developing a framework for real life activities such as clustering techniques.
- Application of clustering algorithms to datasets (UCI/Kaggle/Corel 10k).

SUGGESTED EVALUATION METHODS:
- Quizzes on clustering concepts.
- Assignments on Machine learning applications

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course, the student will be able to

1. Understand concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem and efficiently solve them.
3. Understand the working of various informed and uninformed searching algorithms and different heuristics.
4. Understand the concept of knowledge representation.
5. Understand supervised and unsupervised learning algorithms.
6. Apply Machine learning algorithms for real world problems.

TEXT BOOKS:
1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall,Fourth Edition, 2020.

2. Tom M. Mitchell, Machine Learning, Indian Edition, McGraw-Hill, 2017.

REFERENCES:
1. Munesh Chandra Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing, 2019.
2. Vinod Chandra S.S, Anand Hareendran S, Artificial Intelligence and MachineLearning, PHI Learning, 2014.
3. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
4. Charu C. Aggarwal, Data Classification Algorithms and Applications, CRC Press,2014.
5. Stephen Marsland, Machine Learning – An Algorithmic Perspective, 2nd Edition,CRC Press, 2015.

21CS1603	COMPILER DESIGN (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES : To impart Knowledge on the following topics:

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

UNIT - I   INTRODUCTION TO COMPILERS   9

Phases of a compiler - Lexical Analysis - Role of Lexical Analyzer -Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA - Error Detection and Recovery – Lexical Phase Error Management.

SUGGESTED ACTIVITIES:

- Symbol Table Creation

- Develop a lexical analyzer to recognize a few patterns in C (Ex. identifiers, constants, comments, operators etc).
- Develop a lexical analyzer using lex tool.

SUGGESTED EVALUATION METHODS:

- Assignment on Structure of Compiler.

- Assessment on Finite Automata.

- Seminar in Lexical Analyzer.

UNIT - II   SYNTAX ANALYSIS   12

Context-Free Grammar (CFG) – Derivation Trees – Ambiguity in Grammars and Languages – Need and Role of the parser - Top Down Parsing - Recursive Descent Parser - Predictive Parser - LL(1) Parser-Shift Reduce Parser - LR Parser - LR (0)Item - Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer - Parser Generators -YACC.

SUGGESTED ACTIVITIES:

- Generate YACC specification for a few syntactic categories

- Using different parsing algorithms to develop the parsers for a given grammar
- Implement an Arithmetic Calculator using LEX and YACC

- Design and implement a parser using LEX and YACC tools.

SUGGESTED EVALUATION METHODS:

- Assignments on CFG
- Group Work for Developing the Parsers

UNIT - III   INTERMEDIATE CODE GENERATION   8

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Inherited and Synthesized Attributes - Syntax Directed Translation - Construction of Syntax Tree-Type Systems-Specification of a simple type checker. Intermediate Languages: Three address code – Types of Three address code – Quadruple Triples, Three-address code for Declarations, Arrays, Loops, Back patching.

SUGGESTED ACTIVITIES:

- Develop a Code to generate abstract syntax tree.
- Generate three address codes for a simple program using LEX and YACC.
- Design a simple Type Checker.

SUGGESTED EVALUATION METHODS:

- Assignments on SDD.
- Quizzes on Three Address Code.
- Seminar in Type Checking.

UNIT - IV   CODE OPTIMIZATION   8

Principal Sources of Optimization – Peep-hole optimization – DAG - Optimization of Basic Blocks Global Data Flow Analysis - Efficient Data Flow Algorithm.

SUGGESTED ACTIVITIES:

- Develop an Algorithm for control flow analysis and data flow analysis.
- Implementing simple code optimization techniques.
- Construction of DAG.

SUGGESTED EVALUATION METHODS:

- Quizzes on Optimization.
- Assignment on DAG.

UNIT -V   RUN-TIME ENVIRONMENT AND CODE GENERATION   8

Storage Organization, Stack Allocation Space - Access to Non-local   Data on the Stack - Heap Management - Issues in Code Generation - Design of a simple Code Generator.

SUGGESTED ACTIVITIES:

- Implement storage allocation strategies like (heap, stack, and static).

- Develop a Simple Code Generator.

SUGGESTED EVALUATION METHODS:

- Assignment on Storage Organization.

- Group work for developing Simple Code Generator. Assessment for issues in code Generation.

LIST OF EXPERIMENTS

- Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
- Implement a Lexical Analyzer using Lex Tool

- Implement an Arithmetic Calculator using LEX and YACC

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

- Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation).
- Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

TOTAL: 75 PERIODS

OUTCOMES: At the end of the course, the student will be able to

1. Design and implement a prototype compiler
2. Apply the various optimization techniques
3. Use the different compiler construction tools
4. Acquire knowledge in Syntax directed definition and Run time environment
5. Develop the various parsing techniques and different levels of translation
6. Build target code for backend compiler

TEXT BOOKS:
1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools‖, Second Edition, Pearson Education, 2009.

REFERENCES:
1. Des Watson,A Practical Approach to Compiler Construction- 2017.

2. Allen I. Holub, Compiler Design in C‖, Prentice-Hall Software Series, 2014.
3. Randy Allen, Ken Kennedy, and Optimizing Compilers for Modern Architectures:A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, MorganKaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
5. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan KaufmannPublishers Elsevier Science, 2004.
6. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010
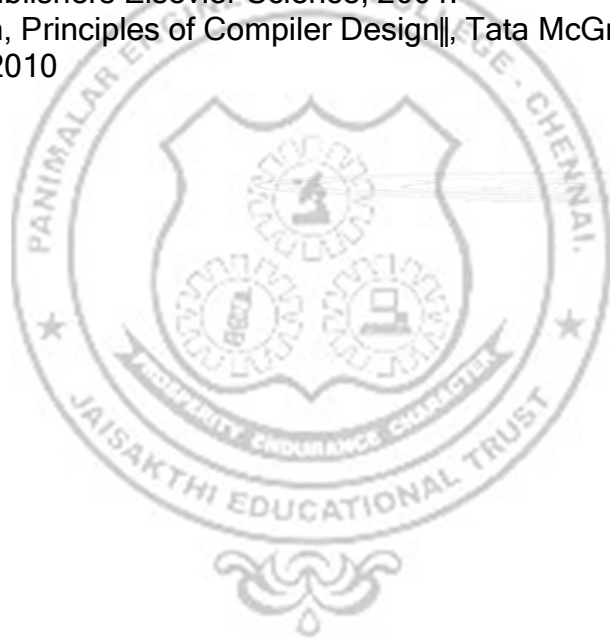
21CS1611   CLOUD COMPUTING AND BIG DATA   L T P C
TECHNOLOGIES LABORATORY   0 0 4 2

OBJECTIVES: To impart Knowledge on the following topics:

- To learn about cloudsim tools.
- To develop web applications in cloud.
- To learn the design and development process involved in creating a cloud based application.
- To learn and Implement file management in Hadoop.
- To learn and implement Hadoop programming.

LIST OF EXPERIMENTS

1. Find a procedure to launch virtual machine using try stack (Online Openstack / Eucalyptus Demo Version)
2. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.
4. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
5. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
6. Install Google App Engine. Create hello world app and other simple web applications using python/java.
7. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files
8. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files.
9. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
10. Implement of Matrix Multiplication with Hadoop Map Reduce.

Mini Project :Suggested Topics(but not limited to)

1. Develop Web service using any one of cloud service
2. Create a SaaS Based application and Deploy in any one of the cloud service provider.
3. Create Cloud based any real time applications.
4. Create E-Learning Platform using Cloud Computing
5. Develop Web service using any one of cloud service
6. Create a SaaS Based application and Deploy in any one of the cloud service provider.
7. Develop any real time applications using Hadoop cluster.

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course, the student will able to:

1. To know how to create Virtual machine using cloud tools.
2. To familiar about creation of VM with different configurations.
3. To implement a web applications in cloud platform.
4. To implement the design and development process involved in creating a cloud based applications.
5. To implement and use parallel programming using Hadoop.

21CS1612 **ARTIFICIAL INTELLIGENCE AND MACHINE** | L | T | P | C |
LEARNING LABORATORY | **0** | **0** | **4** | **2** |

OBJECTIVES: To impart Knowledge on the following topics:

- To study first-order predicate calculus, logical reasoning solving using Prolog language
- Explore the methods of implementing algorithms using Artificial Intelligence and illustrate Search Algorithms
- To study the applications of AI and agent based approach to AI
- Make use of data sets in implementing the Machine Learning algorithms
- To study different types of Machine Learning and Models

LIST OF EXPERIMENTS

ARTIFICIAL INTELLIGENCE

1. Write a program to implement simple Facts and Queries
2. Write a program to solve Monkey Banana Problem
3. Write a program to solve Tower of Hanoi
4. Write a program to solve 8 Puzzle Problem
5. Write a program to solve 4 Queens Problem
6. Write a program to solve Travelling Salesman Problem
7. Write a program to DFS and BFS

MACHINELEARNING

Note: The programs can be implemented in either JAVA or Python

Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students

1. Create a Linear Regression Model in Python using a randomly created data set.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and Comment on the quality of clustering.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

MINI PROJECT: Suggested Topics (but not limited to)

1. Credit Risk Prediction.
2. Disease detection
3. Inventory Demand Forecasting
4. Fake News Classification
5. .Weather forecast

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course, the student will able to

1. Understand the concept of Artificial Intelligence.
2. Apply various search algorithms of Artificial Intelligence.
3. Apply knowledge representation and reasoning techniques
4. Implement Machine Learning Algorithms.
5. Apply appropriate datasets to the Machine Learning Algorithms
6. Identify and apply Machine Learning Algorithms to solve real world problems

21EEC001 - PROFESSIONAL READINESS FOR INNOVATION EMPLOYABILITY AND ENTREPRENEURSHIP

L T P C
0 0 6 3

OBJECTIVES:
- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

This course is an immersive program to keep up with the industry demand and to have critical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration and with mentoring. This is an EEC category course offered as an elective, under the type, "Experiential Project Based Learning".

Highlights of the course:
- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approaches and methodologies.
- Collaborate in teams with other students working on the same topic

OUTCOMES: At the end of the course, the student will able to
- Upskill in emerging technologies and apply to real industry-level use cases
- Understand agile development process
- Develop career readiness competencies, Team Skills / Leadership qualities
- Develop Time management, Project management skills and Communication Skills
- Use Critical Thinking for Innovative Problem Solving
- Develop entrepreneurship skills to independently work on products

Table 1 : Activities

Activity Name	Activity Description
Choosing a Project	Selecting a project from the list of use cases.
Team Formation	Students shall form a team of 3 or 4 members before enrolling to a project. Team members shall distribute the project activities among themselves.
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to

	develop the project.
Project Development	Project shall be developed in agile mode. The status of the project shall be updated through reviews.
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.
Evaluation and S coring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics.

TOTAL: 90 PERIODS

21CS1701	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand Cryptography Theories, Algorithms and Systems
- To understand necessary Approaches and Techniques.
- To learn to build protection mechanisms in order to secure computer networks.
- To learn the various Authentication schemes.
- To understand various Security practices and System security standards

UNIT - I INTRODUCTION 9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model Of Network Security - Security attacks - Services And Mechanisms – OSI Security Architecture – Classical Encryption Techniques : Substitution techniques, Transposition techniques - Steganography - Foundations of Modern Cryptography: Perfect Security – Information Theory - Product Cryptosystem - Cryptanalysis.

SUGGESTED ACTIVITIES

- Implementation of steganography concept.
- Comparing substitution techniques and transposition techniques
- Different Approaches in cryptanalysis in Real Time Problems

SUGGESTED EVALUATION METHODS

- Quiz on Security and attacks.
- Assignments on substitution techniques, transposition technique problems.
- Quiz on simple Classical encryption techniques.

UNIT - II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics of Symmetric Key Cryptography: Algebraic Structures - Modular Arithmetic-Euclids Algorithm- Congruence And Matrices - Groups- Symmetric Key Ciphers: SDES – Block Cipher Principles of DES – Strength of DES– Differential And Linear Cryptanalysis - Block Cipher Design Principles - Block Cipher Mode of Operation - Evaluation Criteria for AES - Advanced Encryption Standard - Triple Des- Blowfish- RC4 -RC5 algorithm - key distribution.

SUGGESTED ACTIVITIES

- Problem Solving on Algebraic structures.
- Implementation of Symmetric key ciphers and RC4 Algorithm.

SUGGESTED EVALUATION METHODS

- Quiz on SDES and mode of operation.
- Assignments on AES and DES algorithms.

UNIT - III   PUBLIC KEY CRYPTOGRAPHY   9

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization - Fermats and Eulers Theorem - Chinese Remainder Theorem - Exponentiation and logarithm - Asymmetric Key Ciphers: RSA cryptosystem - Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve cryptography.

SUGGESTED ACTIVITIES

- Problem solving on Prime numbers and Factorization.
- Solving Puzzles on Chinese Remainder Theorem.

SUGGESTED EVALUATION METHODS

- Quiz on Primes.
- Assignment on Asymmetric key ciphers
- Quiz on Key distribution

MESSAGE AUTHENTICATION AND INTEGRITY   9

UNIT -IV

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC - MD5 - SHA - HMAC - CMAC - Digital signature and authentication protocols - DSA - Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509.

SUGGESTED ACTIVITIES

- Comparing different authentication Algorithms
- Implementing MD5 algorithm

SUGGESTED EVALUATION METHODS

- Assignment on Authentication applications
- Assignment on Digital signature
- Quiz on different Kerberos versions.

UNIT -V   SECURITY PRACTICE AND SYSTEM SECURITY   9

Electronic Mail security – PGP, S/MIME – IP security – Web Security: SET - OWASP- XSS-SQL Injection- SYSTEM SECURITY: Intruders - Malicious software – viruses – Firewalls.

SUGGESTED ACTIVITIES

- Set up a Honeypot and monitor the honeypot on network (KF Sensor).
- Demonstrate intrusion detection system (IDS) using any tool (snort or any others/w)
- Installation of rootkits and study about the variety of options

SUGGESTED EVALUATION METHODS

- Assignment on SQL Injection
- Quiz on Viruses and Firewalls.

TOTAL : 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the fundamentals of network security, security architecture,
2. Apply the different cryptographic operations of symmetric cryptographic algorithms.
3. Apply the different cryptographic operations of public key cryptography.
4. Apply the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards.
6. Analyze various threats and vulnerabilities in systems.

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 8th Edition, 2020. BehrouzA. Ferouzan, Cryptography & Network Security,Tata McGraw Hill,2nd edition 2015.

REFERENCES:

1. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security, Prentice Hall of India,3rd Edition-2020
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd.
3. Charles Pfleeger, Security in Computing, 5th Edition, Prentice Hall of India, 2015
4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13- 046019-2

21CS1702   **MOBILE APPLICATION DEVELOPMENT**   L   T   P   C
                      (LAB INTEGRATED)   3   0   2   4

COURSE OBJECTIVES

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile applications.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile applications.
- To develop mobile applications using various tools and platforms.

UNIT I   **INTRODUCTION TO ANDROID OS**   **9**

Android: An Open Platform for Mobile Development- Introducing the Open Handset Alliance- Introducing the Development Framework- Developing for Android- Developing for Mobile and Embedded Devices- Android Development Tools- Introducing the Application Manifest File -The Android Application Lifecycle.

SUGGESTED ACTIVITIES

- Work on various components and attributes available in application developmentand its frameworks.
- Android studio IDE and its installation

SUGGESTED EVALUATION METHODS

- Assignment on Android Manifest file.
- Assignment on Android application Life cycle.

UNIT II   **BUILDING USER INTERFACE AND INTENT CREATIONS**   **9**

Fundamental Android UI Design- Android User Interface Fundamentals- Introducing Layouts- The Android Widget Toolbox- Introducing Intents- Creating Intent Filters and Broadcast Receivers- Using Internet Services-Connecting to Google App Engine.

SUGGESTED ACTIVITIES

- Create mobile applications using various UI toolkits.
- Design an application that uses Layout Managers and event listeners.

SUGGESTED EVALUATION METHODS

- Assignment on Intents.
- Assignment on Google App engine.

UNIT III   **DATABASES AND CONTENT PROVIDERS**   **9**

Introduction on SQLite- Working with SQLite Databases- Creating Content Providers- Native Android Content Providers- Introducing Services -Using Background Threads- Using Alarms- Creating and Using Menus and Action Bar Action Items.

SUGGESTED ACTIVITIES
- Develop an application that makes use of mobile databases.
- Design an application for MultiThreading .

SUGGESTED EVALUATION METHODS
- Assignment on Menus and Action Items.
- Introduction on SQLite.

UNIT IV   LOCATION-BASED SERVICES AND WIRELESS SERVICES   9
Using Location-Based Services-Using the Emulator with Location-Based Services-Selecting a Location Provider- Finding Your Current Location- Using Bluetooth- Managing Network and Internet Connectivity- Managing Wi-Fi.

SUGGESTED ACTIVITIES
- Develop a web based mobile application that accesses internet and location data.
- Implement an android application that manages wifi access.

SUGGESTED EVALUATION METHODS
- Assignment on working with Emulators.
- Assignment on Internet connectivity Management.

UNIT V   TELEPHONY AND SMS , PUBLISHING APPLICATIONS   9
Using Telephony - Introducing SMS and MMS - Distributing Applications-Introducing the Google Play - Getting Started with Google Play-Publishing Applications.

SUGGESTED ACTIVITIES
- Develop an android application using telephony to send SMS.
- Develop a task for publishing in Google Play store.

SUGGESTED ACTIVITIES
- Assignment on Telephony Applications.
- Quiz on Google play Introduction and its features.

LIST OF EXPERIMENTS
1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.

TOTAL : 75 PERIODS

COURSE OUTCOMES
At the end of the course, the student will be able to
- Understand the basics of Android Operating systems.
- Understand the basics of mobile application development frameworks and tools.
- To design mobile application that manages Database operations.
- To build location based services and wireless environments.
- Understand the concept on Telephony Applications.
- To build applications based on Android OS and Publishing it.

TEXT BOOKS
1. Lauren Darcey and Shane Conder, "Android Wireless Application Development",Pearson Education, 2nd ed. (2011)

REFERENCE BOOKS
1. RetoMeier, "Professional Android 4 Application Development", Wiley, First Edition, 2012
2. ZigurdMednieks, LairdDornin, G. Blake Mike, Masumi Nakamura, "ProgrammingAndroid", O'Reilly, 2ndEdition, 2012.

3. Alasdair Allan, "iPhone Programming", O'Reilly, First Edition, 2010.

21CS1703	DATA SCIENCE AND ANALYTICS	L 3	T 0	P 0	C 3

COURSE OBJECTIVES

- To understand the techniques and processes of data science.
- To apply descriptive data analytics
- To analysis and build predictive models from data
- To develop programming skills using required libraries andpackages to perform data analysis in Python.
- To understand and perform data visualization

UNIT I INTRODUCTION TO DATA SCIENCE 9

Need for Data Science – Benefits and uses – Facets of data – Data Science Process: Setting The Research Goal – Retrieving Data – Cleansing, Integrating and Transforming Data – Exploratory Data Analysis – Build the Models – Presenting And Building Applications.

SUGGESTED ACTIVITIES
- Real world domain specific problems involving big data and listing out thechallenges.
- Demonstration on data science process.

SUGGESTED EVALUATION METHODS
- Student assignment on case studies related to healthcare, climate change,ecommerce, retail business, manufacturing etc.
- Group presentation on big data applications with societal need.
- Quizzes on topics like big data terminologies, big data applications, etc.

UNIT II DESCRIPTIVE ANALYTICS USING STATISTICS 9

Frequency distributions – Outliers –Interpreting Distributions – Graphs – Averages – Describing Variability – Interquartile Range – Variability For Qualitative And Ranked Data - Normal Distributions – Z Scores – Correlation – Scatter Plots – Regression – Regression Line – Least Squares Regression Line Standard Error of Estimate – Interpretation of R^2 – Multiple Regression Equations – Regression Toward The Mean.

SUGGESTED ACTIVITIES
- Solving numerical problems based on statistics.
- Demonstration of descriptive analysis using Python.

SUGGESTED EVALUATION METHODS
- Assignment on data understanding using open-source tools.
- Student Presentation of real world applications and the required descriptive analysis.
- Quiz on all topics in descriptive analytics using statistics.

UNIT III   PREDICTIVE MODELING   9

Linear Regression – Polynomial Regression – Multivariate Regression – MultiLevel Models– Bias/Variance Trade Off – K Fold Cross Validation – Data Cleaning and Normalization – Cleaning Web Log Data – Normalizing Numerical Data –Detecting Outliers -Introduction to Supervised and Unsupervised Learning – Reinforcement Learning – Time series analysis–. Moving averages – Missing Values – Serial Correlation – Autocorrelation.

SUGGESTED ACTIVITIES

- Solve numerical problem solving using linear regression models.
- Demonstrate data cleaning using WEKA tool.
- Demonstration of data pre-processing and machine learning features inPython.

SUGGESTED EVALUATION METHODS

- Simple lab-based activities for machine learning in Python using smallbenchmark datasets.
- Tool based assignments on linear, polynomial and multivariateregression using real world case studies.
- Assignment on comparative analysis of two or more data sets using their features.

UNIT IV   DATA ANALYTICAL FRAMEWORKS   9

Introducing Hadoop – Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System- Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).

SUGGESTED ACTIVITIES:

- Case studies on applications involving usage of data analyticalframeworks.
- Demonstration of Installation and configuring Hadoop and MapReduce.
- Design and develop algorithms to be executed in Map Reduce involvingnumerical methods for analytics.
- Installation of MongoDB and simple data management.

SUGGESTED EVALUATION METHODS:

- Mini Project (Group) – Real time data collection, saving in Hive, implementing analytical techniques using Map-Reduce Tasks and ResultProjection.
- Practical – Programming assignments in MongoDB.
- Quiz on Hive query language.

Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Statsmodels and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python – Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python. Visualizations - Visual data analysis techniques,interaction techniques.

