MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102

MBU
MOHAN BABU
UNIVERSITY
DREAM. BELIEVE. ACHIEVE

SCHOOL OF COMPUTING

Bachelor of Computer Applications (B.C.A)

CURRICULUM AND SYLLABUS

(For 2022-23 Admitted Students)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM(FFCBCS)

MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- Develop industry-focused professionals with a global perspective.
- Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.
- Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.
- Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF COMPUTING

Vision

To lead the advancement of computer science research and education that has real-world impact and to push the frontiers of innovation in the field.

Mission

- Instil within our students fundamental computing knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community.
- Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential.
- Impart continued education and research support to working professionals in the computing domain to enhance their expertise in the cutting-edge technologies.
- Inculcate among the computing engineers of tomorrow with a spirit to solve societal challenges.

DEPARTMENT OF COMPUTER APPLICATIONS

Vision

To become a center of excellence in the field of computer science and applications.

Mission

- Imparting knowledge and skills through contemporary curriculum to the diverse group of students.
- Creating a talent pool of faculty in diverse domains of computer applications through continuous training.
- Domain and transferable skill development for the holistic personality of students to inculcate values and ethics for effective professional practice and as an entrepreneur.

BACHELOR OF COMPUTER APPLICATIONS(BCA)

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of BCA Program will be able to:

PEO1. Pursue higher education in the core and allied areas of computer science and applications.

PEO2. Become professionals in industry or academia with an ability to adapt to evolving technologies in cultivating skills for thriving career.

PEO3. Become successful entrepreneurs and be engaged in technology innovation and deployment.

PEO4. Exhibit professionalism, and uplifting health, safety, legal, environmental, ethical, and cultural diversity issues for serving the society and communicating with local and national peers, bound within regulations and leading to lifelong learning.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of BCA Program will be able to:

PO1. **Computational Knowledge**: Apply knowledge of mathematics and computing fundamental and domain concepts to find solutions for defined problems.

PO2. **Problem Analysis**: Adapt basic principles of Mathematics and Computing sciences to identifyand formulate problems to provide solutions for complex problems.

PO3. **Design/Development of Solutions**: Design, analyze and develop solutions and evaluate system components or processes to meet a specific need for local, regional and global public health, societal, cultural, and environmental systems.

PO4. **Conduct Investigations of Complex Computing Problems**: Use research-based knowledge and methods with the ability toperform analysis and development to reach valid conclusions.

PO5. **Modern Tool Usage:** Design, analyze and develop solutions using modern tools by considering the limitations.

PO6. **Professional Ethics**: Commit to ethics and cyber regulations, responsibilities,

and norms in computing practices.

PO7. **Life-long Learning**: Enhance understanding and building research, strategies in independent learning for continual development as computer applications professional.

PO8. **Project Management and Finance**: Establishing strategies for developing and implementing ideas in multi-disciplinary environments using computing and management skills as a member or leader in a team.

PO9. **Communication Efficacy**: Contribute to progressive community and society in comprehending computing activities by writing effective reports, designing documentation, making an effective presentation, and understanding instructions.

PO10. **Societal and Environmental Concern**: Apply mathematics and computing knowledge to access and solve issues relating to health, safety, societal, environmental, legal, and cultural issues within local, regional and global contexts.

PO11. **Individual and Teamwork**: Self and continuous learning to improve knowledge and competence as a member or leader of a team.

PO12. **Innovation and Entrepreneurship**: Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of BCA Program will be able to:

PSO1. Design, develop, test, and deploy computing applications of specified requirements using programming skills.

PSO2. Apply tools and techniques to create database and adapt managerial and domain Skills of Information Management for storage and decision making.

PSO3. Apply suitable techniques and algorithms to integrate Operating System Services, Network devices, Security mechanisms and Infrastructure to meet the requirements for the deployment of an application on networks.

BACHELOR OF COMPUTER APPLICATIONS(BCA) 3 years

Basket Wise - Credit Distribution

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	36-45
2	PROGRAM CORE	36-42
3	PROGRAM ELECTIVE	18-24
4	SPECIALIZATION ELECTIVE	12-18
5	UNIVERSITY ELECTIVE	6-9
	TOTAL CREDITS	**Min. 120**

BACHELOR OF COMPUTER APPLICATIONS(BCA with Honours)

4 years

Basket Wise - Credit Distribution

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	36-45
2	PROGRAM CORE	42-54
3	PROGRAM ELECTIVE	36-45
4	SPECIALIZATION ELECTIVE	24-30
5	UNIVERSITY ELECTIVE	9-12
	TOTAL CREDITS	**Min. 160**

School Core (36-45 Credits)- BCA General – 3 years

School Core (36-45 Credits)- BCA with Honours – 4 years

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22LG102405	General English	2	-	2	-	3	-
22LG102406	Business Communication	2	-	2	-	3	General English
22CM101401	Principles of Accounting	3	-	-	-	3	-
22MM101401	Matrix Theory and Linear Algebra	3	-	-	-	3	-
22MM101409	Numerical Analysis, Probability and Statistics	3	-	-	-	3	-
22CA111001	Internship	-	-	-	-	2	-
22CA108001	Capstone Project	-	-	-	-	8	-
22CA101001	Computer Fundamentals and Organization	3	-	-	-	3	-
22CA101002	Digital Electronics	3	-	-	-	3	-
22CA102001	Programming for Problem Solving	3	-	2	-	4	-
22MM101410	Discrete Mathematics for Computer Science	3	-	-	-	3	-
22CA101003	Basics of Virtualization and Cloud Technology	3	-	-	-	3	-
22CA105001	Computer Hardware and System Essentials	-	1	2	-	2	-
Management Basket (Min. 2 Credits to be earned)							
22LG101701	Business Communication and Career Skills	2	-	-	-	2	-

22CM101402	Entrepreneurial Development	2	-	-	-	2	-
22CM101403	Innovation and Design Thinking	2	-	-	-	2	-
Mandatory Courses (Min. 6 Credits to be earned. Earned Credits will not be considered for CGPA)							
22LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
22CE107601	Environmental Science	2	-	-	-	2	-
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22LG107603	Spoken English	-	1	2	-	2	General English
22AB107601	NCC/NSS Activities	-	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22AB107602	Yoga	-	-	-	-	2	-

Program Core (36 - 42 Credits) BCA General – 3 years

Program Core (42 - 54 Credits) BCA with Honours – 4 years

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22CA102002	Database Management Systems	3	-	2	-	4	-
22CA102003	Data Warehousing and Data Mining	3	-	2	-	4	Database Management Systems
22CA101004	Computer Communication	3	-	-	-	3	-
22CA102004	Data Structures	3	-	2	-	4	-
22CA102005	Python Programming	3	-	2	-	4	Programming for Problem Solving
22CA104001	Object Oriented Programming through C++	3	-	2	4	5	Programming for Problem Solving
22CA102006	Java Programming	3	-	2	-	4	Object Oriented Programming with C++
22CA102007	Computer Graphics	3	-	2	-	4	-
22CA102008	Data Analytics	3	-	2	-	4	-
22CA101005	Fundamentals of Data Science	2	-	-	-	2	
22CA101006	Software Engineering	3	-	-	-	3	-
22CA101007	User Experience/ Interface (UX/UI) Design	2	-	-	-	2	-
22CA101012	Computer Networks	3	-	-	-	3	Computer Communication
22CA102014	UNIX Shell Programming	2	-	2	-	3	-
22CA101014	Machine Learning	3	-		-	3	Data Warehousing and Data Mining
22CA102022	Web Designing using HTML, CSS, JavaScript	2	-	2	-	3	-
22CA102016	Big Data Programming	2	-	2	-	3	Java Programming/Python Programming