SUGGESTED ACTIVITIES:
- Demonstration of simple Python scripts using NumPy and SciPyPackage.
- Demonstration on NumPy arrays and matrix operations.
- Simple lab activities on dimensionality reduction and feature selectionusing Python.
- Demonstration of experiments on data visualization using matplotlibfunctions.

SUGGESTED EVALUATION METHODS:
- Mini Project using Python for data analytics with benchmark datasets.
- Quiz on data visualization functions.

TOTAL : 45 PERIODS

COURSE OUTCOMES
At the end of the course, the student will be able to
- Identify the real-world business problems and model with analyticalsolutions.
- Convert any real-world decision-making problem to hypothesis andapply suitable statistical testing.
- Build predictive models.
- Write and demonstrate simple applications involving analytics usingHadoop and MapReduce.
- Use open-source frameworks for modeling and storing data.

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing DataScience",Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

REFERENCE BOOKS

1. Frank Pane, "Hands On Data Science and Python Machine Learning",Packt Publishers, 2017.
2. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials",Packt Publications, 2nd Edition, 2016.
3. Seema Acharya, Subhashini Chellapan, "Big Data and Analytics", Wiley, 2015.
4. DT Editorial Services, Big Data, Black Book, Dream Tech Press, 2015.
5. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python",Green Tea Press,2014.

21CS1711   **DATA SCIENCE AND ANALYTICS LABORATORY**   **L   T   P   C**

                                                                        0   0   4   2

OBJECTIVES: To impart Knowledge on the following topics:
- To provide hands-on experience to cloud and data analytics frameworks and tools.
- To use the Python packages for performing analytics.
- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as MapReduce tasks.

LISTS OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupiter, Stats models and Pandas packages.
    L   Reading data from text file, Excel and the web.
    LL Exploring various commands for doing
    descriptive analytics on Iris dataset.

2. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
    L   Univariate analysis: Frequency, Mean,
    Median, Mode, Variance, StandardDeviation,
    Skewness and Kurtosis.
    LL Bivariate analysis: Linear and logistic regression modelling
    LLL Multiple Regression analysis
    Also compare the results of the above analysis for the two data sets.

3. Apply and explore various plotting functions on UCI data sets.

4. Implement Decision tree classification

5. Implement clustering techniques

6. Install and configure Hadoop in its two operating modes:
    Pseudo distributedand fully distributed.

7. Implement the following file management tasks in Hadoop:
    Adding files anddirectories, retrieving files and deleting files.

8. Implement word count / frequency programs using MapReduce
9. Implement an MR program that processes a weather dataset

10. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.

11. Install HIVE and implement the above retail schema definition and perform CRUD operations.

MINI PROJECTS (But not limited to)
1. Leaf Disease Detection
2. Brain Tumor Detection with Data Science
3. Color Detection with Python
4. Detecting Parkinson's Disease
5. Sentiment Analysis
6. Road Lane Line Detection

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Install analytical tools and configure distributed file system.
2. Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
3. Develop, implement and deploy simple applications on very large datasets.
4. Build and apply linear and logistic regression models
5. Perform data analysis with machine learning methods.
6. Implement real world applications by using suitable analytical framework and tools
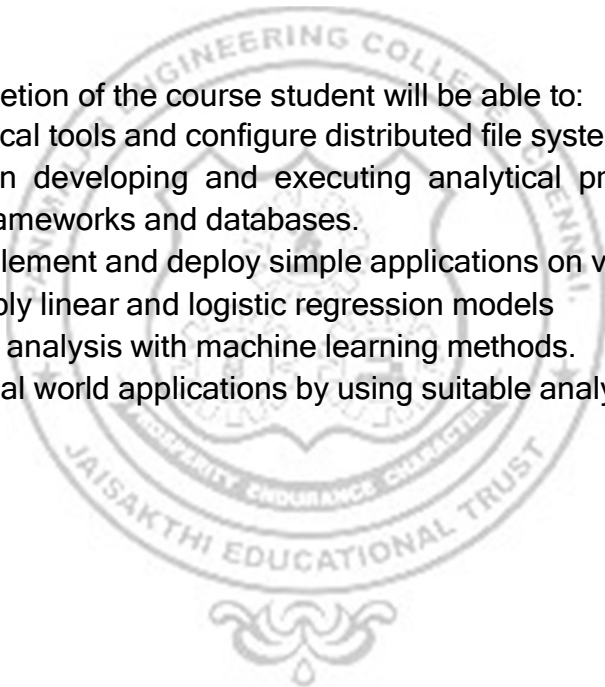
	CRYPTOGRAPHY AND NETWORK SECURITY	**L T P C**
21CS1712	**LABORATORY**	**0 0 4 2**

OBJECTIVES: To impart Knowledge on the following topics:
- To learn different cipher techniques
- To implement the algorithms DES, RSA,SHA-1
- To understand the usage of security tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) Playfair cipher iii) Hill cipher iv) Vigenere cipher

2. Perform encryption and decryption using following transposition techniques
   i) Rail Fence ii) Row & Column Transformation

3. Implementation DES algorithm
4. Implementation AES algorithm.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - DSA.
9. Demonstrate intrusion detection system (IDS) using any tool eg. Snort
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. Implementation of XSS and SQL injection,

MINI PROJECTS: (But not limited to)

1. Keylogger projects.
2. Antivirus.
3. Analysis and Assessment of different Cyber-Attacks
4. Network Monitoring and Anomalies Discovery.
5. Bug Bounties.

TOTAL : 60 PERIODS

OUTCOMES : At the end of the course, the student will able to
1. Develop code for classical Encryption Techniques to solve the problems.
2. Build cryptosystems by applying symmetric key encryption algorithms
3. Develop public key encryption algorithms.
4. Construct code for authentication algorithms.
5. Develop a signature scheme using Digital signature standard.
6. Demonstrate the system security using open-source tools.

21AD1901	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT - I   EXPLORATORY DATA ANALYSIS   9

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.

UNIT - II   EDA USING PYTHON   9

Data Manipulation using Pandas - Pandas Objects - Data Indexing and Selection - Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables - Vectorized String Operations..

UNIT - III   UNIVARIATE ANALYSIS   9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT -IV   BIVARIATE ANALYSIS   9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

UNIT -V   MULTIVARIATE AND TIME SERIES ANALYSIS   9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Fundamentals of TSA - Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the fundamentals of exploratory data analysis.
2. Implement the data visualization using Matplotlib.
3. Perform univariate data exploration and analysis.
4. Apply bivariate data exploration and analysis.
5. Use Data exploration techniques for multivariate and time series data.
6. Use Data visualization techniques for multivariate and time series data.

TEXT BOOKS:
1. Suresh Kumar Mukhiya, Usman Ahmed, ̄Hands-On Exploratory Data Analysis with Python‖, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017.
3. Catherine Marsh, Jane Elliott, ̄Exploring Data: An Introduction to Data Analysis for Social Scientists‖, Wiley Publications, 2nd Edition, 2008.

REFERENCES:
1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, ̄Fundamentals of Data Visualization‖, O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, ̄Interactive Data Visualization: Foundations, Techniques, and Applications‖, 2nd Edition, CRC press, 2015.
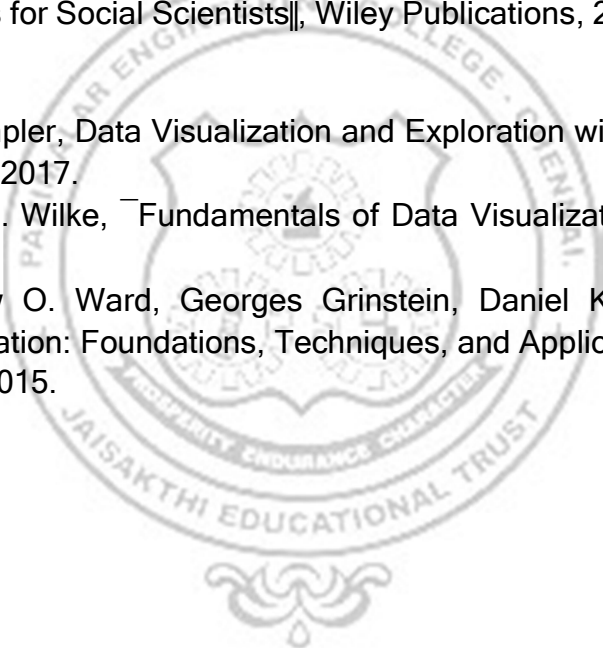
21AD1902 **RECOMMENDER SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT - I **INTRODUCTION** **9**
Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT - II **CONTENT-BASED RECOMMENDATION SYSTEMS** **9**
High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT - III **COLLABORATIVE FILTERING** **9**
A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT -IV **ATTACK-RESISTANT RECOMMENDER SYSTEMS** **9**
Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT -V **EVALUATING RECOMMENDER SYSTEMS** **9**
Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design - Design Issues - Accuracy metrics - Limitations of Evaluation measures.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Design and implement a simple recommender system.

5. Learn about advanced topics of recommender systems.
6. Learn about advanced topics of recommender systems applications

TEXT BOOKS:
1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

21AD1918   **NEURAL NETWORKS AND DEEP LEARNING** | L | T | P | C |
| 3 | 0 | 0 | 3 |

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT - I   **INTRODUCTION**   **9**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT - II   **ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING   9
NETWORKS**

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT - III   **THIRD-GENERATION NEURAL NETWORKS**   **9**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis - Applications: Computer Vision, Image Generation, Image Compression.

UNIT -IV   **DEEP FEEDFORWARD NETWORKS**   **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning - Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization-VC Dimension and Neural Nets.

UNIT -V   **RECURRENT NEURAL NETWORKS**   **9**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs - Deep Recurrent Networks - Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders, LSTM networks.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning
5. Use the key computations to build and train deepneural networks for various tasks.
6. Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ¯Deep Learning‖, MIT Press, 2016.
2. Francois Chollet, ¯Deep Learning with Python‖, Second Edition, Manning Publications, 2021.

REFERENCES:
1. Aurélien Géron, ¯Hands-On Machine Learning with Scikit-Learn and TensorFlow‖, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, ¯Deep Learning: A Practitioner's Approach‖, O'Reilly Media, 2017.
3. Charu C. Aggarwal, ¯Neural Networks and Deep Learning: A Textbook‖, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, ¯Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications‖, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, ¯Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.

21AD1919   **TEXT AND SPEECH ANALYSIS**   **L T P C**
                                                                     3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT - I   **NATURAL LANGUAGE BASICS**   **9**
Foundations of natural language processing - Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words - Feature Engineering for Text representation - Bag of Words model- Bag of N-Grams model - TF-IDF model

UNIT - II   **TEXT CLASSIFICATION**   **9**
Foundations of natural language processing - Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words - Feature Engineering for Text representation - Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT - III   **QUESTION ANSWERING AND DIALOGUE SYSTEMS**   **9**
Information retrieval – IR-based question answering - knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -- evaluating dialogue systems

UNIT -IV   **TEXT-TO-SPEECH SYNTHESIS**   **9**
Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT -V   **AUTOMATIC SPEECH RECOGNITION**   **9**
Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

                                                          TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Explain existing and emerging deep learning architectures for text and speech processing
2. Apply deep learning techniques for NLP tasks, language modelling and machine translation

3. Explain coreference and coherence for text processing
4. Build question-answering systems, chatbots and dialogue systems
5. Apply deep learning models for building speech recognition
6. Apply deep learning models for building text-to-speech systems

TEXT BOOKS:
1. Daniel Jurafsky and James H. Martin, ‾Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Third Edition, 2022.

REFERENCES:
1. Dipanjan Sarkar, ‾Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data‖, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, ‾Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, ‾Fundamentals of Speech Recognition‖ 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, ‾Natural language processing with Python‖, O'REILLY.

21AD1920 BUSINESS ANALYTICS

	L	T	P	C
	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT - I   **INTRODUCTION TO BUSINESS ANALYTICS**   **9**

Analytics and Data Science - Analytics Life Cycle - Types of Analytics - Business Problem Definition - Data Collection - Data Preparation - Hypothesis Generation - Modeling - Validation and Evaluation - Interpretation - Deployment and Iteration

UNIT - II   **BUSINESS INTELLIGENCE**   **9**

Data Warehouses and Data Mart - Knowledge Management -Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions

UNIT - III   **BUSINESS FORECASTING**   **9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models -Data Mining and Predictive Analysis Modelling -Machine Learning for Predictive analytics.

UNIT -IV   **HR & SUPPLY CHAIN ANALYTICS**   **9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT -V   **MARKETING & SALES ANALYTICS**   **9**

Marketing Strategy, Marketing Mix, Customer Behaviour -selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Explain the real world business problems and model with analytical solutions.
2. Explain the real world business problems and model with analytical solutions.
3. Identify the business processes for extracting Business Intelligence

4. Apply predictive analytics for business fore-casting
5. Apply predictive analytics for business fore-casting
6. Use analytics for marketing and sales.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017.
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016.

REFERENCES:

1. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
2. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
3. Mahadevan B, ‾Operations Management -Theory and Practice‖,3rd Edition, Pearson Education,2018.

	L	T	P	C
IMAGE AND VIDEO ANALYTICS	3	0	0	3

21AD1906

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

UNIT - I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures- T-pyramid of an image- the quad tree representation of an image using the homogeneity criterion of equal intensity

UNIT - II IMAGE PRE-PROCESSING 9

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi- speralct images - Local pre-processing in the frequency domain - Line detection by local pre- processing operators - Image restoration – Geometric transformations -Case study of MNIST.

UNIT - III OBJECT DETECTION USING MACHINE LEARNING 9

Object detection- Object detection methods – Deep Learning framework for Object detection- bounding box approach-Intersection over Union (IoU) -Deep Learning Architectures-R-CNN-Faster R- CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures - motion analysis using moving edges - Case study: Geospatial objet detection.

UNIT -IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition-Implementation using FaceNet- Gesture Recognition – Implementation of Facial Detection and Recognition - static hand gesture.

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics-RestNet and Inception v3. Case study: Airport Projects - event detection in video surveillance system.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basics of image processing techniques for computer vision.
2. Understand the basics of image processing techniques for video analysis.
3. Explain the techniques used for image pre-processing.
4. Develop various object detection techniques.
5. Understand the various face recognition mechanisms.
6. Elaborate on deep learning-based video analytics.

TEXT BOOKS:
1. Milan Sonka, Vaclav Hlavac, Roger Boyle, ‾Image Processing, Analysis, and Machine Vision‖, 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021

REFERENCES:
1. Richard Szeliski, ‾Computer Vision: Algorithms and Applications‖, Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, ‾Video Analytics for Business Intelligence‖, Springer, 2012.
3. D. A. Forsyth, J. Ponce, ‾Computer Vision: A Modern Approach‖, Pearson Education, 2003.
4. E. R. Davies, (2012), ‾Computer & Machine Vision‖, Fourth Edition, Academic Press.

21AD1921	COMPUTER VISION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

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

UNIT - I   INTRODUCTION TO IMAGE FORMATION AND PROCESSING   9

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

UNIT - II   FEATURE DETECTION, MATCHING AND SEGMENTATION   9

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

UNIT - III   FEATURE-BASED ALIGNMENT & MOTION ESTIMATION   9

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

UNIT -IV   3D RECONSTRUCTION   9

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

UNIT -V   IMAGE-BASED RENDERING AND RECOGNITION   9

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

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic image processing techniques in OpenCV.

3. To implement some advanced image processing techniques in OpenCV.
4. To apply 2D feature-based image alignment, segmentation and motion estimations.
5. To apply 3D image reconstruction techniques
6. To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard Eugene Woods,‖ Digital Image Processing‖, Pearson,2018.
2. Richard Szeliski, ⁻Computer Vision: Algorithms and Applications‖, Springer-Texts in Computer Science, Second Edition, 2022.
3. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
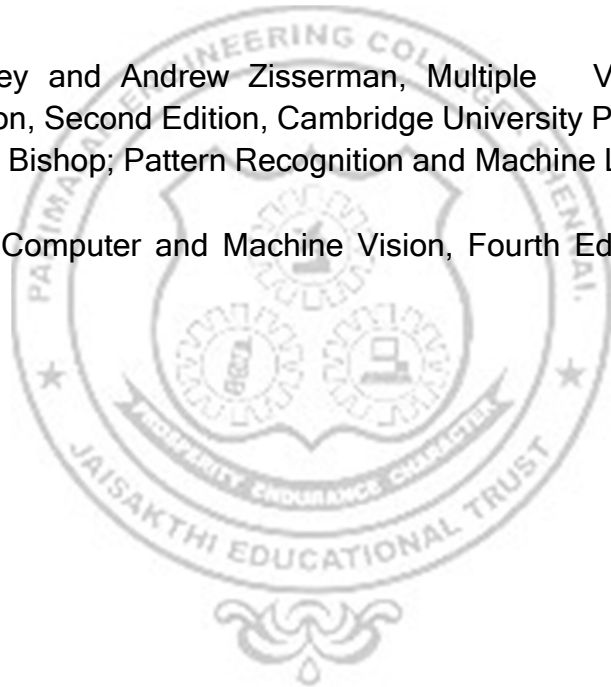
21AD1922   **DATA VISUALIZATION**   L T P C
                                                                    3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the fundamental concepts related to visualization data
- To learn foundations for visualization
- To learn foundations for visualization
- To learn interaction concepts and techniques
- To use visualization techniques for research

UNIT - I   INTRODUCTION AND DATA FOUNDATION   9

Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

UNIT - II   FOUNDATIONS FOR VISUALIZATION   9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson_s Affordance theory – A Model of Perceptual Processing.

UNIT - III   VISUALIZATION TECHNIQUES   9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks-Displaying Arbitrary Graphs/Networks.

UNIT -IV   INTERACTION CONCEPTS AND TECHNIQUES   9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control.

UNIT -V   RESEARCH DIRECTIONS IN VISUALIZATIONS   9

Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the fundamental concepts related to visualization data
2. Learn foundations for visualization and become familiar with visualization techniques
3. Visualize the objects in different dimensions
4. Design and process the data for Visualization.
5. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences
6. Apply the virtualization techniques for research projects.

REFERENCES:
1. Matthew Ward, Georges Grinstein and Daniel Keim, ‾Interactive Data Visualization Foundations, Techniques, Applications‖, 2010
2. Colin Ware, ‾Information Visualization Perception for Design‖, 2nd edition, Margon Kaufmann Publishers, 2004.
3. Robert Spence ‾Information visualization - Design for interaction‖, Pearson Education, 2 nd Edition, 2007.
4. Alexandru C. Telea, ‾Data Visualization: Principles and Practice,‖ A. K. Peters Ltd, 2008.
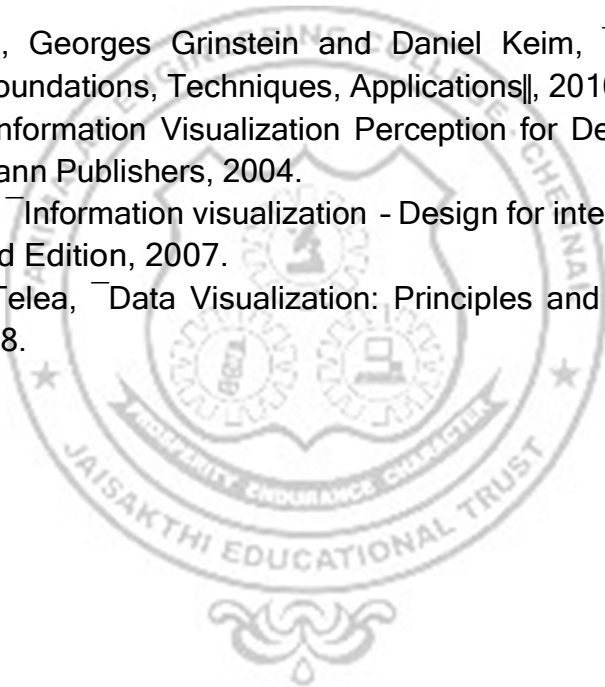
		L	**T**	**P**	**C**
21IT1901	**OPEN SOURCE TECHNOLOGIES**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- Understand the difference between open-source software and commercial software.
- Understand the policies, licensing procedures and ethics of FOSS.
- Understand open-source philosophy, methodology and ecosystem.
- Awareness with Open-Source Technologies
- Knowledge to start, manage open-source projects

UNIT - I   **INTRODUCTION**   **9**

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT - II   **OPEN-SOURCE PRINCIPLES AND METHODOLOGY**   **9**

Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization - Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - III   **OPEN SOURCE PROJECT**   **9**

Starting and maintaining own Open-Source Project, Open-Source Hardware, Open-Source Design, Open-source Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice

UNIT -IV   UNDERSTANDING OPEN-SOURCE ECOSYSTEM   9

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

UNIT -V   OPEN SOURCE ETHICS & CASE STUDIES   9

Open Source Ethics - Open Vs Closed Source - Government - Ethics - Impact of Open source Technology - Shared Software - Shared Source.

Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies.

Study: Understanding the developmental models, licensing, mode of funding, commercial/non- commercial use.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Understand the policies, licensing procedures and ethics of FOSS
3. Build and modify one or more Free and Open Source Software packages.
4. Recognize the applications, benefits and features of Open-Source Technologies
5. Contribute software to and interact with Free and Open Source Software development projects.
6. Gain knowledge to start, manage open-source projects.

TEXT BOOKS:
1. Kailash Vadera, Bhavyesh Gandhi, ̄Open Source Technology‖, Laxmi Publications Pvt Ltd 2012, 1st Edition.
2. Open Source Software, P.Rizwan Ahmed, Margham Publication, Chennai, 2015

REFERENCES:
1. Fadi P. Deek and James A. M. McHugh, ̄Open Source: Technology and Policy‖, Cambridge Universities Press 2009.
2. ̄Open-Source Technology‖, Kailash Vadera&Bhavyesh Gandhi, University Science Press, Laxmi Publications, 2009
3. Unix Concepts and Applications by Sumitabha Das, Tata McGraw Hill Education, 2006
4. The official Ubuntu Book, 8th Edition

5. ¯Perspectives on Free and Open-Source Software‖, Clay Shirky and Michael Cusumano, MIT press.