Program Elective (18 - 24 Credits) BCA General – 3 years

Program Elective (36 - 45 Credits) BCA with Honours – 4 years

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22CA101008	Information Management	Decision Support Systems	3	-	-	-	3	Software Engineering
22CA101009		Advanced Databases	3	-	-	-	3	Database Management Systems
22CA102009	Networks	LINUX Administration	2	-	2	-	3	Computer Communication
22CA101010		Internet of Things	3	-	-	-	3	-
22CA101011		Digital Forensics	3	-	-	-	3	Computer Communication
22CA102010	Infrastructure Management Services	Network Administration	2	-	2	-	3	Computer Communication
22CA102011	Programming Languages	Open Source Programming	2	-	2	-	3	Java Programming
22CA102012		Scripting Languages	2	-	2	-	3	Python Programming
22CA102013		Programming with C#	2	-	2	-	3	Programming for Problem Solving
22CA102015		PHP and MySQL Programming	2	-	2	-	3	Java Programming
22CA101013	Graphics	Game Theory	3	-	-	-	3	Computer Graphics
22CA101015	Cloud Computing	Cloud Computing	3	-	-	-	3	-
22CA102017		MS Azure Administration	2	-	2	-	3	Cloud Computing
22CA102018		Cloud Practitioner	2	-	2	-	3	Cloud Computing
22CA101016	Information Security	Cryptography	3	-	-	-	3	Computer Networks
22CA101017		Cyber Security	3	-	-	-	3	Computer Networks

22CA101018		Ethical Hacking	3	-	-	-	3	Computer Networks
22CA102019	Software Engineering	Object Oriented System Design	2	-	2	-	3	Software Engineering
22CA102020		Software Testing and Automation	2	-	2	-	3	Software Engineering
22CA102021	Platform Based Development	.Net Technologies	2	-	2	-	3	Object Oriented Programming with C++
22CA102023		Web Applications Development using PHP	2	-	2	-	3	Web Designing using HTML,CSS, JavaScript
22CA102024		Multimedia Systems	2	-	2	-	3	Web Applications Development using PHP
22CA102025		Game Design and Development	2	-	2	-	3	Python Programming
22CA102026	Intelligent Systems	Machine Learning and AI Using python	2	-	2	-	3	Python Programming
22CA101019		Artificial Intelligence	3	-	-	-	3	-

Specialization Electives (12 - 18 Credits) BCA General – 3 years

Specialization Electives (24 - 30 Credits) BCA with Honours – 4 years

Course Code		Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22CA101023	Augmented Reality and virtual reality	Introduction to Virtual Reality	3	-	-	-	3	Computer Graphics
22CA102036		Introduction to Graphics and Animation Tools Using Open source Software	3	-	2	-	4	
22CA102037		User Interface Design	3	-	2	-	4	
22CA101024		Introduction to Augmented Reality	3	-	-	-	3	Computer Graphics
22CA101025		Introduction to Digital Arts and Technology	3	-	-	-	3	
22CA102038		Animation Design	3	-	2	-	4	Computer Graphics
22CA102039		Introduction To 3D Computer Animation	3		2		4	Computer Graphics
40		Digital Image Processing	3	1	2	-	5	Computer Graphics
22CA104003		Advance Computer Graphics	2	-	2	4	4	Computer Graphics
22CA101026	Data Science	Text Analytics	3	-	-	-	3	Machine Learning
22CA101027		Web Analytics	3	-	-	-	3	Web Designing using HTML, CSS, JavaScript
22CA101028		Image And Video Analytics	3	-	-	-	3	Digital Image Processing
22CA101029		Computer Vision	3	-	-	-	3	-
22CA102027		Data Visualization	3	-	2	-	4	Python Programming

22CA102028		Data Engineering on Cloud	3	-	2	-	4	Cloud Computing
22CA102029		Business Intelligence Tools	3	-	2	-	4	
22CA102030		Time Series Analysis	3	-	2	-	4	Machine Learning
22CA101030		Predictive Analytics	3	-	-	-	3	Machine Learning

University Elective (6-9 Credits) BCA General – 3 years

University Elective (9-12 Credits) BCA with Honours – 4 years

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EC101701	AI in Healthcare	3	-	-	-	3	-
22CM101701	Banking and Insurance	3	-	-	-	3	-
22DS101701	Bioinformatics	3	-	-	-	3	-
22SS101701	Constitution of India	3	-	-	-	3	-
22CM101702	Cost Accounting and Financial Management	3	-	-	-	3	-
22CB101701	Cyber Laws and Security	3	-	-	-	3	-
22MG101701	Entrepreneurship for Micro, Small and Medium Enterprises	3	-	-	-	3	-
22CE101702	Environmental Pollution and Control	3	-	-	-	3	-
22CB101702	Introduction to Ethical Hacking	3	-	-	-	3	-
22CB101703	Forensic Science	3	-	-	-	3	-
22SS101702	Gender and Environment	3	-	-	-	3	-