6. ¯Understanding Open Source and Free Software Licensing‖, Andrew M. St. Laurent, O'Reilly Media.

7. ¯Open Source for the Enterprise‖, Dan Woods, GautamGuliani, O'Reilly Media

8. Linux kernel Home: http://kernel.org4

9. Open-Source Initiative: https://opensource.org/5

10. The Linux Foundation: http://www.linuxfoundation.org/

11. The Linux Documentation Project: http://www.tldp.org/2

12. Docker Project Home: http://www.docker.com3.

13. Linux Documentation Project: http://www.tldp.org/6

14. Wikipedia: https://en.wikipedia.org/7.https://en.wikipedia.org/wiki/Wikipedia:Contributing _to_Wikipedia8

15. GitHub: https://help.github.com/9

16. The Linux Foundation: http://www.linuxfoundation.org/

21IT1902 **APP DEVELOPMENT**

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OBJECTIVES: To impart Knowledge on the following topics:
- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT - I	**FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT**	**9**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,

UNIT - II	**NATIVE APP DEVELOPMENT USING JAVA**	**9**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT - III	**HYBRID APP DEVELOPMENT**	**9**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,

UNIT -IV	**CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE**	**9**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT -V	**NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS**	**9**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Develop Native applications with GUI Components.
2. Develop hybrid applications with basic event handling.
3. Implement cross-platform applications with location and data storage capabilities.

4. Implement cross platform applications with basic GUI and event handling.
5. Develop web applications with cloud database access.
6. To gain in-depth Knowledge of Popular Frameworks, Server, APIs

TEXT BOOKS:
1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, November 2021
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, 2019.

REFERENCES:
1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition, 2018.
2. Native Mobile Development by Shaun Lewis, Mike Dunn, November 2019
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras, 2015
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019

21CS1903   **CLOUD SERVICES MANAGEMENT**   **L T P C**
                                                                                   3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT - I   CLOUD SERVICE MANAGEMENT FUNDAMENTALS   9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT - II   CLOUD SERVICES STRATEGY   9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT - III   CLOUD SERVICE MANAGEMENT   9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT -IV   CLOUD SERVICE ECONOMICS   9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT -V   CLOUD SERVICE GOVERNANCE & VALUE   9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand Cloud Service Management terminology, definition & concepts
2. Compare and contrast cloud service management with traditional IT service management
3. Build and automate business solutions using cloud technologies.
4. Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services
5. Select appropriate structures for designing, deploying and running cloud-based services In business environment
6. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

TEXT BOOKS:
1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCES:
1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

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21IT1903   **UI AND UX DESIGN**
                                                                       L T P C
                                                                       3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT - I   FOUNDATIONS OF DESIGN   9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT - II   FOUNDATIONS OF UI DESIGN   9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT - III   FOUNDATIONS OF UX DESIGN   9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT -IV   WIREFRAMING, PROTOTYPING AND TESTING   9

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

UNIT -V   RESEARCH, DESIGNING, IDEATING, & INFORMATION   9
ARCHITECTURE

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the various Research Methods used in Design
2. Build UI for user Applications
3. Evaluate UX design of any product or application
4. Demonstrate UX Skills in product development
5. Implement Sketching principles

6. Create Wireframe and Prototype

TEXT BOOKS:
1. Joel Marsh, ˉUX for Beginners‖, O'Reilly , 2022
2. Jon Yablonski, ˉLaws of UX using Psychology to Design Better Product & Services‖ O'Reilly 2021

REFERENCES:
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, ˉDesigning Interface‖ 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan ˉRefactoring UI‖, 2018
3. Steve Krug, ˉDon't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile‖, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

21IT1904   **SOFTWARE TESTING AND AUTOMATION**   **L T P C**
                                                             3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT - I   **FOUNDATIONS OF SOFTWARE TESTING**   **9**

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT - II   **TEST PLANNING**   **9**

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT - III   **TEST DESIGN AND EXECUTION**   **9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT -IV   **ADVANCED TESTING CONCEPTS**   **9**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT -V   **TEST AUTOMATION AND TOOLS**   **9**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basic concepts of software testing and the need for software testing
2. Design Test planning and different activities involved in test planning
3. Design effective test cases that can uncover critical defects in the application
4. Focus on wide aspects of testing
5. Understand multiple facets of testing
6. Automate the software testing using Selenium and TestNG

TEXT BOOKS:

1. Yogesh Singh, ¯Software Testing‖, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.

7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing

21IT1905　　　　　　　　**WEB APPLICATION SECURITY**　　　　　**L　T　P　C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3　0　0　3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT - I　　　　FUNDAMENTALS OF WEB APPLICATION SECURITY　　9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT - II　　　　SECURE DEVELOPMENT AND DEPLOYMENT　　9

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT - III　　　　SECURE API DEVELOPMENT　　9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

**UNIT -IV　　　　VULNERABILITY ASSESSMENT AND PENETRATION　　9
TESTING**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT -V　　　　HACKING TECHNIQUES AND TOOLS　　9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understanding the basic concepts of web application security and the need for it
2. Be acquainted with the process for secure development and deployment of web applications
3. Acquire the skill to design and develop Secure Web Applications that use Secure APIs
4. Be able to get the importance of carrying out vulnerability assessment and penetration testing
5. Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.
6. Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.

TEXT BOOKS:
1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:
1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

	L	**T**	**P**	**C**
21IT1906 **DEVOPS**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT - I   INTRODUCTION TO DEVOPS   9

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.

UNIT - II   COMPILE AND BUILD USING MAVEN , GRADLE & ANT   9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle - Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT - III   CONTINUOUS INTEGRATION USING JENKINS   9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT -IV   CONFIGURATION MANAGEMENT USING ANSIBLE   9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT -V   BUILDING DEVOPS PIPELINES USING AZURE   9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, ELK

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand different actions performed through Version control tools like Git.

2. Understand the various installation procedure of SDK
3. Ability to Perform Automated Continuous Deployment
4. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
5. Ability to do configuration management using Ansible
6. Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS:
1. Roberto Vormittag, ‾A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises‖, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, ‾Linux for Beginners: An Introduction to the Linux Operating System and Command Line‖, Kindle Edition, 2014

REFERENCES:
1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, ‾Ansible for DevOps: Server and configuration management for humans‖, First Edition, 2015
3. David Johnson, ‾Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps‖, Second Edition, 2016.
4. Mariot Tsitoara, ‾Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer‖, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

21IT1907　　　PRINCIPLES OF PROGRAMMING LANGUAGES

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3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT - I　　　SYNTAX AND SEMANTICS　　　9

Evolution of programming languages - describing syntax - context-free grammars - attribute grammars - describing semantics - lexical analysis - parsing - recursive-descent – bottom up parsing

UNIT - II　　　DATA, DATA TYPES, AND BASIC STATEMENTS　　　9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection - primitive data types - strings - array types - associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements - mixed mode assignments - control structures - selection - iterations - branching - guarded statements

UNIT - III　　　SUBPROGRAMS AND IMPLEMENTATIONS　　　9

Subprograms - design issues - local referencing - parameter passing - overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms - stack and dynamic local variables – nested subprograms - blocks - dynamic scoping

UNIT -IV　　　OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING　　　9

Object-orientation - design issues for OOP languages - implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads - statement level concurrency - exception handling - event handling

UNIT -V　　　FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES　　　9

Introduction to lambda calculus– fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming - Programming with Prolog - multi-paradigm languages

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Describe syntax and semantics of programming languages
2. Explain data, data types, and basic statements of programming languages
3. Design and implement subprogram constructs
4. Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
5. Understand and adopt new programming languages
6. Applying the programming Languages in creating various applications

TEXT BOOKS:
1. Robert W. Sebesta, ―Concepts of Programming Languages‖, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, ―Programming Language Pragmatics‖, Fourth Edition, Elsevier, 2018.
3. R. Kent Dybvig, ―The Scheme programming language‖, Fourth Edition, Prentice Hall, 2011.
4. Jeffrey D. Ullman, ―Elements of ML programming‖, Second Edition, Pearson, 1997.
5. W. F. Clocksin and C. S. Mellish, ―Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
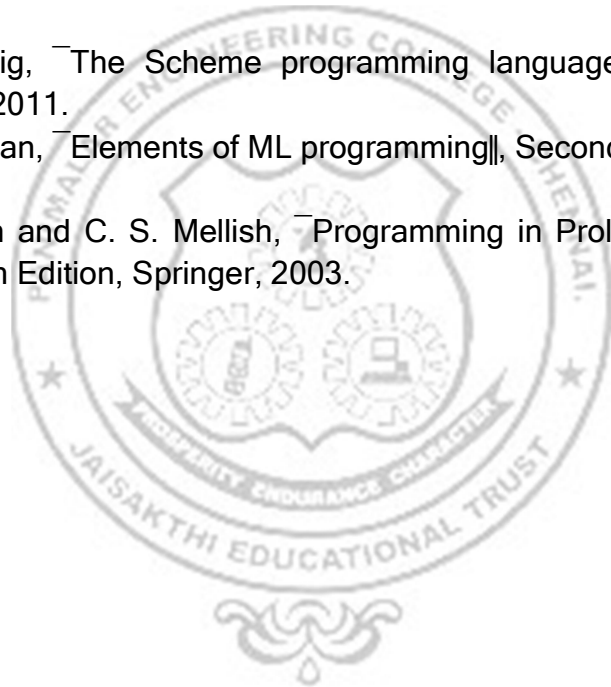
VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

21CS1901	CLOUD TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT - I	CLOUD PLATFORM ARCHITECTURE	9

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Architectural Design Challenges

UNIT - II	VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE	9

Basics of Virtual Machines - Taxonomy of Virtual Machines - Virtualization – Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization - Implementation levels of virtualization - Virtualization structure - Virtualization of CPU, Memory and I/O devices – Virtual clusters and Resource Management – Virtualization for data center automation

UNIT - III	PAAS CLOUD PLATFORM	9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blops

UNIT -IV   **AWS CLOUD PLATFORM – IAAS**   **9**

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager.

UNIT -V   **PROGRAMMING MODEL**   **9**

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Developing Map Reduce Applications - Design of Hadoop file system -Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Employ the concepts of virtualization in the cloud computing
2. Identify the architecture, infrastructure and delivery models of cloud computing
3. Deploy practical virtualization solution
4. Develop the Cloud Application in AWS platform
5. Apply concepts to design Cloud Applications
6. Develop services using various Cloud computing programming models.

TEXT BOOKS:
1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, ‾Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, ‾The Docker Book‖, O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, ‾Cloud security. A Comprehensive Guide to Secure Cloud Computing‖, Wiley Publishing, 2010.

REFERENCES:
1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019 3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.

5. Danielle Ruest, Nelson Ruest, ¯Virtualization: A Beginner"s Guide‖, McGraw-Hill Osborne Media, 2009. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
6. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
8. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

21CS1902   **VIRTUALIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT - I   INTRODUCTION TO VIRTUALIZATION   9

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT - II   SERVER AND DESKTOP VIRTUALIZATION   9

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT - III   NETWORK VIRTUALIZATION   9

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization- VLAN-WAN Architecture-WAN Virtualization

UNIT -IV   STORAGE VIRTUALIZATION   9

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT -V   VIRTUALIZATION TOOLS   9

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM-Google Virtualization- Case study.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basics and types of Virtualization
2. Understand the Hypervisors and its types
3. Analyze the virtualization concepts for server and Desktop
4. Apply the Virtualization for real-world applications
5. Install & Configure the different VM platforms
6. Experiment with the VM with various software

TEXT BOOKS:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Dave McCrory , Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center, Auerbach,2006
4. Chris Wolf, Erick M. Halter, ‾Virtualization: From the Desktop to the Enterprise‖, APress, 2005.

REFERENCES:

1. James E. Smith, Ravi Nair, ‾Virtual Machines: Versatile Platforms for Systems and Processes‖, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, ‾Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center‖, Auerbach Publications, 2006.

21CS1903   **CLOUD SERVICES MANAGEMENT**   L T P C
                                                  3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT - I   CLOUD SERVICE MANAGEMENT FUNDAMENTALS   9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT - II   CLOUD SERVICES STRATEGY   9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT - III   CLOUD SERVICE MANAGEMENT   9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT -IV   CLOUD SERVICE ECONOMICS   9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT -V   CLOUD SERVICE GOVERNANCE & VALUE   9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand Cloud Service Management terminology, definition & concepts
2. Compare and contrast cloud service management with traditional IT service management
3. Build and automate business solutions using cloud technologies.
4. Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services
5. Select appropriate structures for designing, deploying and running cloud-based services In business environment
6. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

TEXT BOOKS:
1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCES:
1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

	L	T	P	C

21CS1904 STORAGE TECHNOLOGIES

L T P C
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT - I   **STORAGE SYSTEMS**   **9**

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT - II   **INTELLIGENT STORAGE SYSTEMS AND RAID**   **9**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storage Architecture- Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage.

UNIT - III   **STORAGE NETWORKING TECHNOLOGIES AND**   **9**
                              VIRTUALIZATION

FibreChannel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol,connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT -IV   **BACKUP, ARCHIVE AND REPLICATION**   **9**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT -V   SECURING STORAGE INFRASTRUCTURE   9

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
2. Illustrate the usage of advanced intelligent storage systems and RAID
3. Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
4. Examine the different role in providing disaster recovery and remote replication technologies
5. Discuss the different backup and recovery strategies
6. Infer the security needs and security measures to be employed in information storage management

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley, India,2012.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.
3. Ulf Troppens,Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

21CS1905   **SITE RELIABILITY ENGINEERING**   L T P C
                                                                          3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the organizational impact of introducing SRE
- To gain knowledge of how to develop service-level objectives from business objectives.
- To gain familiarity with incident and problem analysis.
- To explore the knowledge in the production system towards the monitoring of services.
- To gain insights into building incident management and scaling processes for better reliability and performance

UNIT - I   **INTRODUCTION**   **9**

Introduction to Site Reliability Engineering (SRE) - Tenets of SRE - Production Environment – Hardware - Software Infrastructure- Development Environment - Sample Service - SRE and DevOps - Technology to support SRE - Google SRE model

UNIT - II   **PRINCIPLES OF SRE**   **9**

Embracing Risk - Service Level Objectives - Monitoring Distributed Systems - Release Engineering – Simplicity - Minimal APIs

UNIT - III   **EFFECTIVE SRE MANAGEMENT AND PRACTICES**   **9**

Practical Alerting from Time-Series Data - Being On-Call - Effective Troubleshooting - Emergency Response - Learn from the Past - Managing Incidents - Postmortem Culture: Learning from Failure - Tracking Outages - Testing for Reliability - Software Engineering in SRE

UNIT -IV   **LOAD BALANCING AND CRITICAL STATE MANAGEMENT**   **9**

Load Balancing at the Frontend - Load Balancing in the Datacenter - Handling Overload - Addressing Cascading Failures - Managing Critical State: Distributed Consensus for Reliability - Distributed Periodic Scheduling with Cron - Data Processing Pipelines and Data Integrity

UNIT -V   **MANAGEMENT OF SRE**   **9**

Accelerating SREs to On-Call and Beyond – Interrupts handling - Embedding an SRE to Recover from Operational Overload - Communication and Collaboration in SRE - Evolving SRE Engagement Model - Availability Table - Collection of Best Practices for Production Services - Example Incident State Document - Example Postmortem - Example Production Meeting Minutes

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the organizational impact of introducing SRE
2. Gain knowledge of how to develop service-level objectives from business objectives
3. Differentiate between service level agreement of user with organizational service level agreement
4. Become familiar with incident and problem analysis.
5. Become familiar with incident and problem analysis.
6. Confirm the scaling processes for better reliability and performance.

TEXT BOOKS:
1. Betsy Beyer, Chris Jones, Niall Richard Murphy, Jennifer Petoff, ̄Site Reliability Engir
2. Heather Adkin   ̄na Oprea, Piotr Lewandowski,   Reliable Systems‖, 2020
3. Betsy Beyer, N   ent Kawahara and Stephen Thorne

REFERENCES:
1. Enterprise R   -   Site Reliability Googleusercont   atic/pdf/enterprise-roadmap-to-sre.
2. Anatomy of a   ty Engineering - https://static.go   com/media/sre.   ngineers.pdf
3. Incident M   -   Site Reliability Engineering -   https://static. googleusercontent.com/media/sre.google/en//static/pdf/IncidentMeticsInSre. pdf

21CS1906 **STREAM PROCESSING**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT - I   **FOUNDATIONS OF DATA SYSTEMS**   **9**

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT - II   **REAL-TIME DATA PROCESSING**   **9**

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT - III   **DATA MODELS AND QUERY LANGUAGES**   **9**

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT -IV   **EVENT PROCESSING WITH APACHE KAFKA**   **9**

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT -V   **REAL-TIME PROCESSING USING SPARK STREAMING**   **9**

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand data Processing terminology, definition & concepts
2. Understand the applicability and utility of different streaming algorithms.
3. Describe and apply current research trends in data-stream processing.
4. Analyze the suitability of stream mining algorithms for data stream systems.
5. Program and build stream processing systems, services and applications.
6. Solve problems in real-world applications that process data streams.

TEXT BOOKS:
1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication,2018
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media,2017
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing,2017

REFERENCES:
1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

	L	T	P	C

21IT1906   **DEVOPS**

L   T   P   C
3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT - I   INTRODUCTION TO DEVOPS   9

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.

UNIT - II   COMPILE AND BUILD USING MAVEN , GRADLE & ANT   9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT - III   CONTINUOUS INTEGRATION USING JENKINS   9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT -IV   CONFIGURATION MANAGEMENT USING ANSIBLE   9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT -V   BUILDING DEVOPS PIPELINES USING AZURE   9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, ELK

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand different actions performed through Version control tools like Git.

2. Understand the various installation procedure of SDK
3. Ability to Perform Automated Continuous Deployment
4. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
5. Ability to do configuration management using Ansible
6. Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS:

1. Roberto Vormittag, ¯A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises‖, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, ¯Linux for Beginners: An Introduction to the Linux Operating System and Command Line‖, Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, ¯Ansible for DevOps: Server and configuration management for humans‖, First Edition, 2015
3. David Johnson, ¯Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps‖, Second Edition, 2016.
4. Mariot Tsitoara, ¯Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer‖, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

21CS1907 **SECURITY AND PRIVACY IN CLOUD** L T P C
                                                 3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT - I   FUNDAMENTALS OF CLOUD SECURITY CONCEPTS   9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT - II   SECURITY DESIGN AND ARCHITECTURE FOR CLOUD   9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT - III   ACCESS CONTROL AND IDENTITY MANAGEMENT   9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT -IV   CLOUD SECURITY DESIGN PATTERNS   9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT -V   MONITORING, AUDITING AND MANAGEMENT   9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the cloud concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Define cloud policy and Identity and Access Management.
4. Design cloud security patterns
5. Understand various risks and audit and monitoring mechanisms in the cloud.
6. Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:
1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ‾Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ‾Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ‾Cloud Security and Privacy‖, OREILLY 2011

REFERENCES:
1. Mark C. Chu-Carroll ‾Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi,2013

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

21IT1908	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods
- To understand hacking options available in Web and wireless applications
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT - I   INTRODUCTION   9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - ProtectingAgainst Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT - II   FOOT PRINTING, RECONNAISSANCE AND   9
**   SCANNING NETWORKS**

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT - III   ENUMERATION AND VULNERABILITY ANALYSIS   9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT - IV   SYSTEM HACKING   9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT - V   NETWORK PROTECTION SYSTEMS   9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. To express knowledge on basics of computer based vulnerabilities
2. To gain understanding on different foot printing, reconnaissance and scanning methods.
3. To demonstrate the enumeration and vulnerability analysis methods
4. To gain knowledge on hacking options available in Web and wireless applications
5. To acquire knowledge on the options for network protection.
6. To use tools to perform ethical hacking to expose the vulnerabilities

TEXT BOOKS:
1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, DafyddStuttard and Marcus Pinto, 2011.

REFERENCES:
1. 1.Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.
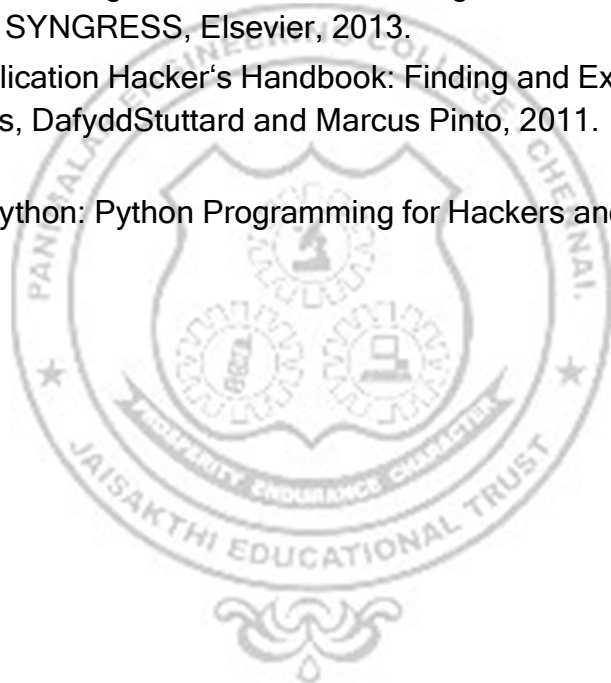
	L	**T**	**P**	**C**

21IT1909   **DIGITAL AND MOBILE FORENSICS**   **3**   **0**   **0**   **3**

OBJECTIVES: To impart Knowledge on the following topics:
- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices
- To understand and use forensics tools for Android devices.

UNIT - I   **INTRODUCTION TO DIGITAL FORENSICS**   **9**

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase - The Analysis Phase - The Presentation Phase

UNIT - II   **DIGITAL CRIME AND INVESTIGATION**   **9**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methodsfor Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT - III   **DIGITAL FORENSIC READINESS**   **9**

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT - IV   **iOS FORENSICS**   **9**

Mobile Hardware and Operating Systems - iOS Fundamentals - Jailbreaking - File System - Hardware - iPhone Security - iOS Forensics - Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT - V   **ANDROID FORENSICS**   **9**

Android basics - Key Codes - ADB - Rooting Android - Boot Process - File Systems - Security - Tools - Android Forensics - Forensic Procedures - ADB - Android Only Tools - Dual Use Tools-Oxygen Forensics - MobilEdit - Android App Decompiling.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Have knowledge on digital forensics.
2. Know about digital crime and investigations.
3. Be forensic ready.
4. Investigate, identify and extract digital evidence from iOS devices.
5. Investigate, identify and extract digital evidence from Android devices.
6. Exploration of digital evidence using various OS

TEXT BOOKS:

1. Andre Arnes, ‾Digital Forensics‖, Wiley, 2018.
2. Chuck Easttom, ‾An In-depth Guide to Mobile Device Forensics‖, First Edition, CRCPress, 2022.

REFERENCES:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, CharlesRiver Media, 2005, ISBN: 1-58450-389.

	L	T	P	C
21IT1910 **SOCIAL NETWORK SECURITY**   3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:
- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT - I   **FUNDAMENTALS OF SOCIAL NETWORKING**   **9**

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT - II   **SECURITY ISSUES IN SOCIAL NETWORKS**   **9**

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT - III   **EXTRACTION AND MINING IN SOCIAL NETWORKING**   **9**
                      DATA
Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNIT - IV   **PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES**   **9**
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.

UNIT - V   **ACCESS CONTROL, PRIVACY AND IDENTITY**   **9**
                      MANAGEMENT
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Develop semantic web related simple applications
2. Address Privacy and Security issues in Social Networking
3. Explain the data extraction and mining of social networks
4. Explain the access control policies and identities for network services
5. Discuss the prediction of human behavior in social communities
6. Describe the applications of social networks

TEXT BOOKS:
1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing, 2017
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES:
1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, ‾Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009.

	L	T	P	C

21IT1911   **MODERN CRYPTOGRAPHY**

L T P C
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and messageauthentication codes.

UNIT - I   INTRODUCTION   9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT - II   FORMAL NOTIONS OF ATTACKS   9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM- CPA and NM- CCA2, Inter-relations among the attack model

UNIT - III   RANDOM ORACLES   9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

UNIT - IV   BUILDING A PSEUDORANDOM PERMUTATION   9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT - V   MESSAGE AUTHENTICATION CODES   9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes:One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. FormallyAnalyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authenticatio
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Express the use of Message Authentication Codes.
6. Identify the modern cryptographic methods in implementing a closed network with authentication

TEXT BOOKS:
1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications,Springer Verlag, 2002.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low PricedEdition), 2016.
3. Introduction to Modern Cryptography: Principles and Protocols (Chapman & Hall/CRCCryptography and Network Security Series), 2007

REFERENCES:
1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available athttp://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced EditionAvailable),Part 1 and Part 23, 2009.
3. William Stallings, ‾Cryptography and Network Security: Principles and Practice‖, PHI 3rdEdition, 2006

21IT1912   ENGINEERING SECURE SOFTWARE SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

**UNIT-I   NEED OF SOFTWARE SECURITY AND LOW-LEVEL   9
                ATTACKS**

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

UNIT-II   SECURE SOFTWARE DESIGN   9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

UNIT-III   SECURITY RISK MANAGEMENT   9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation - Risk Assessment Techniques - Threat and Vulnerability Management.

UNIT-IV   SECURITY TESTING   9

Traditional Software Testing - Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation - Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

UNIT-V   SECURE PROJECT MANAGEMENT   9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Identify various vulnerabilities related to memory attacks.
2. Apply security principles in software development.
3. Evaluate the extent of risks.
4. Involve selection of testing techniques related to software security in the

testingphase of software development.
5. Use tools for securing software.
6. Justify the adopted security testing in the created application

TEXTBOOKS:
1. Julia H. Allen, ¯Software Security Engineering‖, Pearson Education, 2008
2. Evan Wheeler, ¯Security Risk Management: Building an Information Security Risk Management Program from the Ground Up‖, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, ¯The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)‖, Addison-Wesley Professional,2006

REFERENCES:
1. Robert C. Seacord, ¯Secure Coding in C and C++ (SEI Series in Software Engineering)‖, Addison-Wesley Professional, 2005.
2. Jon Erickson, ¯Hacking: The Art of Exploitation‖, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, ¯Hacking Web Apps: Detecting and Preventing Web Application Security Problems‖, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, ¯Web Application Security, A Beginner's Guide‖, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, ¯Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)‖, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, Secure Software Development: A Security Programmer's Guide, 2008.

21IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT-I   INTRODUCTION TO BLOCKCHAIN   9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT-II   BITCOIN AND CRYPTOCURRENCY   9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT-III   BITCOIN CONSENSUS   9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopolyproblem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT-IV   HYPERLEDGER FABRIC & ETHEREUM   9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT-V   BLOCKCHAIN APPLICATIONS   9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practicein the crypto currency domain.
3. Understand the function of Blockchain as a method of securingdistributed ledgers, howconsensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Apply security features in blockchain technologies.

6. Be familiar with existing and potential applications of blockchain technology

TEXTBOOKS:
1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography,Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, ‾Mastering Bitcoin: Unlocking Digital Cryptocurrencies‖,O'Reilly, 2014.

REFERENCES:
1. Daniel Drescher, ‾Blockchain Basics‖, First Edition, Apress, 2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton UniversityPress, 2016.

3. Melanie Swan, ‾Blockchain: Blueprint for a New Economy‖, O'Reilly, 2015

4. Ritesh Modi, ‾Solidity Programming Essentials: A Beginner's Guide to Build Smart Contractsfor Ethereum and Blockchain‖, Packt Publishing, 2018.

5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

	L	T	P	C
21IT1914   **CYBER PHYSICAL SYSTEMS SECURITY**   3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To learn about design of cyber-physical systems.
- To know about MATLAB usage.
- To learn about analysis of cyber-physical systems.
- How to implement safety assurance in these systems.
- To do the software analysis
- To know basic security measures to take in Cyber-Physical Systems

UNIT-I   INTRODUCTION TO CYBER-PHYSICAL SYSTEMS   9
Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS.

UNIT-II   CPS - PLATFORM COMPONENTS   9

CPS - Platform components: CPS HW platforms - Processors, Sensors, Actuators, CPS Network - WirelessHart, CAN, Automotive Ethernet, CPS Sw stack – RTOS, Scheduling Real Time control tasks Principles of Automated Control Design: Dynamical Systems and Stability Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise.

UNIT-III   USING MATLAB   9

Matlab toolboxes - Simulink, Stateflow CPS implementation: From features to software components, Mapping software components to ECUs, CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT-IV   CPS SAFETY ASSURANCE AND SOFTWARE ANALYSIS   9
Formal Methods for Safety Assurance of Cyber-Physical Systems: Advanced Automata based modeling and analysis, Basic introduction, and examples, Timed and Hybrid Automata, Definition of trajectories, Formal Analysis: Flow pipe construction, reachability analysis Analysis of CPS Software: Weakest Pre-conditions, Bounded Model checking, CPS SW Verification: Frama-C, CBMC Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection Automotive Case study: Vehicle ABS hacking Power Distribution Case study: Attacks on Smart Grids

UNIT-V   CPS SECURITY   9

CPS vulnerabilities, threats, attacks & failures, CPS security threats, CPS vulnerabilities, Cyberphysical system attacks, CPS failures, Evaluating risks, Securing CPS, CPS security challenges, CPS security solutions, CPS forensics, Limitations, CPS protection recommendations

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the core principles behind CPS.
2. Identify safety specifications and critical properties.
3. Understand abstraction in system designs.
4. Express pre and post conditions and invariants for CPS models.
5. Identify CPS security threats and do the software analysis.
6. Justify the basic security measures in Cyber-Physical Systems ensuring security technologies

TEXTBOOKS:
1. Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2017.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

REFERENCES:
1. André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dynamics., Springer, 2010. 426 pages,ISBN 978-3-642-14508-7.

2. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, The publisher, Paul Temme, 2011.

3. Jean-Paul A. Yaacoub, Ola Salman, Hassan N. Noura, NesrineKaaniche, Ali Chehab, Mohamad Malli, "Cyber-physical systems security: Limitations, issues and future trends", Microprocessors and Microsystems, Vol 77, 2020, ISSN 0141-9331 (Unit 5)

4. Sajal Das, Krishna Kant, and Nan Zhang, ¯Handbook on Securing Cyber-Physical CriticalInfrastructure – Foundations & Challenges‖, Morgan Kaufmann, 2012.

5. Awad, A.I., Furnell, S., Paprzycki, M., Sharma, S.K., Security in Cyber-Physical Systems Foundations and Applications, Springer International Publishing, 2021

	L	T	P	C
21CS1907 **SECURITY AND PRIVACY IN CLOUD**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT-I   FUNDAMENTALS OF CLOUD SECURITY CONCEPTS   9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT-II   SECURITY DESIGN AND ARCHITECTURE FOR CLOUD   9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT-III   ACCESS CONTROL AND IDENTITY MANAGEMENT   9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT-IV   CLOUD SECURITY DESIGN PATTERNS   9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT-V   MONITORING, AUDITING AND MANAGEMENT   9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the cloud concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Define cloud policy and Identity and Access Management.
4. Design cloud security patterns

5. Understand various risks and audit and monitoring mechanisms in the cloud.
6. Define the various architectural and design considerations for security in the cloud.

TEXTBOOKS:
1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ‾Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ‾Virtualization Security, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ‾Cloud Security and Privacy‖, OREILLY 2011

REFERENCES:
1. Mark C. Chu-Carroll ‾Code in the Cloud‖,CRC Press, 2011

2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya,Christian Vechhiola, S. ThamaraiSelvi,2013

21CS1908   **AUGMENTED REALITY/VIRTUAL REALITY**   L T P C
                                                           3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in thedevelopment of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT - I   **INTRODUCTION**   **9**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices - 3D Position Trackers - Types of Trackers - Navigation and Manipulation Interfaces - Gesture Interfaces - Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System - Personal Graphics Displays - Large Volume Displays - Sound Displays - Human Auditory System.

UNIT - II   **VR MODELING**   **9**

Modeling - Geometric Modeling - Virtual Object Shape - Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants -Object Hierarchies - Viewing the 3D World - Physical Modeling - Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Behavior Modeling - Model Management.

UNIT - III   **VR PROGRAMMING**   **9**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT -IV   **APPLICATIONS**   **9**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization - VR in Business - VR in Entertainment - VR in Education.

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

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basic concepts of AR and VR
2. Understand the tools and technologies related to AR/VR
3. Understand the graphical processing units and their architectures.
4. Know the working principle of AR/VR related Sensor devices
5. Design of various models using modeling techniques
6. Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, ‾Virtual Reality Blueprints: Create compelling VR experiences for mobile‖, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, ‾Augmented Reality: Principles & Practice‖, Addison Wesley, 2016

REFERENCES:

1. John Vince, ‾Introduction to Virtual Reality‖, Springer-Verlag, 2004.
2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design‖, Morgan Kaufmann, 2003.

21CS1909   MULTIMEDIA AND ANIMATION

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT - I   INTRODUCTION TO MULTIMEDIA   9
Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT - II   MULTIMEDIA FILE FORMATS AND STANDARDS   9
File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT - III   MULTIMEDIA AUTHORING   9
Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools,Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools,audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations.

UNIT -IV   ANIMATION   9
Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT -V   MULTIMEDIA APPLICATIONS   9
Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

OUTCOMES: Upon completion of the course, the students will be able to:
1. Get the bigger picture of the context of Multimedia and its applications

2. Use the different types of media elements of different formats on content pages
3. Author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Use different standard animation techniques for 2D, 21/2 D, 3D applications for the mobile UI
5. Explore different popular applications of multimedia
6. Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:
1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia‖, Third Edition, Springer Texts in Computer Science, 2021.

REFERENCES:
1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, ⁻Multimedia Computing‖, Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, ⁻Multimedia System Design‖, Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, ⁻Multimedia Cloud Computing Systems‖, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, ⁻3D Graphics and Animation‖, Second Edition, New Riders, 2002.
6. Rogers David, ⁻Animation: Master - A Complete Guide (Graphics Series)‖, Charles River Media, 2006.
7. Rick parent, ⁻Computer Animation: Algorithms and Techniques‖, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, ⁻UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native‖, Packt Publishing, 2022.

21CS1910 **VIDEO CREATION AND EDITING**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording.
- To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT - I **FUNDAMENTALS** **9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT - II **STORYTELLING** **9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT - III **USING AUDIO AND VIDEO** **9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT -IV **WORKING WITH FINAL CUT PRO** **9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT -V **WORKING WITH AVID XPRESS DV 4** **9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Compare the strengths and limitations of Nonlinear editing.
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Apply different media tools.
5. Address the core issues of advanced editing and training techniques.
6. Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, ¯Digital Video for Dummies‖, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, ¯Editing Digital Video: The Complete Creative and Technical Guide‖, Digital Video and Audio, McGraw – Hill 2003.

21IT1903   **UI AND UX DESIGN**   **L   T   P   C**
                                                                     3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:
- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT - I   **FOUNDATIONS OF DESIGN**   **9**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT - II   **FOUNDATIONS OF UI DESIGN**   **9**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT - III   **FOUNDATIONS OF UX DESIGN**   **9**

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT -IV   **WIREFRAMING, PROTOTYPING AND TESTING**   **9**

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

UNIT -V   **RESEARCH, DESIGNING, IDEATING, & INFORMATION**   **9**
                                              ARCHITECTURE

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:
1. Understand the various Research Methods used in Design
2. Build UI for user Applications
3. Evaluate UX design of any product or application
4. Demonstrate UX Skills in product development
5. Implement Sketching principles

6. Create Wireframe and Prototype

TEXT BOOKS:
1. Joel Marsh, ¯UX for Beginners‖, O'Reilly , 2022
2. Jon Yablonski, ¯Laws of UX using Psychology to Design Better Product & Services‖ O'Reilly 2021

REFERENCES:
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, ¯Designing Interface‖ 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan ¯Refactoring UI‖, 2018
3. Steve Krug, ¯Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile‖, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

21CS1911 **DIGITAL MARKETING** L T P C
                                      3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To examine and explore the role and importance ofdigital marketing in today's rapidly changing business environment.
- Focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT - I **INTRODUCTION TO ONLINE MARKET** **9**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT - II **SEARCH ENGINE OPTIMISATION** **9**

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT - III **E- MAIL MARKETING** **9**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT -IV **SOCIAL MEDIA MARKETING** **9**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT -V **DIGITAL TRANSFORMATION** **9**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
2. To know the key elements of a digital marketing strategy.
3. Focuses on how digital marketing can be utilized by organizations

4. Study how the effectiveness of a digital marketing campaign can be measured
5. Undertand social media marketing
6. Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOKS:
1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition , 2017;ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press, 2015, ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition, 2017; ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D.,2014, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited,2014.
5. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach,2E South-Western ,Cengage Learning,2017.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education,2015.

21CS1912	**VISUAL EFFECTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT - I	**ANIMATION BASICS**	**9**

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT - II	**CGI, COLOR, LIGHT**	**9**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT - III	**SPECIAL EFFECTS**	**9**

Special Effects - props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects - wind, rain, fog, fire

UNIT -IV	**VISUAL EFFECTS TECHNIQUES**	**9**

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT -V	**COMPOSITING**	**9**

Compositing - chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course, the student will be able to:
1. Implement animation in 2D / 3D following the principles and techniques
2. Use CGI, color and light elements in VFX applications
3. Create special effects using any of the state of the art tools
4. Apply popular visual effects techniques using advanced tools
5. Use compositing tools for creating VFX for a variety of applications

6. Understand the state of the art vfx techniques

TEXT BOOKS:
1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES:
1. Jon Gress, ⎺Digital Visual Effects and Compositing‖, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics‖, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, ⎺Introduction to Visual Effects A Computational Approach‖, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, ⎺Lighting for Animation: The art of visual storytelling
   , Routledge, 1st Edition, 2016.
5. Eran Dinur, ⎺The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, ⎺ The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures‖, Third Edition, 2020.and Games‖, Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

21CS1913   **GAME DEVELOPMENT**   **L T P C**
                                                       3 0 0 3

OBJECTIVES : To impart Knowledge on the following topics:
- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT - I   3D GRAPHICS FOR GAME DESIGN   9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models - Animation - Controller Based Animation.

UNIT - II   GAME DESIGN PRINCIPLES   9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design - Proposals - Writing for Preproduction, Production and Post - Production.

UNIT - III   GAME ENGINE DESIGN   9

Rendering Concept - Software Rendering - Hardware Rendering - Spatial Sorting Algorithms – Algorithms for Game Engine- Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT -IV   OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS   9

Pygame Game development - Unity - Unity Scripts -Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT -V   GAME DEVELOPMENT USING PYGAME   9

Developing 2D and 3D interactive games using Pygame - Avatar Creation - 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development - Device Handling in Pygame - Overview of Isometric and Tile Based arcade Games –   Puzzle Games.

                                                       TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:
1. Explain the concepts of 2D and 3d Graphics
2. Understand the stages of game development
3. Design game design documents.
4. Implementation of gaming engines.
5. Survey gaming environments and frameworks.
6. Implement a simple game in Pygame.

TEXT BOOKS:

1. Sanjay Madhav, ¯Game Programming Algorithms and Techniques: A Platform Agnostic Approach‖, Addison Wesley,2013.
2. David H. Eberly, ¯3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, CRC Press,2006.
3. Will McGugan, ¯Beginning Game Development with Python and Pygame: From Novice to Professional‖, Apress,2007.

REFERENCES:

1. Paul Craven, ¯Python Arcade games‖, Apress Publishers,2016.
2. Jung Hyun Han, ¯3D Graphics for Game Programming‖, Chapman and Hall/CRC, 2011.

21CS1914   **MULTIMEDIA DATA COMPRESSION AND STORAGE**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices
- To understand the concepts of data streaming services

UNIT - I   BASICS OF DATA COMPRESSION   9
Introduction — Lossless and Lossy Compression- Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression - Applications

UNIT - II   IMAGE COMPRESSION   9
Lossless Image compression - JPEG-CALIC-JPEG LS-Prediction using conditional averages - Progressive Image Transmission - Lossless Image compression formats - Applications - Facsimile encoding

UNIT - III   VIDEO COMPRESSION   9
Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.

UNIT -IV   DATA PLACEMENT ON DISKS   9
Statistical placement on Disks - Striping on Disks - Replication Placement on Disks - Constraint allocation on Disks - Tertiary storage Devices - Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems - Constraint allocation on Hierarchical storage system

UNIT -V   DISK SCHEDULING METHODS   9
Scheduling methods for disk requests - Feasibility conditions of concurrent streams- Scheduling methods for request streams

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
1. Understand the basics of text, Image and Video compression
2. Understand the categories of compression for text, image and video
3. Understand the various compression algorithms for multimedia content
4. Explore the applications of various compression techniques
5. Explore knowledge on multimedia storage on disks
6. Understand scheduling methods for request streams

TEXT BOOKS:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

VERTICAL VI: EMERGING TECHNOLOGIES

21CS1908   **AUGMENTED REALITY/VIRTUAL REALITY**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT - I   **INTRODUCTION**   **9**

Introduction to Virtual Reality and Augmented Reality - Definition - Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality - Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices - 3D Position Trackers - Types of Trackers - Navigation and Manipulation Interfaces - Gesture Interfaces - Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System - Personal Graphics Displays - Large Volume Displays - Sound Displays - Human Auditory System.

UNIT - II   **VR MODELING**   **9**

Modeling - Geometric Modeling - Virtual Object Shape - Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants -Object Hierarchies - Viewing the 3D World - Physical Modeling - Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Behavior Modeling - Model Management.

UNIT - III   **VR PROGRAMMING**   **9**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT -IV   **APPLICATIONS**   **9**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization - VR in Business - VR in Entertainment - VR in Education.

UNIT -V   **AUGMENTED REALITY**   **9**

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

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
1. Understand the basic concepts of AR and VR
2. Understand the tools and technologies related to AR/VR
3. Understand the graphical processing units and their architectures.
4. Know the working principle of AR/VR related Sensor devices
5. Design of various models using modeling techniques
6. Develop AR/VR applications in different domains

TEXT BOOKS:
1. Charles Palmer, John Williamson, ̄Virtual Reality Blueprints: Create compelling VR experiences for mobile‖, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, ̄Augmented Reality: Principles & Practice‖, Addison Wesley, 2016

REFERENCES:
1. John Vince, ̄Introduction to Virtual Reality‖, Springer-Verlag, 2004.

2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design‖, Morgan Kaufmann, 2003.

21CS1915   **ROBOTIC PROCESS AUTOMATION**   L T P C
                                                    3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT - I   INTRODUCTION TO ROBOTIC PROCESS AUTOMATION   9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT - II   AUTOMATION PROCESS ACTIVITIES   9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT - III   APP INTEGRATION, RECORDING AND SCRAPING   9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT -IV   EXCEPTION HANDLING AND CODE MANAGEMENT   9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT -V   DEPLOYMENT AND MAINTENANCE   9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to
1. Understand the basic concepts of Robotic Process Automation.
2. Enunciate the key distinctions between RPA and existing automation techniques and platforms.
3. Use UiPath to design control flows and work flows for the target process
4. Implement recording, web scraping andprocess mining by automation
5. Use UIPath Studio to detect, and handle exceptions in automation processes
6. Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:
1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , ¯The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems‖, Apress publications, 2020.

REFERENCES:
1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, ¯Robotic Process Automation Rpa A Complete Guide ¯, 2020

21AD1918 **NEURAL NETWORKS AND DEEP LEARNING** | L | T | P | C |
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
* To understand the basics in deep neural networks
* To understand the basics of associative memory and unsupervised learning networks
* To apply CNN architectures of deep neural networks
* To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
* To apply autoencoders and generative models for suitable applications.