22ME101701	Global Strategy and Technology	3	-	-	-	3	-
22EE101704	Green Technologies	3	-	-	-	3	-
22ME101702	Human Resource Management	3	-	-	-	3	-
22SS101703	Indian Economy	3	-	-	-	3	-
22SS101704	Indian History	3	-	-	-	3	-
22SS101705	Indian Tradition and Culture	3	-	-	-	3	-
22ME101703	Management Science	3	-	-	-	3	-
22ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
22LG201701	Personality Development	3	-	-	-	3	-
22CE101704	Remote Sensing, GIS and GPS	3	-	-	-	3	-
22SS101706	Women Empowerment	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.

2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG102405	**GENERAL ENGLISH**	2	-	2	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course deals with selected literary works of eminent writers, exercises on speaking, reading comprehensions for skimming and scanning, vocabulary, grammar, pronunciation, and conversation practice.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge of literary works of various pieces of eminent writers.

CO2 Adapt general and technical vocabulary in communication.

CO3 Apply grammatically correct English in writing.

CO4 Analyze texts using reading techniques.

CO5 Apply different communication styles in various situations.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	2	-	-	-	-	-
CO2	2	2	-	-	-	-	2	-	3	-	-	-
CO3	2	2	-	-	3	-	2	-	3	-	-	-
CO4	2	3	2	-	2	-	2	-	3	-	-	-
CO5	2	2	-	-	3	-	2	-	3	-	-	-
Course Correlation Mapping	**2**	**2**	**2**	**-**	**3**	**-**	**2**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: 'A snake in the Grass' short story by R.K. Narayan. ***(06 Periods)***

A Snake in the Grass–A Short Story, ReadingComprehension,Grammar, Vocabulary,Pronunciation,and Conversation Practice.

Module 2: 'On saying Please' short essay by A. G. Gardiner ***(06 Periods)***

On Saying Please–A Short Essay, Reading Comprehension, Grammar Vocabulary,Pronunciation,and Conversation Practice.

Module 3: 'If You Forget Me' poemby Pablo Neruda ***(06 Periods)***

If you Forget Me - A Poem, ReadingComprehension,Grammar, Pronunciation, andConversation Practice.

Module 4: 'After the Sunset'short story by Bhoopal ***(06 Periods)***

After the Sunset–A Short Story, Reading Comprehension,Grammar, Pronunciation, and Conversation Practice.

Module 5: 'Man's Peril' essayby Bertrand Russel ***(06 Periods)***

Man's Peril - An Essay, Reading Comprehension,Vocabulary,Grammar, Pronunciation,and Conversation Practice.

Total Periods: 30

EXPERIENTIAL LEARNING

1. In rainy seasons a lot of snakes are found crawling around. Prepare a write-up on the reactions of people when they found snakes.
2. India is now for entrepreneurs and the government announced a lot of startup programmes for that. Prepare a presentation on recent entrepreneurs.
3. Small courtesies play a major role in creating an impression on other people. List out a few examples.
4. Prepare a PowerPoint presentation on the present scenario in higher education and jobs in India.
5. Being a shopkeeper and persuading a customer to buy a product which is introduced newly in the market. Prepare a conversation.
6. The English language has a rich vocabulary. List out the homophones and homonyms and write down the pronunciation and meaning of those words.
7. Describe a situation in your college where teamwork is needed and explain the strategies to manage the team effectively.
8. India is a country of unity in diversity. List out the existence of different racial and

religious people and bring out reasons for the harmonious relationship among the people.

9. Forget and forgive are the most important quality of any human being. Prepare a write-up on any two experiences which come across in your life where you forgive or forget to maintain good relationships with friends or relatives.