UNIT - I   **INTRODUCTION**   **9**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT - II   **ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING**   **9**
NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT - III   **THIRD-GENERATION NEURAL NETWORKS**   **9**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis - Applications: Computer Vision, Image Generation, Image Compression.

UNIT -IV   **DEEP FEEDFORWARD NETWORKS**   **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization-VC Dimension and Neural Nets.

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs - Deep Recurrent Networks - Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders, LSTM networks.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning
5. Use the key computations to build and train deepneural networks for various tasks.
6. Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ‾Deep Learning‖, MIT Press, 2016.
2. Francois Chollet, ‾Deep Learning with Python‖, Second Edition, Manning Publications, 2021.

REFERENCES:
1. Aurélien Géron, ‾Hands-On Machine Learning with Scikit-Learn and TensorFlow‖, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, ‾Deep Learning: A Practitioner's Approach‖, O'Reilly Media, 2017.
3. Charu C. Aggarwal, ‾Neural Networks and Deep Learning: A Textbook‖, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, ‾Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications‖, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, ‾Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.

21IT1915   **CYBER SECURITY**   L T P C
                                                                      3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To learn cybercrime and cyber law.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

UNIT - I   INTRODUCTION   9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime; Cybercriminals - Classification of Cybercrimes - A Global Perspective on Cyber Crimes; Cyber Laws - The Indian IT Act - Cybercrime and Punishment.

UNIT - II   ATTACKS AND COUNTERMEASURES   9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks - Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack - Attack Tools - Countermeasures.

UNIT - III   RECONNAISSANCE   9

Harvester - Whois - Netcraft - Host - Extracting Information from DNS - Extracting Information from E-mail Servers - Social Engineering Reconnaissance; Scanning - Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT -IV   INTRUSION DETECTION   9

Host -Based Intrusion Detection - Network -Based Intrusion Detection - Distributed or Hybrid Intrusion Detection - Intrusion Detection Exchange Format - Honeypots - Example System Snort.

UNIT -V   INTRUSION PREVENTION   9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

OUTCOMES: On successful completion of this course, the student will be able to
1. Explain the basics of cyber security, cyber crime and cyber law
2. Classify various types of attacks and learn the tools to launch the attacks
3. Apply various tools to perform information gathering
4. Apply intrusion techniques to detect intrusion
5. Apply intrusion prevention techniques to prevent intrusion
6. Design and explore the firewalls to defined networks

TEXT BOOKS:
1. Anand Shinde, ¯Introduction to Cyber Security Guide to the World of Cyber Security‖, Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, ¯Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives‖, Wiley Publishers, 2011
3. https://owasp.org/www-project-top-ten/

REFERENCES:
1. David Kim, Michael G. Solomon, ¯Fundamentals of Information Systems Security‖, Jones & Bartlett Learning Publishers, 2013
2. Kimberly Graves, ¯CEH Official Certified Ethical hacker Review Guide‖, Wiley Publishers, 2007
3. Kimberly Graves, ¯CEH Official Certified Ethical hacker Review Guide‖, Wiley Publishers, 2007
4. William Stallings, Lawrie Brown, ¯Computer Security Principles and Practice‖, Third Edition, Pearson Education, 2015
5. Georgia Weidman, ¯Penetration Testing: A Hands-On Introduction to Hacking‖, No Starch Press, 2014 (Lab)

21CS1916 QUANTUM COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT - I   QUANTUM COMPUTING BASIC CONCEPTS   9
Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions

UNIT - II   QUANTUM GATES AND CIRCUITS   9
Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

UNIT - III   QUANTUM ALGORITHMS   9
Quantum parallelism - Deutsch's algorithm - The Deutsch-Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

UNIT -IV   QUANTUM INFORMATION THEORY   9
Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT -V   QUANTUM CRYPTOGRAPHY   9
Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to
1. Understand the background of classical computing and quantum computing.
2. Gain knowledge about the basic hardware and mathematical models of quantumcomputation.
3. Understand the background of Quantum Mechanics.
4. Analyze the computation models
5. Model the circuits using quantum computation,environments and frameworks.

6. Understand the quantum operations such as noise and error-correction.

TEXT BOOKS:
1. Parag K Lala, Mc Graw Hill Education, ¯Quantum Computing, A Beginners Introduction‖, First edition, 2020.
2. Michael A. Nielsen, Issac L. Chuang, ¯Quantum Computation and Quantum Information‖, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition, 2020, ¯Quantum Computingfor Everyone‖.

REFERENCES:
1. Scott Aaronson, ¯Quantum Computing Since Democritus‖, Cambridge University Press, 2013.
2. N. David Mermin, ¯Quantum Computer Science: An Introduction‖, Cambridge University Press, 2007.

| | **L** | **T** | **P** | **C** |

21IT1913 **CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES** **L T P C**
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT - I **INTRODUCTION TO BLOCKCHAIN** **9**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT - II **BITCOIN AND CRYPTOCURRENCY** **9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT - III **BITCOIN CONSENSUS** **9**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT -IV **HYPERLEDGER FABRIC & ETHEREUM** **9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT -V **BLOCKCHAIN APPLICATIONS** **9**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:
1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Understand the function of Blockchain as a method of securingdistributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

5. Apply security features in blockchain technologies.
6. Be familiar with existing and potential applications of blockchain technology

TEXT BOOKS:
1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. 2.Andreas Antonopoulos, ‾Mastering Bitcoin: Unlocking Digital Cryptocurrencies‖, O'Reilly, 2014.

REFERENCES:
1. Daniel Drescher, ‾Blockchain Basics‖, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, ‾Blockchain: Blueprint for a New Economy‖, O'Reilly, 2015
4. Ritesh Modi, ‾Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain‖, Packt Publishing, 2018.
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

		L	T	P	C
21CS1913   **GAME DEVELOPMENT**   **L T P C**
                                                                 3 0 0 3

OBJECTIVES : To impart Knowledge on the following topics:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT - I   **3D GRAPHICS FOR GAME DESIGN**   **9**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models - Animation - Controller Based Animation.

UNIT - II   **GAME DESIGN PRINCIPLES**   **9**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design - Proposals – Writing for Preproduction, Production and Post – Production.

UNIT - III   **GAME ENGINE DESIGN**   **9**

Rendering Concept – Software Rendering - Hardware Rendering - Spatial Sorting Algorithms – Algorithms for Game Engine- Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT -IV   **OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS**   **9**

Pygame Game development - Unity – Unity Scripts -Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT -V   **GAME DEVELOPMENT USING PYGAME**   **9**

Developing 2D and 3D interactive games using Pygame - Avatar Creation - 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development - Device Handling in Pygame - Overview of Isometric and Tile Based arcade Games - Puzzle Games.

TOTAL: 45 PERIODS

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

1. Explain the concepts of 2D and 3d Graphics
2. Understand the stages of game development
3. Design game design documents.
4. Implementation of gaming engines.
5. Survey gaming environments and frameworks.

6. Implement a simple game in Pygame.

TEXT BOOKS:
  1. Sanjay Madhav, ¯Game Programming Algorithms and Techniques: A Platform Agnostic Approach‖, Addison Wesley,2013.
  2. David H. Eberly, ¯3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, CRC Press,2006.
  3. Will McGugan, ¯Beginning Game Development with Python and Pygame: From Novice to Professional‖, Apress,2007.

REFERENCES:
  1. Paul Craven, ¯Python Arcade games‖, Apress Publishers,2016.
  2. Jung Hyun Han, ¯3D Graphics for Game Programming‖, Chapman and Hall/CRC, 2011.

21CS1917 3D PRINTING AND DESIGN   L T P C
                                       3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

UNIT - I   INTRODUCTION   9

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

UNIT - II   3D PRINTING PRINCIPLES   9

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

UNIT - III   INKJET TECHNOLOGY   9

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

UNIT -IV   LASER TECHNOLOGY   9

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

UNIT -V   INDUSTRIAL APPLICATIONS   9

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

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to:
1. Outline and examine the basic concepts of 3D printing technology
2. Explain the principles of 3D printing technique
3. Outline 3D printing workflow
4. Explain and categorize the concepts and working principles of 3D printing using inkjet technique
5. Explain and categorize the working principles of 3D printing using laser technique

6. Explain various method for designing and modeling for industrial applications

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

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

VERTICAL VII : ARTIFICIAL INTELLIGENCE TECHNIQUES

		L	T	P	C
21AD1923	**KNOWLEDGE ENGINEERING**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT - I   REASONING UNDER UNCERTAINTY   9

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

UNIT - II   METHODOLOGY AND MODELING   9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT - III   ONTOLOGIES – DESIGN AND DEVELOPMENT   9

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

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

UNIT -IV   REASONIING WITH ONTOLOGIES AND RULES   9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine - Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge - Reasoning with Partially Learned Knowledge.

UNIT -V   LEARNING AND RULE LEARNING   9

Machine Learning - Concepts - Generalization and Specialization Rules - Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basics of Knowledge Engineering.
2. Understand different reasoning concepts related to uncertainty
3. Apply methodologies and modelling for Agent Design and Development.
4. Design and develop ontologies.
5. Apply reasoning with ontologies and rules.
6. Understand learning and rule learning.

TEXT BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning,Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and ComputationalFoundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1stEdition,2001.

21AD1903   **SOFT COMPUTING**   **L   T   P   C**
                                                                    3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated withneural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples andgeneralize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior ofprograms based on soft computing

UNIT - I   **INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC**   **9**

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems - Case study : AHP Approach.

UNIT - II   **NEURAL NETWORKS**   **9**

Supervised Learning Neural Networks - Perceptrons - Backpropagation - Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks- CNN.

UNIT - III   **GENETIC ALGORITHMS**   **9**

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over — Mutation - Fitness Function — Maximizing function- maximizing a function program - Case study: Job scheduling.

UNIT -IV   **NEURO FUZZY MODELING**   **9**

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling - Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysisof Adaptive Learning Capability- Two input sine function- three input non linear function.

UNIT -V   **APPLICATIONS**   **9**

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction- Hybrid Approach

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the fundamentals of fuzzy logic operators and inference mechanisms

2. Understand the mathematical background for carrying out the optimization associated with neural network learning
3. Understand neural network architecture for AI applications such as classification andclustering
4. Learn the functionality of Genetic Algorithms in Optimization
5. Use hybrid techniques involving Neural networks and Fuzzy logic
6. Apply soft computing techniques in real world applications

TEXT BOOKS:
1. Sajang, J.-S. R., Sun, C.T., & Mizutani, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python Case Studiesand Applications from the Industry, Apress, 2020

REFERENCES:
1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques andApplications,1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, ‾Neural Networks, Fuzzy Logic and Genetic Algorithms‖, PHI,2003.
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and GeneticAlgorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India PvtLtd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, ‾Computational Intelligence - PC Tools‖, APProfessional, Boston, 1996

21AD1918   **NEURAL NETWORKS AND DEEP LEARNING**   **L T P C**
                                                          3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.

- To apply autoencoders and generative models for suitable applications.

UNIT - I   **INTRODUCTION**   **9**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT - II   **ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING**   **9**
                                   NETWORKS 9

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT - III   **THIRD-GENERATION NEURAL NETWORKS**   **9**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT -IV   **DEEP FEEDFORWARD NETWORKS**   **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

UNIT -V   **RECURRENT NEURAL NETWORKS**   **9**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders, LSTM networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning
5. Use the key computations to build and train deepneural networks for various tasks.
6. Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. 1.   Ian Goodfellow, Yoshua Bengio, Aaron Courville, ¯Deep Learning‖, MIT Press, 2016.
2. Francois Chollet, ¯Deep Learning with Python‖, Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, ¯Hands-On Machine Learning with Scikit-Learn and TensorFlow‖, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, ¯Deep Learning: A Practitioner's Approach‖, O'Reilly Media, 2017.
3. Charu C. Aggarwal, ¯Neural Networks and Deep Learning: A Textbook‖, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.

7. S Rajasekaran, G A Vijayalakshmi Pai, ¯Neural Networks, FuzzyLogic and GeneticAlgorithm, Synthesis and Applications‖, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, ¯Neural Networks Algorithms, Applications, andProgramming Techniques‖, Addison Wesley, 2003.

21AD1919 **TEXT AND SPEECH ANALYSIS**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT - I	NATURAL LANGUAGE BASICS	9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming - Lemmatization - Removing stop-words - Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model - TF-IDF model

UNIT - II	TEXT CLASSIFICATION	9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

UNIT - III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	9

Information retrieval – IR-based question answering - knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -- evaluating dialogue systems

UNIT -IV	TEXT-TO-SPEECH SYNTHESIS	9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT -V	AUTOMATIC SPEECH RECOGNITION	9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Explain existing and emerging deep learning architectures for text and speech processing
2. Apply deep learning techniques for NLP tasks, language modelling and machine translation
3. Explain coreference and coherence for text processing
4. Build question-answering systems, chatbots and dialogue systems

5. Apply deep learning models for building speech recognition
6. Apply deep learning models for building text-to-speech systems

TEXT BOOKS:
1. Daniel Jurafsky and James H. Martin, ¯Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Third Edition, 2022.

REFERENCES:
1. Dipanjan Sarkar, ¯Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data‖, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, ¯Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, ¯Fundamentals of Speech Recognition‖ 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, ¯Natural language processing with Python‖, O'REILLY.

21AD1924   **OPTIMIZATION TECHNIQUES IN MACHINE**   **L T P C**
                              LEARNING   **3 0 0 3**

OBJECTIVES: To impart Knowledge on the following topics:
- To formulate and solve linear programming problems
- To understand and analyze how to deal with changing data.

- To identify and interpret potential unintended effects in the project.
- To understand and define procedures to operationalize the machine learning model
- To maintain the applied machine learning model.

UNIT - I   INTRODUCTION   9

What is optimization, Formulation of LPP, Solution of LPP: Simplex method, Basic Calculus for optimization: Limits and multivariate functions, Derivatives and linear approximations: Single variate functions and multivariate functions.

UNIT - II   MACHINE LEARNING STRATEGY   9

ML readiness, Risk mitigation, Experimental mindset, Build/buy/partner, setting up a team, Understanding and communicating change.

UNIT - III   RESPONSIBLE MACHINE LEARNING   9

AI for good and all, Positive feedback loops and negative feedback loops, Metric design andobserving behaviours, Secondary effects of optimization, Regulatory concerns.

UNIT -IV   MACHINE LEARNING IN PRODUCTION AND PLANNING   9

Integrating info systems, users break things, time and space complexity in production, when to retain the model- Logging ML model versioning, Knowledge transfer, Reporting performance to stakeholders.

UNIT -V   CARE AND FEEDING OF MACHINE LEARNING MODEL   9

MLPL Recap, Post deployment challenges, QUAM monitoring and logging, QUAM Testing, QUAM maintenance, QUAM updating, Separating Datastack from Production, Dashboard Essentials and Metrics monitoring.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will able to

1. Formulate and solve linear programming problems

**2.** Understand and analyze how to deal with changing data.

3. Understand and interpret potential unintended effects in their project.
4. Understand and define procedures to operationalize the applied machine learning model.
5. Understand and define procedures to maintain the applied machine learning model.
6. Understand how to optimize the use of Machine Learning in real-life problems.

TEXT BOOKS:
1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.
2. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing, 2020.
3. Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J.Kulkarni, Springer, 2019.

REFERENCES:
1. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill,2017.
2. Optimization for Machine Learning, Suvrit Sra, Sebastian Nowozin and Stephen J. Wright, MITPress, 2011.
3. Algorithms for Optimization by Mykel J. Kochenderfer and Tim A. Wheeler, MIT Press, 2019.
4. Accelerated Optimization for Machine Learning: First-Order Algorithms by Cong Fang, Huan Li,and Zhouchen Lin, Springer, 2020.

21AD1916   **GAME THEORY**   L T P C
                                                   3 0 0 3
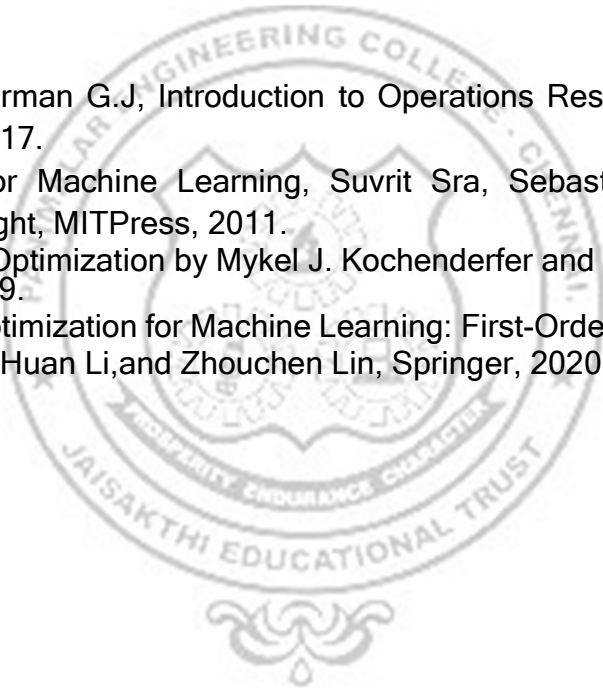
OBJECTIVES: To impart Knowledge on the following topics:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate,including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of gametheory, and to provide insights into using game theory in modelling applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

UNIT - I   **INTRODUCTION**   **9**

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-non- cooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT - II   **GAMES WITH PERFECT INFORMATION**   **9**

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria –mixed strategy equilibrium — zero-sum games

UNIT - III   **GAMES WITH IMPERFECT INFORMATION**   **9**

Games with Imperfect Information – Bayesian Games –Motivational Examples – General Definitions – Information aspects–Illustrations — Extensive Games with Imperfect – Information– Strategies – Nash Equilibrium –Repeated Games – The Prisoner's Dilemma Bargaining

NON-COOPERATIVE GAME THEORY   **9**
UNIT -IV

Non-cooperative Game Theory – Self-interested agents – Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal – Form Games —Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two- player, general- sum games — Identifying dominated strategies

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design with unrestricted preferences

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.

2. Formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.

3. Discuss the use of Nash Equilibrium for other problems.

4. Identify key strategic aspects and be able to connect them to appropriate theoretic concepts given a real world situation.

5. Identify some applications that need aspects of Bayesian Games.

6. Implement a typical Virtual Business scenario using Game theory.

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.

2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge University Press, 2007.

4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

5. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic,and Logical Foundations, Cambridge University Press 2008.

REFERENCES:

1. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, ¯Game Theory in Wireless and Communication Networks‖, Cambridge University Press, 2012.

2. Y.Narahari, ¯Game Theory and Mechanism Design‖, IISC Press, World Scientific.

3. William Spaniel, ¯Game Theory 101: The Complete Textbook‖, CreateSpace Independent Publishing, 2011.

COGNITIVE SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT - I   PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE   9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science - Science of Information Processing -Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT - II   COMPUTATIONAL INTELLIGENCE   9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making -Learning – Language –Vision.

UNIT - III   PROBABILISTIC PROGRAMMING LANGUAGE   9

WebPPL Language – Syntax – Using Javascript Libraries –
Manipulating probability types and distributions - Finding Inference – Exploring random computation - Coroutines: Functions that receive continuations -Enumeration

UNIT -IV   INFERENCE MODELS OF COGNITION   9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis - Algorithms for Inference.

LEARNING MODELS OF COGNITION   9

UNIT -V

Learning as Conditional Inference - Learning with a Language of Thought - Hierarchical Models- Learning (Deep) Continuous Functions – Mixture Models.

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to:
1. Understand the underlying theory behind cognition.
2. Connect to the cognition elements to computational intelligence.
3. Explore probabilistic programming language.
4. Implement mathematical functions through WebPPL.
5. Develop applications using cognitive inference model.

6. Develop applications using cognitive learning model.

TEXT BOOKS:
1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, ¯The MIT Encyclopedia of the Cognitive Sciences‖,The MITPress, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind,Cambridge University Press 2020

REFERENCES:
1. Noah D. Goodman, Andreas Stuhlmuller, ¯The Design and Implementation of ProbabilisticProgramming Languages‖, Electronic version of book, https://dippl.org/.

2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, ¯Probabilistic Models of Cognition‖, Second Edition, 2016, https://probmods.org/.
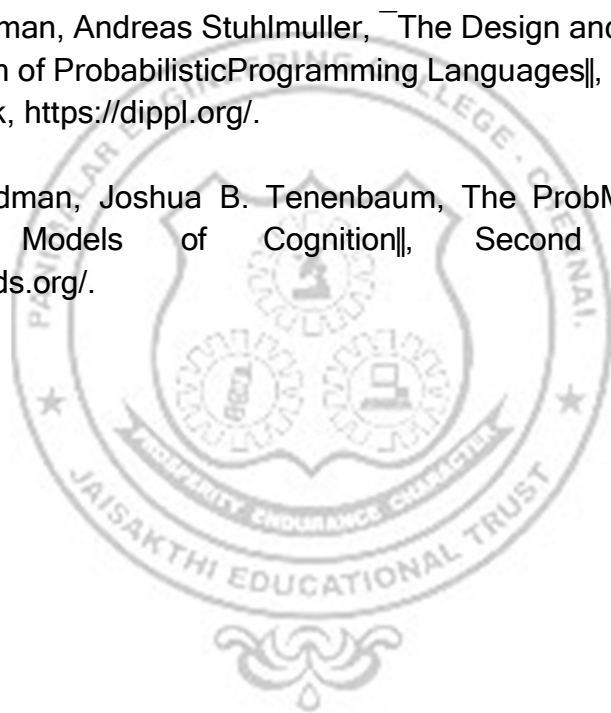
21AD1907 ETHICS AND AI L T P C
                                                          3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk for Human rights and other fundamental values
- To understand ethics in all AI applications

UNIT - I   **INTRODUCTION TO ETHICS OF AI**   **9**

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities, Ethics of AI and big data.

UNIT - II   **FRAMEWORK AND MODELS**   **9**

AI Governance by Human-right centered design, Normative models, Role of professionalnorms, Teaching Machines to be Moral

UNIT - III   **CONCEPTS AND ISSUES**   **9**

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender,AI as a moral right-holder, Trust and Transparency.

UNIT -IV   **PERSPECTIVES AND APPROACHES**   **9**

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents, Deep learning values.

UNIT -V   **CASES AND APPLICATION**   **9**

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics, Chatbots.

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to:
1. Understand the ethical issues in the development of AI agents
2. Learn the ethical considerations of AI with perspectives on ethical values
3. Apply the ethical policies in AI based applications and Robot development
4. To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights
5. This study will help to overcome the evil genesis in the concepts of AI.

6. To apply ethics in all AI applications

TEXT BOOKS:
1. Paula Boddington, ̄Towards a Code of Ethics for Artificial Intelligence‖, Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, ̄The Oxford Handbook of Ethicsof AI‖, Oxford University Press Edited book, 2020

REFERENCES:
1. S. Matthew Liao, ̄Ethics of Artificial Intelligence‖, Oxford University Press EditedBook, 2020
2. N. Bostrom and E. Yudkowsky. ̄The ethics of artificial intelligence‖. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages316–334. Cambridge University Press, Cambridge, 2014.
3. Wallach, W., & Allen, C, ̄Moral machines: ceaching robots right from wrong‖, Oxford University Press, 2008.

21CS1918	COMMUNICATION THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To introduce the concepts of various analog modulations and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To know the principles of sampling & quantization

UNIT - I AMPLITUDE MODULATION 9

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope -comparison of different AM techniques, Superheterodyne Receiver.

UNIT - II ANGLE MODULATION 9
Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation – Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

UNIT - III RANDOM PROCESS 9
Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNIT -IV NOISE CHARACTERIZATION 9
Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise -In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de- emphasis for FM.

UNIT -V SAMPLING & QUANTIZATION 9
Low pass sampling - Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding - PAM, PPM, PWM, PCM – TDM, FDM.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the concepts of various analog modulations and their spectral characteristics
2. Design AM communication systems
3. Design Angle modulated communication systems
4. Apply the concepts of Random Process to the design of Communication systems
5. Analyze the noise performance of AM and FM systems
6. Gain knowledge in sampling and quantization

TEXT BOOKS:
1. J.G.Proakis, M.Salehi, ¯Fundamentals of Communication Systems‖, Pearson Education 2014.
2. Simon Haykin, ¯Communication Systems‖, 4th Edition, Wiley, 2014.

REFERENCES:
1. B.P.Lathi, ¯Modern Digital and Analog Communication Systems‖, 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, ¯Electronic Communications, 4th edition PHI 2006
3. A.Papoulis, ¯Probability, Random variables and Stochastic Processes‖, McGraw Hill, 3rd edition, 1991
4. B.Sklar, ¯Digital Communications Fundamentals and Applications‖, 2nd Edition Pearson Education 2007
5. H P Hsu, Schaum Outline Series - ¯Analog and Digital Communications‖ TMH 2006
6. Couch.L., "Modern Communication Systems", Pearson, 2001.

21CS1919   **NETWORK DESIGN AND PROGRAMMING**   **L T P C**
                                                          3 0 0 3
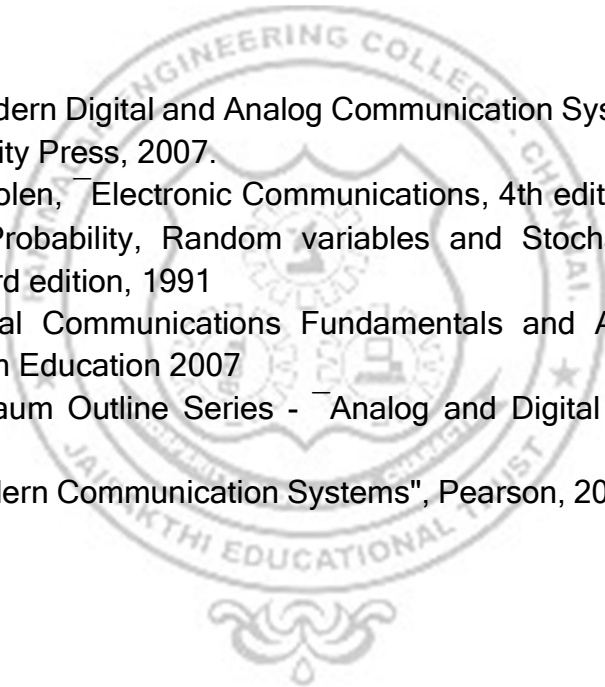
OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic networking principles
- To explore various networking devices and protocols required for network design andmanagement
- To study two novel networking technologies: SDN and DTN
- To learn network programming in UNIX C

UNIT - I   NETWORKING PRINCIPLES   9

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks - Collision detection and collision avoidance, Hidden and Exposed Terminals - Switched networks - Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios -Applications, Quality of Service - End to end level and network level solutions.

UNIT - II   PHYSICAL NETWORK DESIGN   9

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches -Remote Access Technologies and Devices — Modems and DSLs — SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

UNIT - III   LOGICAL DESIGN AND MANAGEMENT   9

IPv4 and IPv6 Dynamic Addressing -Hierarchical routing - VLSMand CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP - VPN -RMON and SNMP

UNIT -IV   INNOVATIVE NETWORKS   9

Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers - Network Function Virtualization - Needs of the Data Centres - SDN solutions for data centres - Delay Tolerant Networks — Overlay architecture — Bundle Protocol — Opportunistic routing and Epidemic routing

UNIT -V   NETWORK PROGRAMMING IN UNIX C   9

Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets - socket, connect, bind, listen, accept and close functions – TCP client and server – Elementary UDP sockets -recvfrom and sendto functions , connect function with UDP – Raw sockets – Client-server design alternatives — Iterative and Concurrent servers.

OUTCOMES:
On successful completion of the course student will be able to:
1. Apply the networking principles to design a network
2. Explore various networking devices
3. Explore protocols required for network design and management
4. Apply SDN in computing paradigms like Cloud Computing and Internet of Things
5. Configure the networking devices and protocols
6. Develop network applications in various platforms

TEXT BOOKS:
1. Larry Peterson and Bruce Davie, ̄Computer Networks: A Systems Approach‖, 5th edition,Morgan Kauffman, 2011
2. W.Richard Stevens, Bill Fenner and Andrew M Rudoff, ̄Unix Network Programming: TheSockets Networking API: Volume 1‖, 3rd Edition, Addison Wesley, 2003
3. Paul Goransson, Chuck Black, ̄Software Defined Networks: A Comprehensive Approach‖,Morgan Kauffman, 2014

REFERENCES:
1. ParitoshPuri, M.P.Singh,- Asurvey paper on routing in delay tolerant networks, International Conference on Information and Computer Networks (ISCON), 2013, DOI:10.1109/ICISCON.2013.6524206
2. Ying Dar Lin, Ren-Hung Hwang and Fred Baker, ̄Computer Networks: An Open Source Approach‖, McGraw Hill, 2011

	L	**T**	**P**	**C**

21IT1916 **WIRELESS TECHNOLOGIES** **L T P C**
                                          3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the concepts of various wireless technologies
- To review the concepts of wireless networks
- To explore the emerging wireless technologies and their potential impact

UNIT - I   WIRELESS LAN and PAN   9

Introduction, fundamentals of WLAN -technical issues, network architecture, IEEE 802.11- physical layer, Mac layer mechanism, CSMA/CA,RTS/CTS, Polling, Bluetooth- User scenarios, Architecture, Radio layer, Baseband layer, Link manager protocol, L2CAP, Security, SDP, IEEE 802.15.3. 19

UNIT - II   WIRELESS INTERNET   9

Introduction – Wireless Internet, address mobility, inefficiency of transport layer and Application layer protocol, mobile IP — simultaneous binding, route optimization, mobile IP variations, handoffs, IPv6 advancements, IP for wireless domain, security in mobile IP, TCP in wireless domain — TCP over wireless , TCPs -traditional, snoop, indirect, mobile, transaction- oriented, impact of mobility.

UNIT - III   AD-HOC SENSOR NETWORK   9

Wireless Sensor Network — Applications, design Challenges, Protocol stack, comparisons with MANET node architecture, network architecture, MAC protocols-requirements, IEEE 802.15.4 MAC protocol, Routing Protocol – energy aware routing, Location based routing, clustering, aggregation, QoS, security protocol, Zigbee standard.

UNIT -IV   3G NETWORKS   9

Evolution from GSM, 3G Services and Applications - UMTS network structure - Core network - UMTS Radio access - HSPA — HSUPA- HSDPA- CDMA 1X - EVDO Rev -0, Rev- A, Rev-B, Rev-C Architecture- Protocol stack, Cognitive Radio network, Spectrum Sensing.

UNIT -V   4G - LTE   9

Overview of LTE Networks - Need for LTE- From LTE to LTE-Advanced SAE :- LTE Architecture, Radio Protocol stack , Interfaces, Concept of HetNET, Quality of Service and Bandwidth Reservation - QoS metrics, Signaling for Bandwidth Requests and Grants, Bandwidth Allocation and Traffic Handling, Mobility Management, Security Protocols

                                                      TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the concepts of various wireless technologies
2. Design the various wireless networks.

3. Design the 4G and LTE networks
4. Design application sensor networks.
5. Design Heterogeneous networks
6. Explore the emerging wireless technologies and their potential impact

TEXT BOOKS:
1. Vijay. K. Garg, ¯Wireless Communication and Networking‖, Morgan Kaufmann Publishers, 2007
2. Abd-Elhamid M. Taha and Hossam S. Hassanein and Najah Abu Ali, ¯LTE, LTE- Advanced andWimax towards IMT-advanced networks‖ John Wiley &Sons , 2012.
3. Jochen Schiller, ¯Mobile Communication‖, Pearson education, 2nd edition 2005.

REFERENCES:
1. HarriHolma and Antti Toskala, ¯HSDPA/HSUPA for UMTS‖, John Wiley & Sons, 2006.

2. Holger Karl and Andreas Willing, ¯Protocols and Architecture for Wireless Sensor Network‖,John Wiley & Sons, 2007.

3. JuhaKorhonen, ¯Introduction to 3G Mobile Communication‖, Artech House, 2003.

4. Larry J. Greenstein, Andrea J. Goldsmith, ¯Principles of Cognitive Radio‖, Cambridge Universitypress, 2013
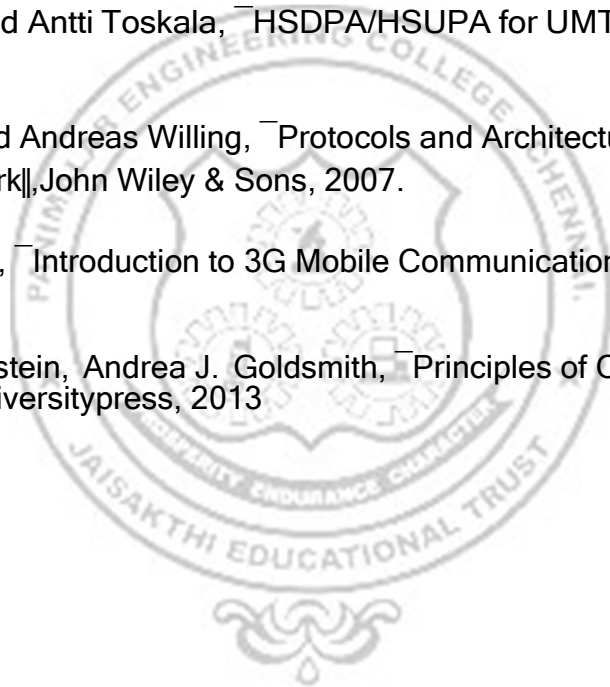
21IT1917 **NETWORK MANAGEMENT** L T P C
3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To appreciate the need for interoperable network management as a typical distributed application
- To familiarize concepts and terminology associated with SNMP
- To be aware of current trends in network management technologies

UNIT - I   OSI NETWORK MANAGEMENT   9

OSI Network management model - Organizational model - Information model, Communication model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/CMIS.

UNIT - II   BROADBAND NETWORK MANAGEMENT   9

Broadband networks and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN, ATM Network Management - ATM Network reference model, Integrated local Management Interface. ATM Management Information base, Role of SNMP and ILMI in ATM Management, M1, M2, M3, M4 interface. ATM Digital Exchange Interface Management.

UNIT - III   SIMPLE NETWORK MANAGEMENT PROTOCOL   9

SNMPv1 Network Management: Communication and Functional Models. The SNMP Communication Model, Functional model. SNMP Management SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base,SNMPv2 Protocol, Compatibility With SNMPv1.Configuration management, Fault management, Performance management, Event Correlation Techniques 168 security management, Accounting management, Report Management, Policy Based Management, Services Level Management.

UNIT -IV   NETWORK MANAGEMENT SYSTEMS   9

Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT -V   WEB-BASED MANAGEMENT   9

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web- Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the need for interoperable network management as a typical distributed application

2. Diagnose problems and make minor repairs to computer networks using appropriate diagnosticssoftware
3. Demonstrate how to correctly maintain LAN computer systems
4. Maintain the network by performing routine maintenance tasks
5. Apply network management tools
6. Understand the concepts and terminology associated with web based management

TEXT BOOKS:
1. Lakshmi G Raman, "Fundamentals of Telecommunication Network Management", EasternEconomy Edition IEEE Press, New Delhi, 1999.
2. Mani Subramanian, "Network Management - Principles and Practice", Pearson Education, Secondedition, 2010.
3. Mani Subramanian, "Network Management Principles and Practice", Addison Wesley, Secondedition, 2010.

REFERENCES:
1. Mark Burges, "Principles of Network System Administration", Wiley, 2000.
2. Salah Aiidarons and Thomas Plevayk, "Telecommunications Network Technologies andImplementations‖, Eastern Economy Edition IEEE press, New Delhi, 1998.
3. Stephen Morris, "Network Management, MIBs and MPLS- Principles, Design and Implementation", Pearson Education, 2003.
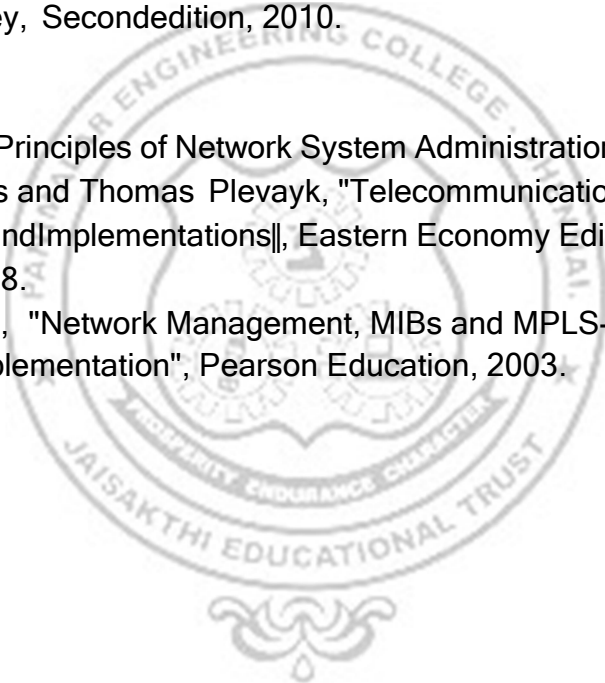
21CS1920   **WIRELESS ADHOC AND SENSOR NETWORKS**   L   T   P   C
                                                                         3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the correspondingsolutions.

UNIT - I   MAC & ROUTING IN AD HOC NETWORKS   9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks - Contention-Based MAC protocols - MAC Protocols Using Directional Antennas - Multiple- Channel MAC Protocols - Power-Aware MAC Protocols - Routing in Ad hoc Networks – Design Issues –Proactive, Reactive and Hybrid Routing Protocols

UNIT - II   TRANSPORT & QOS IN AD HOC NETWORKS   9

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions - Network Layer QoS solutions -QoS Model

UNIT - III   MAC & ROUTING IN WIRELESS SENSOR NETWORKS   9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks - Low duty cycle protocols and wakeup concepts – Contention- Based protocols – Schedule-Based protocols - IEEE 802.15.4 Zigbee - Topology Control - Routing Protocols

UNIT -IV   TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS   9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples

UNIT -V   SECURITY IN AD HOC AND SENSOR NETWORKS   9

Security Attacks - Key Distribution and Management - Intrusion Detection - Software based Anti-tampertechniques - Water marking techniques - Defense against routing attacks - Secure Ad hoc routing protocols — Broadcast authentication WSN protocols — TESLA — Biba — Sensor Network Security Protocols — SPINS

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Identify different issues and challenges in the design of wireless adhoc and sensor networks
2. Understand the working of MAC and Routing Protocols for ad hoc and sensor networks
3. Understand the Transport Layer protocols and
4. Analyze the QoS for ad hoc and sensor networks.
5. Analyze protocols developed for ad hoc and sensor networks.
6. Identify and understand security issues in ad hoc and sensor networks.

TEXT BOOKS:
1. C.Siva Ram Murthy and B.S.Manoj, ¯Ad Hoc Wireless Networks – Architectures and Protocols‖,Pearson Education, 2006.
2. Holger Karl, Andreas Willing, ¯Protocols and Architectures for Wireless Sensor Networks‖, JohnWiley & Sons, Inc., 2005.

REFERENCES:
1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, ¯Ad Hoc Mobile Wireless Networks‖,Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, ¯Ad Hoc and Sensor Networks: Theoryand Applications (2nd Edition)‖, World Scientific Publishing, 2011.
3. Waltenegus Dargie, Christian Poellabauer, ¯Fundamentals of Wireless Sensor Networks Theoryand Practice‖, John Wiley and Sons, 2010
4. Xiang-Yang Li , ¯Wireless Ad Hoc and Sensor Networks: Theory and Applications‖, 1227 thedition, Cambridge university Press,2008.

		L	**T**	**P**	**C**
21IT1918	**PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the concepts of wireless sensor networks
- To understand the protocols for WSN
- To get exposure on WSN environment with TinyOS and like
- To understand the layered approach in sensor networks
- To design WSN and analyse performance

UNIT - I   WIRELESS SENSOR NETWORK ARCHITECTURE   9

ntroduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT - II   DATA LINK LAYER   9

MAC protocols — fundamentals, low duty cycle protocols and wakeup concepts, contention- based protocols, Schedule-based protocols - SMAC, BMAC,TRAMA, Link Layer protocols – fundamentals task and requirements, error control, framing, link management, Naming and addressing - address assignment, unique, Content-based and geographical addressing.

UNIT - III   NETWORK LAYER   9

Routing protocols – Requirements, Taxonomy - Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing — COUGAR, ACQUIRE, Hierarchical Routing — LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques, Localization and positioning - Properties, Approaches, Mathematical basics for single hop and multi-hop environment.

UNIT -IV   TRANSPORT LAYER   9

Transport Protocol, Coverage and deployments - Sensing models, Coverage measures, Random deployments: Poisson model, Boolean sensing model, general sensing model, Coverage determination, grid deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control, Time synchronization - Issues and protocol - Sender/Receiver, Security – protocols and KeyDistribution Techniques.

UNIT -V   TOOLS FOR WSN   9

TinyOS - Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment - Cooja simulator, Programming.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the concepts of wireless sensor networks
2. Understand the protocols for WSN
3. Understand the layered approach in sensor networks
4. Design energy efficient WSNs.
5. Design and implement protocols in TinyOS and Contiki.
6. Design application dependent WSNs.

TEXT BOOKS:
1. Holger Karl , Andreas willig, ¯Protocol and Architecture for Wireless Sensor Networks‖, JohnWiley Publication, 2006.

2. KazemSohraby, Daniel Minoli and TaiebZnati, ¯Wireless Sensor NetworksTechnology Protocols and Applications‖, John Wiley & Sons, 2007.
3. Paolo Santi, ¯Topology Control in Wireless Adhoc and Sensor Networks‖, John Wiley & Sons,2005.

REFERENCES:
1. Anna Hac, ¯Wireless Sensor Network Design‖, John Wiley & Sons, 2003.
2. C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, ¯Wireless SensorNetworks‖, Springer Publication, 2004
3. Philip Levis, David Gay,"TinyOS Programming", Cambridge University Press, 2009
4. Contiki - Open Source Operating System for IOT - http://www.contiki-os.org/

21CS1921   **NEXT GENERATION NETWORKS**   L T P C
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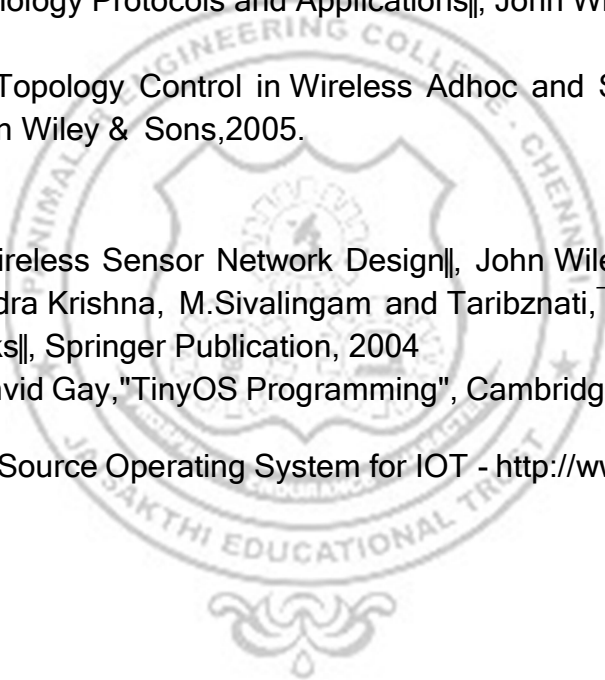
OBJECTIVES: To impart Knowledge on the following topics:

- To learn the technical, economic and service advantages of next generation networks.
- To learn the evolution of technologies of 4G and beyond.
- To learn Software defined Mobile Network issues and integrating challenges with LTE.
- To explore the NGN framework catering the services of end user with QoS provisioning.
- To learn about the NGM management and standards.