10. Make a case study on the problems of second language learners of English and suggest solutions to overcome them.

11. How do you feel that the role of science and technology in nation-building?

RESOURCES

TEXTBOOKS:

1 G. Damodar "*English Language for Undergraduate Students*", Cambridge University-2019.

REFERENCE BOOKS:

1. https://www.researchgate.net/publication/331773456_RK_Narayan's_A_Snake_in_the_Grass_and_Stephen_Leacock's_With_the_Photographer_-_A_Comparative_Study
2. https://smartenglishnotes.com/2020/07/17/on-saying-please-summary-analysis-and-questions-and-answers/

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=WnOOKO0CdaM
2. https://www.youtube.com/watch?v=H6Nlz8qmcFc
3. https://www.youtube.com/watch?v=-lTliZO85YM
4. https://www.youtube.com/watch?v=048YjXwgHWE
5. https://www.youtube.com/watch?v=XLLQm7Grmcc

WEB RESOURCES:

1. https://www.researchgate.net/publication/331773456_RK_Narayan's_A_Snake_in_the_Grass_and_Stephen_Leacock's_With_the_Photographer_-_A_Comparative_Study
2. https://smartenglishnotes.com/2020/07/17/on-saying-please-summary-analysis-and-questions-and-answers/
3. http://www.emcp.com/product_catalog/school/litLink/Grade09/U09-04forgetme/
4. https://englishlanguage-lit.blogspot.com/2021/05/after-sunset-short-story-by-bhoopal.html
5. https://www.taylorfrancis.com/chapters/mono/10.4324/9781003090359-31/man-peril-bertrand-russell?context=ubx&refId=1d767e2d-ceb1-4537-9de5-6417eab47d1e

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG102406	**BUSINESS COMMUNICATION**	2	-	2	-	3

Pre-Requisite : **General English**

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course deals with the importance of communication, barriers to Communication, Effectiveness in communicating ideas, feelings, instructions, and thoughts, especially in business. Business Communication is designed to introduce skills and practices that will help to communicate and develop communication strategies among businesses, clients/stakeholders.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of the English language and the Process of communication.

CO2. Apply methods of effective business correspondence with brevity and clarity.

CO3. Understand various types of reports by applying rules.

CO4. Use Business Language and presentation for effective writing.

CO5. Apply modern technology in business communication.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	2	-	3	-	-	-
CO2	2	-	-	-	2	-	2	-	2	-	-	-
CO3	3	2	2	-	2	-	2	-	3	-	-	-
CO4	3	-	-	-	-	-	2	-	3	-	-	-
CO5	2	-	-	-	2	-	2	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**2**	**-**	**2**	**-**	**2**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO COMMUNICATION ***(06 Periods)***

Nature of Communication, Process and Importance of Communication, Types of Communication (verbal &Non-Verbal), Different forms of Communication; Barriers to Communication: Linguistic Barriers, Psychological Barriers, Interpersonal Barriers, Cultural Barriers, Physical Barriers, and Organizational Barriers.

Module 2: BUSINESS CORRESPONDENCE ***(06 Periods)***

Letter Writing, Inviting quotations, Sending quotations, Placing orders, Inviting tenders, Writing sales letters, claim & adjustment letters and social correspondence, Preparing Memorandum, Interoffice Memo, Notices, Agenda, Minutes, Job application letter, and resume.

Module 3: REPORT WRITING ***(06 Periods)***

Types of reports, format of reports, steps in report writing, writing reports, the process of writing a report, and the importance of visuals such as tables, diagrams, and charts in writing reports, applying citation rules (APA style documentation).

Module 4: BUSINESS LANGUAGE AND PRESENTATION ***(06 Periods)***

Importance of Business language, Vocabulary: Words often confused, Words often misspelled, Common errors in English. **Oral Presentation**: Importance, Characteristics, Presentation Plan, PowerPoint presentation, and Visual aids.

Module 5: TECHNOLOGY AND BUSINESS COMMUNICATION ***(06 Periods)***

Role of Technology in Business Communication, effects, and advantages of technology in Business Communication: email, text messaging, instant messaging; modern techniques: video conferencing, and social networking; The strategic importance of e-communication.

Total Periods: 30

EXPERIENTIAL LEARNING

1. People often get confused in identifying or using English vocabulary on most occasions. Prepare a list of confusing words and find methods to overcome the difficulties in using those words.
2. Organizations and institutions use modern technology in communicating with their colleagues, clients, and stakeholders. Make a PowerPoint presentation on the modern communication system of any organization and its role in the success of the organization.
3. As a student in the modern technological world, organizing or attending webinars is inevitable. Analyze the pros and cons of video conferencing by organizing webinars and preparing a report.
4. Form a team and act as a team leader and Prepare a performance appraisal report of the team using visual aids to support the presentation.
5. Make a detailed study on social networking and its impact on modern business.

6. Prepare a Case study on the e-commerce websites regarding their communication strategy.
7. Analyze various email providers and their benefits in view of a user-friendly interface.
8. Conduct a meeting on a business proposal. Follow the procedure and prepare the minutes of the meeting.
9. Being an employee of an organization checking outstanding bills is mandatory. Prepare a letterhead and write a letter to a company to settle the outstanding bills.
10. The technology in the field of communication is growing fast. Analyze and prepare a report on the growth of technology in communication by comparing the past with the present.

RESOURCES

TEXTBOOK:

1. P. D. Chaturvedi, &MukeshChaturvedi,"*BusinessCommunicationSkills*", Concepts, and Applications 3rd Edition, 2013
2. VikramBisen and Priya. "*Business Communication*". New Age International, 2009.

REFERENCE BOOKS:

1. Guffey Mary Ellen, Loewy Dana Almonte& Richard *"Essentials of business communication"* Nelson College Indigenous, 2018.
2. AnjaneeSethi and BhavanaAdhikari "*Business Communication*", Tata Mcgraw Hill, 2009
3. P. D. Chaturvedi, &MukeshChaturvedi*"Business Communication":* for B. Com course of Uttar Pradesh Universities Pearson Education, 2011.
4. Om P Juneja and AaratiMujumdar, *"Business Communication Techniques and Methods"*OrientBlackswanPvt. Ltd., 2010
5. Jones, Leo and Richard Alexander"*New International Business English*" CUP, 2003.
6. Horner, David and Peter Strutt"*Words at Work*" CUP. 1996.
7. Levi, Daniel "*Group Dynamics for Teams*" Sage Publications India Pvt. Ltd, 3rd Edition, New Delhi, 2011.
8. Owen, Roger "*BBC Business English*" BBC, 1996.
9. R. C. Sharma and Krishna Mohan "*Business correspondence and report writing: a practical approach to business & technical communication",* Mc Graw Hill India, 2017.
10. Michelle Reid. "*Report Writing Red*" Globe Press, 2018.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110105052
2. https://edurev.in/courses/14522_Business-Communication-The-Ultimate-Guide

WEB RESOURCES:

1. http://www.rapodar.ac.in/pdf/elearn/Business%20Communication%20Semester%20I%20notes.pdf
2. https://www.nextiva.com/blog/what-is-business-communication.html#:~:text=Business%20communication%20is%20the%20process,organizational%20practices%20and%20reduce%20errors.
3. https://www.cloudtalk.io/blog/the-importance-of-business-communication-definition-types-and-tips/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CM101401	PRINCIPLES OF ACCOUNTING	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

The course is designed so that the students can understand the scientific preparation of accounting books with relevant interpretation. The course also provides students with knowledge of preparation of final accounts.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of basic concepts of financial accounting.

CO2. Analyze Cash book and reconciliation statements and acquaint oneself with preparation of statements.

CO3. Demonstrate knowledge on preparation of Bank Reconciliation statements.

CO4. Analyze and prepare financial statements for the sole proprietorship of business.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ACCOUNTING ***(09 Periods)***

Meaning – Definition – Objectives of Accounting - Scope of accounting – Accounting principles – Branches of accounting - Classification of accounts - Double Entry System - Book Keeping – Users of Accounting Information - Advantages and limitations of accounting

Module 2: PROCESS OF ACCOUNTING ***(09 Periods)***

Meaning and Definition of Journal – Importance of Journal Entry – Proforma of Journal Entries – Jounalising – Posting - Problems on Journal Entries – Ledger – Problems on Ledger accounts - Balancing of Ledger accounts

Module 3: SUBSIDIARY BOOKS ***(09 Periods)***

Introduction to Subsidiary Books- Purchase Book, sales Book, Purchase Returns, Sales Returns, Bills Receivable, Bills Payable, Journal Paper-Preparation of Subsidiary Books- Cash Books, Three Column Cash Book– Trial Balance (Simple problems)

Module 4: BANK RECONCILIATION STATEMENT ***(09 Periods)***

Meaning – Need - Reasons for differences between cash book and pass book balances – Favorable and over draft balances – Ascertainment of correct cash book balance (Amended Cash Book) - Preparation of Bank Reconciliation Statement. (Including problems)

Module 5: PREPARATION OF FINAL ACCOUNTS ***(09 Periods)***

Introduction to Final Accounts - Trading account - Profit and Loss account - Balance Sheet with simple adjustments (Simple problems)

Total Periods: 45

EXPERIENTIAL LEARNING

1. Observation of Recording Business Transactions in an Audit firm.
2. Visiting a Business and knowing entire process of maintenance of Books of Accounts.