UNIT - I   INTRODUCTION   9

Evolution of public mobile services -motivations for IP based services, Wireless IP network architecture — 3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends.

UNIT - II   4G and BEYOND   9

Introduction to LTE-A -Requirements and Challenges, network architectures – EPC, E-UTRAN architecture-mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT - III   SDMN-LTE INTEGRATION   9

SDN paradigm and applications, SDN for wireless-challenges, Leveraging SDN for 5G networks- ubiquitous connectivity-mobile cloud-cooperative cellular network-restructuring mobile networks to SDN- SDN/LTE integration benefits.

UNIT -IV   NGN ARCHITECTURE   9

Evolution towards NGN-Technology requirements, NGN functional architecture-Transport stratum, service stratum, service/ content layer and customer terminal equipment function. NGN entities, Network and Service evolution -fixed, mobile, cable and internet evolution towards NGN.

UNIT -V   NGN MANAGEMENT AND STANDARDIZATION   9

NGN requirements on Management-Customer, third party, Configuration, Accounting, performance, device and information management. Service and control management- End-to-End QoS and security. ITU and GSI-NGN releases, ETSI-NGN concept and releases, NGMN alliance and NGMN.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the technical, economic and service advantages of next generation networks.

2. Understand the issues and challenges of wireless domain in future generation network design.
3. Understand the evolution of technologies of 4G and beyond.
4. Explore the LTE concepts and technologies.
5. Understand the integration of SDN with LTE.
6. Understand the NGN management and standardizations.

TEXT BOOKS:
1. Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials" Wiley,January 2008.

2. Martin Sauter,"3G,4G and Beyond bringing networks, devices and web together", Wiley, 2ndedition-2013.

3. Thomas Plavyk, ¯Next generation Telecommunication Networks, Services and Management‖,Wiley & IEEE Press Publications, 2010.

REFERENCES:
1. Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyondLTE Network Architecture", Wiley, June 2015.
2. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rdedition- 2016.
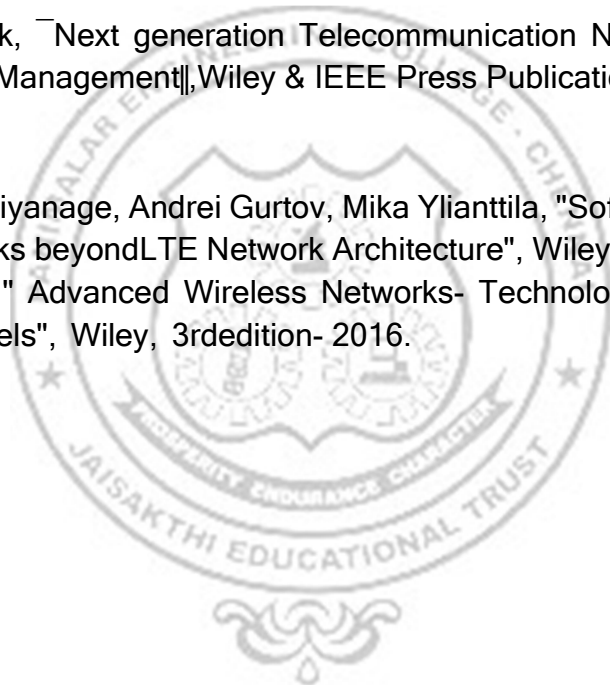
21IT1919   **SOFTWARE DEFINED NETWORKS**   L   T   P   C
                                                       3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT - I   **SDN: INTRODUCTION**   **9**

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Controlplane and Application Plane

UNIT - II   **SDN DATA PLANE AND CONTROL PLANE**   **9**

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT - III   **SDN APPLICATIONS**   **9**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT -IV   **NETWORK FUNCTION VIRTUALIZATION**   **9**

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT -V   **NFV FUNCTIONALITY**   **9**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases — SDN and NFV

                                         TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the need for SDN and its data plane operations
2. Describe the motivation behind SDN
3. Identify the functions of the data plane and control plane
4. Design and develop network applications using SDN
5. Orchestrate network services using NFV
6. Explain various use cases of SDN and NFV

TEXT BOOKS:

1. William Stallings, ¯Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud‖,Pearson Education, 1st Edition, 2015.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, ¯Network Function Virtualization‖, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, ¯SDN: Software Defined Networks‖, O'Reilly Media, 2013.
3. Fei Hu, ¯Network Innovation through OpenFlow and SDN: Principles and Design‖, 1st Edition,CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, ¯Software Defined Networks: AComprehensive Approach‖, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, ¯Software-Defined Networking with OpenFlow‖, 2nd Edition,O'Reilly Media, 2017.

	L	T	P	C
21CE1010 AIR POLLUTION AND CONTROL ENGINEERING	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT - I   INTRODUCTION   9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards -Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT - II   METEOROLOGY   9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT - III   CONTROL OF PARTICULATE CONTAMINANTS   9

Factors affecting Selection of Control Equipment - Gas Particle Interaction - Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT - IV   CONTROL OF GASEOUS CONTAMINANTS   9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT - V   INDOOR AIR QUALITY MANAGEMENT   9

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution - Measurement - Standards - Control and Preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
2. Ability to identify, formulate and solve air and noise pollution problems

3. Ability to design stacks and particulate air pollution control devices to meet applicable standards.
4. Ability to select control equipment's.

5. Ability to ensure quality, control and preventive measures.
6. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management

TEXTBOOKS:
1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, ¯Air Pollution Control Engineering‖, Tokyo, springer science + science media LLC,2004.

2. Noel de Nevers, ¯Air Pollution Control Engineering‖, Waveland press,Inc 2017.

3. Anjaneyulu. Y, ¯Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES:
1. David H.F. Liu, Bela G. Liptak, ¯Air Pollution‖, Lweis Publishers, 2000.

2. Arthur C. Stern, ¯Air Pollution (Vol.I - Vol.VIII)‖, Academic Press, 2006.

3. Wayne T.Davis, ¯Air Pollution Engineering Manual‖, John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, ¯Air Pollution‖, Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, ¯Environmental Pollution Control Engineering‖, New Age International(P) Limited Publishers,2006.

21CE1001	ENERGY CONSERVATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart knowledge on the principle of Energy Conversion and Management
- To provide details of Energy Conservation, Energy Management &. Audit.
- To impart knowledge on the principle of Energy Conversion and Management

UNIT - I	ENERGY SCENARIO AND ENERGY CONSERVATION ACT 2001	9

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energyintensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.
Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.

UNIT - II	FINANCIAL MANAGEMENT, ENERGY MONITORING AND TARGETING	9

Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs).Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

UNIT - III	ENERGY MANAGEMENT & AUDIT	9

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.

UNIT - IV	ENERGY EFFICIENCY IN THERMAL UTILITIES AND SYSTEMS	9

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation.
Steam System: Properties of steam, assessment of steam distribution losses, steamleakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance

assessment of steam system, thermo- compressor, steam pipe insulation, condensate pumping, steam dryers.

Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

**UNIT - V   ENERGY AND ENVIRONMENT, AIR POLLUTION,   9
                         CLIMATE CHANGE**

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To summarized the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation.
2. To infer the concept of financial management, energy monitoring and targeting.
3. To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.
4. To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.
5. To evaluate the net present worth in financial management and performance assessment of various thermal utilities and systems

TEXT BOOKS:

1. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication.
2. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press

REFERENCES:

1. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.

2. Bureau of Energy Efficiency Reference book: No.1, 2, 3, 4.

3. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing

		L	**T**	**P**	**C**
21GE1004	**HOSPITAL WASTE MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- Understand the hazardous materials used in
- Understand various waste disposal procedures and management.
- Understand the various facility guidelines of administrative area safety and control of hazardous energy
- Understand the inputs of healthcare immunizations and medication safety.

UNIT - I	**HEALTH CARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS**	**9**

Healthcare Hazard Control: Introduction, Hazard Control, Hazard Control Management and responsibilities, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees and System Safety. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers' Compensation.

UNIT - II	**BIOMEDICAL WASTE MANAGEMENT**	**9**

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and Classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labelling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT - III	**HAZARDOUS MATERIALS**	**9**

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT - IV	**FACILITY SAFETY**	**9**

Facility Safety : Introduction, Facility Guidelines: Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colours, and Marking Requirements, Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT - V	**INFECTION CONTROL, PREVENTION AND PATIENTSAFETY**	**9**

Healthcare Immunizations, Centres for Disease Control and Prevention, Disinfectants , Antiseptics, OSHA Blood borne Pathogens Standard and Healthcare Opportunistic Infections. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centred Healthcare

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Analyse various hazards, accidents and its control.
2. Design waste disposal procedures for different biomedical wastes.

3. Categorize different biomedical wastes based on its properties.
4. Outline the Hazardous safety and its Healthcare hazardous Material regulations.
5. Design different safety facility in hospitals.
6. Propose various regulations and safety norms.

TEXT BOOKS:
1. Tweedy, James T., Healthcare
2. Anantpreet Singh, SukhjitKaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).
3. Solid and Hazardous Waste Management, Second Edition by M.N. Rao (Author), Razia Sultana (Author)-BS Publications.
4. Infectious and Medical Waste Management By Peter A. Reinhardt -CRC Press

REFERENCES:
1. R.C.Goyal, ‾Hospital Administration and Human Resource Management‖, PHI – Fourth Edition,2006
2. J. Landrum, ‾Medical Waste Management and disposal‖, Elsevier, 1991
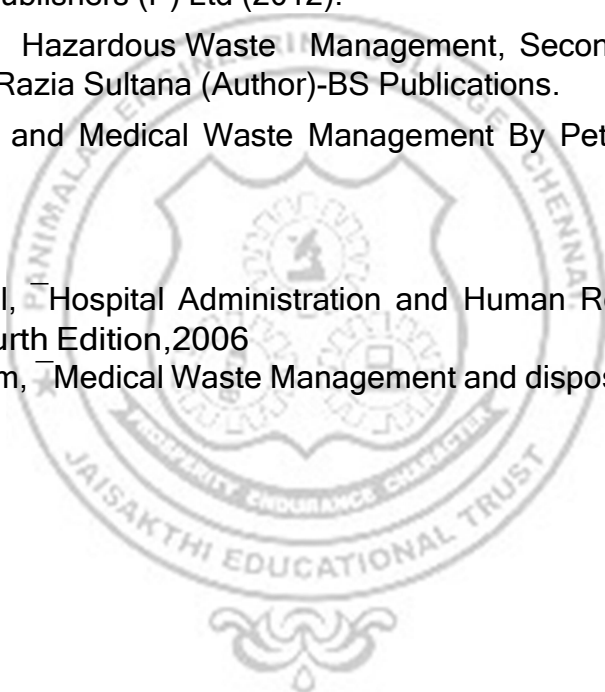
		L	T	P	C
21CY1001	**INDUSTRIAL NANO TECHNOLOGY**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- To learn about basis of nanomaterial science.
- To learn about preparation of nanomaterials.
- To learn about characterizations of nanomaterials.
- To learn about applications of nanomaterials in medicine and engineering

UNIT - I   INTRODUCTION OF NANOTECHNOLOGY   9

Origin of nanoscale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering - Classifications of nanostructured materials- nanoparticles- quantum dots, nanowires- ultra-thinfilms - multilayered materials. Effects of nanoscale materials on physicochemical, mechanical, electronic and optical properties.

UNIT - II   PREPARATION METHODS   9

Bottom-up synthesis and top-down approach - co-precipitation, sol-gel method, electro deposition, self-assembly, sputtering, mechanical ball milling and vapour phase deposition.

UNIT - III   CHARACTERIZATION TECHNIQUES   9

X-ray diffraction technique (XRD), Scanning Electron Microscope (SEM) - environmental techniques - Transmission Electron Microscopy including high-resolution imaging (HRTEM), Surface Analysis techniques - Atomic Force Microscope (AFM), Scanning Probe Microscope (SPM), Scanning Tunneling microscope (STM) and Nano indentation

UNIT - IV   NANOTECHNOLOGY IN MEDICINE   9

Nano biotechnology: Nano-probes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bio-imaging, Quantum dots for cancer treatment nanorobotics for surgery - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) for healthcare - nano-crystalline silver for bacterial inhibition.

UNIT - V   NANOTECHNOLOGY IN NGINEERING   9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip. Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery. Sensors – Classification, Types of sensors, properties, biosensors, nanosensors, nanobiosensors. Nanotoxicity.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Familiarize about the science of nanomaterial's.
2. Demonstrate the preparation of nanomaterial's

3. Develop the knowledge in characteristic nanomaterial.
4. Understand about the role of nanotechnology in the field of medicine.
5. Understand applications of nanoscience in technology.
6. Understand applications of nanoscience in sensors.

TEXT BOOKS:
1. A.S. Edelstein and R.C. Cammearata, eds., ‟Nanomaterials: Synthesis, Properties and Applications‖, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, ‟NanoscaleCharecterisation of surfaces & Interfaces‖, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.
3. Christof M. Niemeyer, Chad A. Mirkin, Nanobiotechnology, Concepts, Applications

REFERENCES:
1. G Timp, ‟Nanotechnology‖, AIP press/Springer, 1999.
2. Malsch, Neelina H, (et), Biomedical Nanotechnology, Washington, DC; CRC Press, 2005
3. AkhleshLakhtakia,‟The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations‖. Prentice-Hall of India (P) Ltd, New Delhi, 2007.
4. HocineYahia Shape Memory Implants, Springer Verlag, 2000.
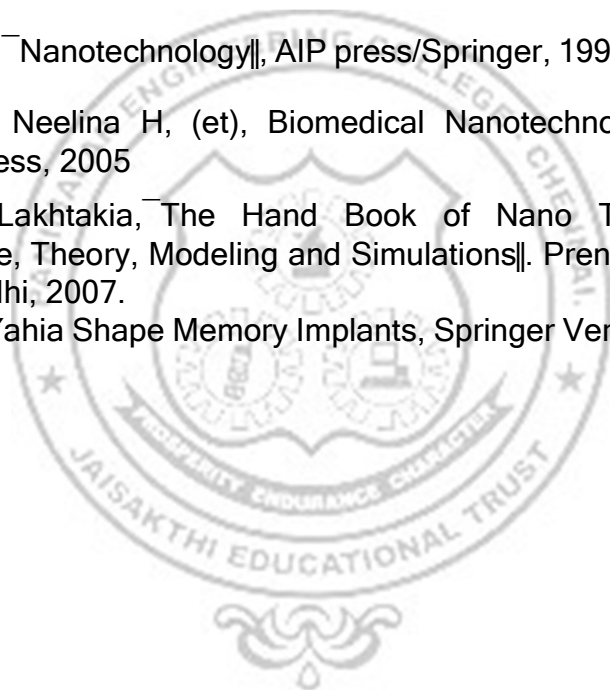
21EE1003 **LOGIC AND DISTRIBUTED CONTROL SYSTEM** L T P C
                                                        3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To give an introductory knowledge about PLC and the programming languages.
- To give basic knowledge in the architecture and local control unit of distributed control system.
- To give basic knowledge about Computer Controlled Systems
- To give adequate information in the interfaces used in DCS.

UNIT-I   **PLC & SCADA**   **9**

PLC: Evolutions of PLCs - Programmable Controllers - Architecture, I/O modules - Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures

UNIT-II   **BASICS OF PLC PROGRAMMING(LADDER)**   **9**

Basics of PLC programming - Ladder Logic - Relay type instructions - Timer/Counter instructions - Program control instructions - Data manipulation and math instructions – Programming Examples .

UNIT-III   **PLC PROGRAMMING (OTHER LANGUAGES)**   **9**

Functional block programming - Sequential function chart - Instruction list - Structured text programming – PLC controlled sequential Process Examples.

UNIT-IV   **DISTRIBUTED CONTROL SYSTEM**   **9**

DCS: Evolution & types - Hardware architecture - Field control station - Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller - Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.

UNIT-V   **ADVANCED TOPICS IN AUTOMATION**   **9**

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation - OLE for Process Control - Safety PLC - Case studies: PLC - SCADA – DCS

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand components such as PLC, SCADA, DCS,I/O modules and field devices of an industrial automation system.
2. Develop the program using PLC for industrial applications.
3. Program a PLC using ladder logic .
4. Describe the functionality of SCADA.
5. Understand the systems used in distributed control systems.

TEXTBOOKS:
1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010.
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker, Inc., Newyork ,1990.

REFERENCES:
1. Clarke, G., Reynders, D. and Wright, E., ¯Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems‖, Newnes, 1st Edition, 2004.
2. Hughes, T.A., ¯Programmable Logic Controllers: Resources for Measurements and Control Series‖, 3rd Edition, ISA Press, 2004.
3. McMillan, G.K., ¯Process/Industrial Instrument and Controls Handbook‖, 5thEdition, McGraw- Hill handbook, New York, 1999.

	L	T	P	C
21EC1011 **TELE HEALTH TECHNOLOGY**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To know telecommunication basics and practices
- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical tandards,mobile telemedicine and its applications.

UNIT-I   **TELEMEDICINE AND HEALTH**   **9**

History and Evolution of telemedicine, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine

UNIT-II   **TELEMEDICAL TECHNOLOGY**   **9**

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication, Mobile communication.

UNIT-III   **TELEMEDICAL STANDARDS**   **9**

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series Video Conferencing, Security and confidentiality of medical records, Cyber laws related to telemedicine.

UNIT-IV   **MOBILE TELEMEDICINE**   **9**

Tele radiology: Image Acquisition system Display system, Tele pathology, Medical information storage and management for telemedicine- patient information, medical history, test reports, medical images, Hospital information system.

UNIT-V   **TELEMEDICAL APPLICATIONS**   **9**

Telemedicine – health education and self-care. • Introduction to robotics surgery, Telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Business aspects - Project planning and costing, Usage of telemedicine.

TOTAL:45PERIODS

OUTCOMES:
Onsuccessfulcompletionofthecoursestudentwillbeableto:
1. Apply multimedia technologies in telemedicine
2. Explain protocols behind encryption techniques for secure transmission of data
3. Apply telehealth in healthcare

TEXTBOOKS:

1. Norris, A.C. Essentials of Telemedicine and Telecare, Wiley, 2002

2. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd, Taylor and Francis 2006 Wiley 1999 (unit-3,4&5)

REFERENCES:

1. OCarroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), Public Health Informatics and Information Systems, Springer, 2003.
2. Ferrer-Roca, O., Sosa – Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.

3. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.

4. Bemmel, J.H. van, Musen, M.A. (Eds.) Handbook of Medical Informatics. Heidelberg, Germany: Springer, 1997

5. Mohan Bansal ‖ Medical Informatics‖, Tata McGraw-Hill, 2004.

OPEN ELECTIVE – II

		L	T	P	C
21EE1001	**BASIC CIRCUIT THEORY**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- ⅄ To introduce electric circuits and its analysis
- ⅄ To impart knowledge on solving circuit equations using network theorems
- ⅄ To introduce the phenomenon of resonance in coupled circuit
- ⅄ To educate on obtaining the transient response of circuits.
- ⅄ To introduce Phasor diagrams and analysis of three phase circuits
- ⅄ To introduce electric circuits and its analysis

UNIT - I   **BASIC CIRCUITS ANALYSIS CABLES**   **9**

Resistive elements – Ohm's Law Resistors in series and parallel circuits – Kirchhoff's laws – Mesh current and node voltage - methods of analysis.

UNIT - II   **NETWORK REDUCTION AND THEOREMS FOR DC AND AC**   **9**
                                    CIRCUITS

Network reduction: voltage and current division, source transformation - star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem - Millman's theorem..

UNIT - III   **TRANSIENT RESPONSE ANALYSIS**   **9**

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT - IV   **THREE PHASE CIRCUITS**   **9**

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT - V   **RESONANCE AND COUPLED CIRCUITS**   **9**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance - Coefficient of coupling - Tuned circuits - Single tuned circuits.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Ability to comprehend the basics of circuit analysis.
2. Ability of solve electrical circuits using theorems
3. Ability to analyze the transient response

4. Able to comprehend the three phase circuits
5. Able to understand coupled circuits

TEXT BOOKS:
1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, ‾Engineering Circuits Analysis‖, McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, ‾Fundamentals of Electric Circuits‖, Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, ‾Circuit Analysis Theory and Practice‖, Cengage Learning India, 2013
4. Sudhakar A and Shyam Mohan SP, ‾Circuits and Network Analysis and Synthesis‖, McGraw Hill, 2015.

REFERENCES:
1. Chakrabarti A, ‾Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, 1999.
2. Jegatheesan, R., ‾Analysis of Electric Circuits,‖ McGraw Hill, 2015.
3. Joseph A. Edminister, MahmoodNahri, ‾Electric circuits‖, Schaum‟s series, McGrawHill, New Delhi, 2010.
4. M E Van Valkenburg, ‾Network Analysis‖,Prentice-Hall of India Pvt Ltd, New Delhi, 2015
5. Mahadevan, K., Chitra, C., ‾Electric Circuits Analysis,‖ Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
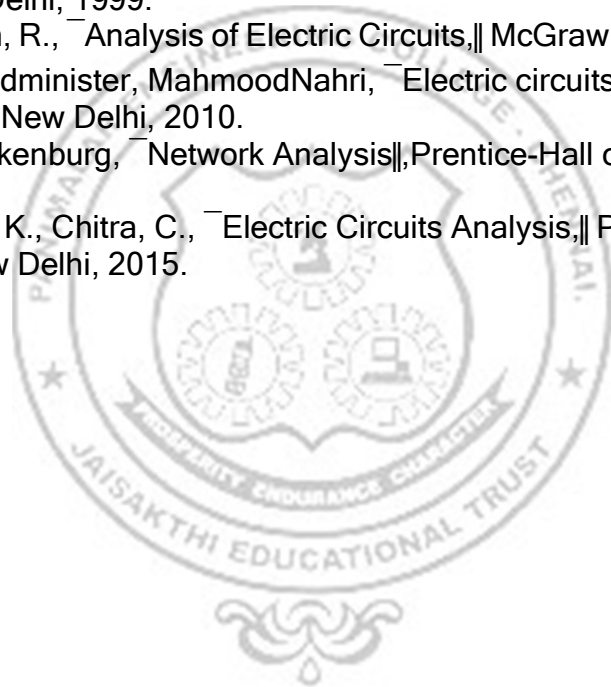
	L	**T**	**P**	**C**

21CY1002   **ENERGY TECHNOLOGY**   **3   0   0   3**

OBJECTIVES: To impart Knowledge on the following topics:
   ỿ   To gain knowledge about different energy sources
   ỿ   To attain knowledge in energy conservation

UNIT - I   ENERGY   9
Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, environmental aspects of energy utilisation, energy alternatives.

UNIT - II   CONVENTIONAL ENERGY   9
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT - III   NON-CONVENTIONAL ENERGY   9
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, application of nano technology in solar energy conversion, energy plantations. Wind energy, types of windmills, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy, hydrogen energy.

UNIT - IV   BIOMASS ENERGY   9
Biomass origin - Resources - Biomass estimation. Thermochemical conversion - Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, bioCNG, integrated gasification.

UNIT - V   ENERGY CONSERVATION   9
Energy conservation - Act; Energy management definition, importance, duties and responsibilities; Energy audit – need, Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management – waste to energy conservation technologies (plastic to petrol).

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
   **1.**   Become intellectual in energy studies

2. Understand conventional Energy sources.
3. Understand the concept of various non-conventional energy resources
4. Attain knowledge in biomass sources and develop design parameters for equipments to be used in chemical process industries
5. Understand energy conservation in process industries

TEXT BOOKS:

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.
4. Energy Management, Paul W.O"Callaghan McGraw – Hill, 1993
5. Khan B.H. Non-Conventional Energy Resources, The McGraw Hills, 2nd Edition 2016.

REFERENCES:

1. NejatVezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981
4. . Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008
5. John W Twidell and Tony D Weir Renewable Energy Resources, Taylor and Francis, 2nd Edition 2006.
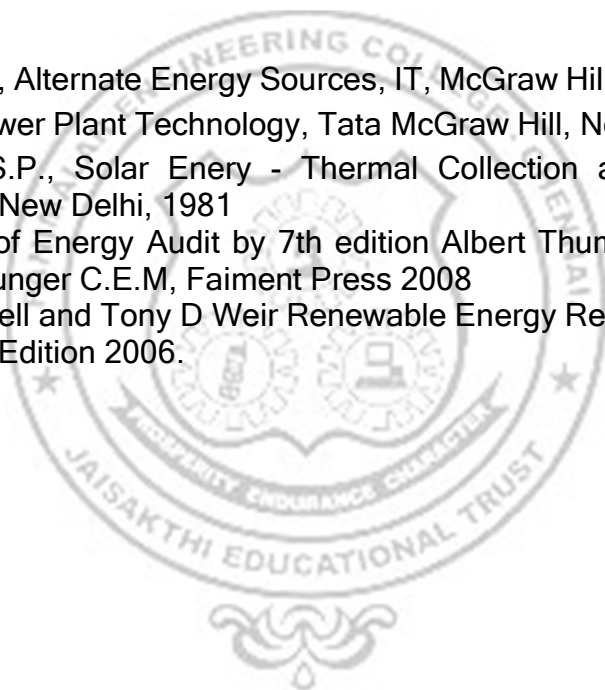
	L	**T**	**P**	**C**
21EC1004 **ELECTRONIC DEVICES**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:
- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LCD and other Opto-electronic devices

UNIT-I   **9**
SEMICONDUCTOR DIODE

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT-II   **9**
BIPOLAR JUNCTION TRANSISTORS

N PN -PNP - Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - h-parameter model, Ebers Moll Model, Multi Emitter Transistor.

UNIT-III   **9**
FIELD EFFECT TRANSISTORS

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

UNIT-IV   **9**
SPECIAL SEMICONDUCTOR DEVICES
M Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Zener diode-Varactor diode - Gallium Arsenide device, LDR.

UNIT-V   **9**
POWER DEVICES AND DISPLAY DEVICES

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS, LCD, Photo transistor, Opto Coupler, CCD.

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Explain the V-I characteristics of semiconductor diode.
2. Classify the configurations of BJT and understand its equivalence circuits.
3. Understand the drain – transfer characteristics of FET.
4. Illustrate the characteristics of special semiconductor devices.
5. Outline the concepts of power devices.
6. Outline the concepts of display devices.

TEXTBOOKS:

1. Donald A Neaman, ¯Semiconductor Physics and Devices‖, Fourth Edition, Tata McGrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, ¯Electronic Devices and circuits‖, Third Edition, Tata McGraw- Hill, 2008.

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, ¯Electron Devices and Circuit Theory Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, ¯ A Text Book of Applied Electronics S.Chand Publications, 2006.

3. Yang, ¯Fundamentals of Semiconductor devices, McGraw Hill International Edition,1978.

		L	T	P	C
21CE1009	**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**	3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT-I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT-II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks – Checklist Methods – Mathematical models for Impact prediction.

UNIT-III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing-Environmental Clearance

UNIT-IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis-

UNIT-V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Carry out scoping and screening of developmental projects for environmental and social assessments
2. Explain different methodologies for environmental impact prediction and assessment
3. Plan environmental impact assessments and environmental management plans
4. Evaluate environmental impact assessment reports

TEXTBOOKS:

1. Canter, R.L, ¯Environmental impact Assessment ¯, 2nd Edition, McGraw Hill Inc, New Delhi,1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu,¯Environmental Impact Assessment for Developing Countries in Asia‖, Volume 1 – Overview, Asian Development Bank,1997.
3. Peter Morris, RikiTherivel ¯Methods of Environmental Impact Assessment‖, Routledge Publishers,2009.

REFERENCES:

1. Becker H. A., Frank Vanclay,¯The International handbook of social impact assessment‖ conceptual and methodological advances, Edward Elgar Publishing,2003.
2. Barry Sadler and Mary McCabe, ¯Environmental Impact Assessment Training Resource Manual‖, United Nations Environment Programme,2002.
3. Judith Petts, ¯Handbook of Environmental Impact Assessment Vol. I and II‖, Blackwell Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.
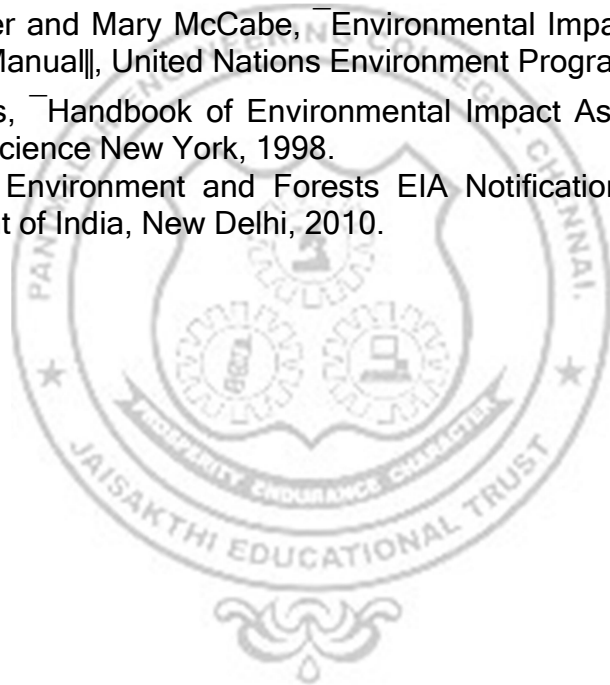
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21GE1003 **HOSPITAL MANAGEMENT** **3 0 0 3**

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the fundamentals of hospital administration and management
- To know the market related research process
- To explore various information management systems and relative supportive services
- To learn the quality and safety aspects in hospital

UNIT-I **9**
OVERVIEW OF HOSPITAL ADMINISTRATION

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Role of hospital administration – Hospital system - Need for scientific planning and design of hospitals

UNIT-II **9**
HUMAN RESOURCE MANAGEMENT IN HOSPITAL

Principles of HRM – Functions of HRM – Profile of HRD Manager – Human Resource Inventory – Manpower Planning – Significance – Importance of HR Planning – Factors influencing HR Planning Process – Job Analysis

UNIT-III **9**
RECRUITMENT AND TRAINING

Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer Performance Appraisals: Techniques & Practices

UNIT-IV **9**
SUPPORTIVE SERVICES

Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services -Transportation services – Mortuary services – Hospital security services

UNIT-V **9**
COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL

Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules – Challenges of e-health – electronic medical records

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Explain the principles of Hospital administration
2. Identify the importance of Human resource management
3. List various marketing research techniques
4. Identify Information management systems and its uses
5. Explain the principles of Hospital administration

TEXTBOOKS:

1. R.C.Goyal, ¯Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006
2. G.D.Kunders, ¯Hospitals - Facilities Planning and Management - TMH, New Delhi – Fifth Reprint 2007
3. Stephen P. Robbins and Mary Coulter, Management (Prentice Hall of India Pvt. Ltd., New Delhi)
4. J.E. Park and K. Park, Textbook of Preventive and Social Medicine (M/S BanarsidasBhanot Publishers, Jabalpur)
5. Elaine La Monica, Management in Health Care (Macmillan Press Ltd, London) References
6. B.M. Sakharkar, Principles of Hospital Administration and Planning (Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi)

REFERENCES:

1. Cesar A.Caceres and Albert Zara, ¯The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, ¯Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Peter Berman ¯Health Sector Reform in Developing Countries‖ - Harvard University Press, 1995.
4. William A. Reinke ¯Health Planning For Effective Management‖ - Oxford University Press.1988
5. Blane, David, Brunner, ¯Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press 2002.
6. Arnold D. Kalcizony& Stephen M. Shortell, ¯Health Care Management‖, 6th Edition Cengage Learning, 2011.

21EC1002	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:
- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT-I   ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT-II   BIO-CHEMICAL AND NON ELECTRICAL PARAMETER   9
MEASUREMENT

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT-III   ASSIST DEVICES   9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT-IV   PHYSICAL MEDICINE AND BIOTELEMETRY   9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT-V   RECENT TRENDS IN MEDICAL INSTRUMENTATION   9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Know the human body electro- physiological parameters and recording of bio-potentials
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
4. Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods
5. Know about recent trends in medical instrumentation

TEXTBOOKS:

1. Khandpur, R.S., ̄Handbook of Biomedical Instrumentation‖, TATA McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Leslie Cromwell, ̄Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, ̄Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, ̄Introduction to Biomedical Equipment Technology‖, John Wiley and Sons, New York, 2004

21EC1006   **SIGNALS AND SYSTEMS**   **L T P C**
                                                                       3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- To understand the basic properties of signals.
- To analyze the basic systems using properties.
- To analyze the characteristics of continuous time signals in the Fourier and Laplace domain
- To analyze LTI – Continuous time systems in Time domain and Frequency domain
- To analyze the characteristics of Discrete time signals in the Fourier and Z transform domain
- To analyze LTI - Discrete time systems in Time domain and Frequency domain

UNIT- I   **CLASSIFICATION OF SIGNALS AND SYSTEMS**   **9**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classificationofsignals – Continuous time (CT) and Discrete Time (DT) signals, Periodic &Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT- II   **ANALYSIS OF CONTINUOUS TIME SIGNALS**   **9**

Fourier Series for periodic signals -Analysis of Continuous Time Signals using Fourier Transform – Inverse FT -Properties of FT, CT analysis using Laplace Transform- Unilateral LT and Bilateral LT- Inverse LT- Properties of Unilateral LT.

UNIT- III   **LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS**   **9**

Impulse response - convolution integrals – Graphical method - Properties of convolution integral- Overall impulse response for interconnected systems - Fourier and Laplace transforms in Analysis of CT systems - Solving of Differential Equation.

UNIT- IV   **ANALYSIS OF DISCRETE TIME SIGNALS**   **9**
Baseband signal sampling -Analysis of Discrete Time Signals using Discrete Time Fourier Transform (DTFT)- Inverse DTFT-Properties of DTFT- Analysis of Discrete Time Signals using Z-Transform – Inverse Z-Transform - Properties of Z-Transform.

UNIT- V   **LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS**   **9**

Impulse response – Convolution sum -Graphical method - Properties of Discrete Convolution- Overall iimpulse response for interconnected systems -Solving of Difference equations- Solution of Difference equation using DTFT- solution of difference equation using Z-transform.

                                                                      TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand the basics of signals and its classifications
2. Analyze the basic systems and its classifications
3. Determine the frequency Response for Deterministic signal and also analyze in S-domain
4. Apply the Fourier and Laplace Transform for the analysis of LTI -Continuous Time systems
5. Analyze the Characteristics of DT signals by using DTFT and Z-transform
6. Apply the Fourier and Z- Transform for the analysis of LTI -Discrete Time systems

TEXTBOOKS:
1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, ˉSignals and Systems‖,Pearson,2015.
2. S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2007.

REFERENCES:
1. B.P.Lathi,ˉPrinciples of Linear Systems and Signals‖,Second Edition,Oxford,2009.
2. R.E.Zeimer,W.H.Tranter and R.D.Fannin,ˉSignals &Systems-Continuous and Discrete‖,Pearson,2007.
3. John Alan Stuller,ˉAn Introduction to SignalsandSystems‖,Thomson,2007.
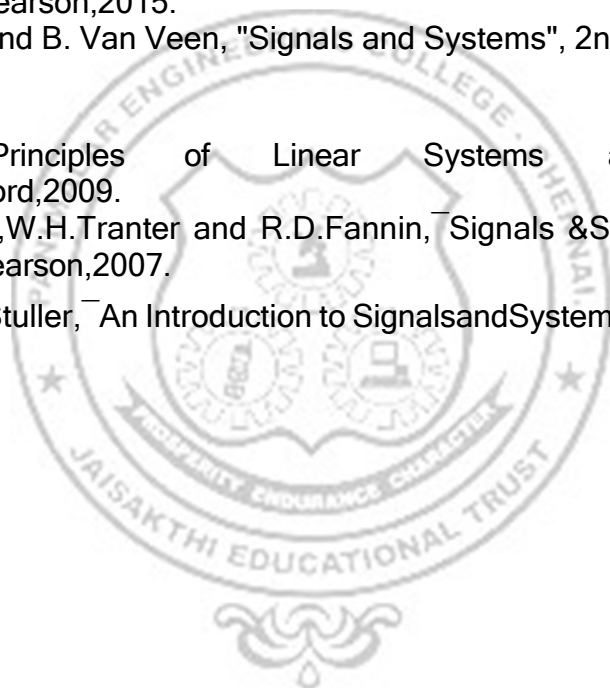
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21ME1006   **SYSTEMS ENGINEERING**   L T P C
                                                                          3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- Illustrate the life cycle phases and framework for systems engineering.
- Describe about systems engineering process.
- Apply ergonomic and system dynamic models for evaluation of alternatives.
- Create knowledge on Reliability, Markov and Time series models for analysis f alternatives.
- Describe about decision assessment methods in systems engineering.

UNIT-I   **INTRODUCTION**   **9**

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT-II   **SYSTEMS ENGINEERING PROCESSES**   **9**

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT-III   **ANALYSIS OF ALTERNATIVES - I**   **9**

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

UNIT-IV   **ANALYSIS OF ALTERNATIVES – II**   **9**

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT-V   **DECISION ASSESSMENT**   **9**

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management

TOTAL:45PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Be able to recognize life cycle phases in systems engineering.
2. Apply steps in systems engineering process for large scale problems.
3. Able to develop system dynamic models for analyzing alternatives.
4. Gain ability to evaluate alternatives in large scale problems.
5. Be able Attain confidence in assessment and arrive decisions for complex problems.

TEXTBOOKS:

1. Andrew P. Sage, James E. Armstrong Jr. ¯Introduction to Systems Engineering‖, John Wiley and Sons, Inc, 2000.
2. Alexander Kossiakoff, Steven M. Biemer, Samuel J. Seymour, David A. Flanigan "Systems Engineering Principles and Practice", 3rd Edition

REFERENCES:

1. Andrew P.Sage, ¯Systems Engineering‖, John Wiley & Sons, 1992.

2. Andrew P.Sage, William B.Rouse, ¯Hand book of Systems Engineering and Management‖, John Wiley & Sons, 1999.

21ME1008 **SUPPLY CHAIN MANAGEMENT**   **L T P C**
                                              3 0 0 3

OBJECTIVES: To impart Knowledge on the following topics:
- Describe the role and drivers of and supply chain management in achieving competitiveness.
- Explain about Supply Chain Network Design.
- Illustrate about the issues related to Logistics in Supply Chain
- Appraise about Sourcing and Coordination in Supply Chain.
- Application of Information Technology and Emerging Concepts in Supply Chain.

UNIT-I   **INTRODUCTION**   **9**

Role of Logistics and Supply chain Management: Scope and Importance - Evolution of Supply Chain – Examples of supply Chains - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT-II   **SUPPLY CHAIN NETWORK DESIGN**   **9**

Role of Distribution in Supply Chain - Factors influencing Distribution network design - Design options for Distribution Network- Distribution Network in Practice - Role of network Design in Supply Chain – Framework for network Decisions.

UNIT-III   **LOGISTICS IN SUPPLY CHAIN**   **9**

Role of transportation in supply chain - Factors affecting transportations decision - Design option for transportation network – Tailored transportation – Routing and scheduling in transportation - 3PL- 4PL- Global Logistics - Reverse Logistics; Reasons, Activities and issues.

UNIT-IV   **SOURCING AND COORDINATION IN SUPPLY CHAIN**   **9**

Role of Sourcing in supply chain - Supplier selection - Contracts - Design Collaboration - Sourcing planning and analysis - Supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT-V   **IT AND EMERGING CONCEPTS IN SUPPLY CHAIN**   **9**

The role IT in supply chain-The supply chain IT framework - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain- Introduction to Warehouse Management, Risks in Supply Chain, Lean supply Chains, Sustainable supply Chains.

                                              TOTAL:45 PERIODS

OUTCOMES:
On successful completion of the course student will be able to:
1. Ability to understand the scope of Supply Chain Management and the Drivers of SC performance
2. Ability to design suitable SC network for a given situation
3. Ability to solve the issues related to Logistics in SCM
4. Ability to understand Sourcing, Coordination and current issues in SCM
5. Ability to appraise about the applications of IT in SCM and apply SCM concepts in selected enterprise

TEXTBOOKS:
1. Sunil Chopra, Peter Meindl and D.V. Kalra, ‾Supply Chain Management: Strategy, Planning, and Operation", Pearson Education, 2016.

REFERENCES:
1. Ravi Ravindran A, Donald P. Warsing, Jr, ‾Supply Chain Engineering: Models and Applications‖, ‾CRC Press, 2012.
2. Srinivasan G.S, ‾Quantitative models in Operations and Supply Chain Management‖, PHI, 2010

21CY1003   **WASTE WATER TREATMENT**   **L   T   P   C**
                                                         3   0   0   3

OBJECTIVES: To impart Knowledge on the following topics:
- To provide basic under standings about the requirements of water, its preliminary treatment
- To give the students a broad understanding of all issues related to the analysis and design of water supply and wastewater disposal systems.

UNIT-I   WATER AS A RESOURCE, ITS QUALITY & PARAMETERS   9

Water sources- water quantity- maintenance of water cycle- impurities in water- effects of impurities in water- water quality parameters- physical, chemical & biological. Characteristics of potable water- wastewater effluent standards -water quality indices. Need for water and wastewater treatment - associated environmental laws- drinking water and wastewater discharge standards, water reuse and recycling concepts.

UNIT-II   INDUSTRIAL WATER TREATMENT   9

Filtration - size and shape characteristics of filtering media - sand filters hydraulics of filtration – design considerations – radial, up flow, high rate and multimedia filters, pressure filter. Water softening - lime soda, zeolite and demineralization processes- industrial water treatment for boilers.

UNIT-III   CONVENTIONAL TREATMENT METHODS   9

Taste and odour control - adsorption - activated carbon treatment - removal of color - iron and manganese removal - aeration, oxidation, ion exchange and other methods - effects of fluorides – fluoridation and de fluoridation -desalination - conventional activated sludge process and its modifications - trickling filter, bio-towers and rotating biological contactors-corrosion prevention and control - factors influencing corrosion - Lange Lier index - corrosion control measures.

UNIT-IV   WASTE WATER TREATMENT   9
Description and design of wastewater collection system- Quantity and quality of wastewater- wastewater treatment plant layout and related issues- Sewage and waste water treatments systems: A. Primary treatment methods - B. Secondary treatment methods and - C. Tertiary treatment methods. Equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons - Chemical oxidation - types of reactors and reactors analysis

**UNIT-V   DOMESTIC WASTE WATER TREATMENT METHODS   &   9
                              RECENT TRENDS**
Water purification systems in natural systems - Rate of water supplies for urban and rural systems. Unit operations and processes, treatment flow-diagrams for different sources of water. Water supply norms -Advanced water treatment, Automation in Water Supply and Smart Water Supply Systems, Package treatment units, implications of 24x7 supply, Water Economics & Pricing and application of nano materials package treatment units

OUTCOMES:
On successful completion of the course student will be able to:
1. Understand water quality standards and parameters
2. Understand the principles and operation of water treatment systems
3. Attain knowledge about the conventional treatment methods used in water
4. Analyze the various planning & design of waste water collection & conveyance and treatment systems.
5. Understand the need for advanced water treatment with automation in treatment, water economics and patented material

TEXTBOOKS:
1. Metcalf and Eddy, ¯Wastewater Engineering‖, 4th ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., ¯Industrial Water Pollution Control‖, 2nd Edn., McGraw Hill Inc., 1989.

REFERENCES:
1. S.P. Mahajan, ¯Pollution control in process industries‖, 27th Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, ¯Green Chemistry: An Introductory Text‖, 2nd edition, RSC publishing, 2010.
3. C.S. Rao, ¯Environmental Pollution Control Engineering‖, New Age International, 2007.
4. Water Supply and Pollution Control. Authors: Warren Viessman Jr. and Mark J. Hammer. 7th Edition 2005. Publisher: Pearson Education
5. Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2nd edition (February 16, 1999)