RESOURCES

TEXT BOOKS:

1. Maheswari S.N. &Maheswari S. K., "*Introduction to Financial Accountancy*," Vikas Publications, 2020.

2. Grewal. T.S., "*Fundamentals of Accounting,*" Sultan Chand& Sons Pvt Ltd New Delhi, 2019.

REFERENCE BOOKS:

1. Jawahar Lal, Financial Accounting, Wheeler Publishing, New Delhi, 2021.
2. Chawla & Jain-Financial Accounting, Kalyani Publishers, New Delhi, 2008.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=tIDFXs6_Tjc
2. https://www.youtube.com/watch?v=xWKfKCnQqAE

WEB RESOURCES:

1. https://icmai.in/upload/Students/Syllabus2016/Inter/Paper-5New.pdf
2. https://ebooks.lpude.in/management/bba/term_2/DMGT104_FINANCIAL_ACCOUNTING.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101401	MATRIX THEORY AND LINEAR ALGEBRA	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a discussion on matrix factorizations, linear systems, Eigenvalues and Eigenvectors, vector spaces, linear transformations, and orthogonality.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of matrix factorizations and solutions of the linear system.

CO2. Determine the Eigenvalues and Eigenvectors of the matrix and implement the concept of Eigen values and decompositions of a matrix in intelligent systems.

CO3. Apply the concepts of vector spaces and linear transformation on problems of computational systems.

CO4. Use the inner product spaces for the study of orthogonality and to construct orthonormal basis.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		3	2	-	-	-	-	-	-	-
CO2	2	3		2	2	-	-	-	-	-	-	-
CO3	3	3	-	2	1	-	-	-	-	-	-	-
CO4	2	3		3	2	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	-	**3**	**2**	**-**	**-**	**-**	-	**-**	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: MATRICES AND LINEAR SYSTEM OF EQUATIONS ***(10 Periods)***

Elementary Row-operations, Elementary Matrices, Echelon form, Rank of a matrix by row-reduction, Solutions of system of linear equations by row reduction, Matrix Factorization, LU factorization, LDU factorization.

Module 2: EIGEN VALUES, EIGEN VECTORS AND DIAGONALIZATION ***(09 Periods)***

Characteristic equation of a matrix, Eigenvalues and Eigenvectors of matrices, Similarity of matrices, Diagonalization by using Eigenvalues, Cayley-Hamilton Theorem (Without Proof), Evaluation of matrix powers.

Module 3: VECTOR SPACES ***(10 Periods)***

Vector spaces, Sub-spaces, Four fundamental subspaces of a matrix, Span, Linearly independent and dependent, Basis, construction of Basis, dimensions, Finite dimensional vector space.

Module 4: LINEAR TRANSFORMATION ***(08 Periods)***

Linear transformation, Kernal and range of linear transformation, Basic properties, Invertible linear transformation, Matrix of linear transformation.

Module 5: INNER PRODUCT SPACES ***(08 Periods)***

Inner product, Norm, Distance, Inner product space, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalization, Singular Value Decomposition for square matrices.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Explain the role of Eigen values and Eigen vectors in image processing.
2. Explain how the matrix theory is used in robotics and automachines.

RESOURCES

TEXT BOOKS:

1. Peter Selinger, "*Matrix theory and linear algebra*", 1st Edition, creative commons license, 2018.
2. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, "*Linear Algebra*," Pearson Education, 5th Edition, 2022.

REFERENCE BOOKS:

1. Kuladeep Sing, "*Linear Algebra step by step*," 1st edition, Oxford University press, 2014.
2. David Poole, "*Linear Algebra: A Modern Introduction*," Brooks/Cole, 2nd edition, 2005.
3. Edgar G. Goodaire, "*Linear Algebra*," Cambridge University Press, 1st Edition, 2014.
4. M. Thamban Nair and Arindama Singh, "*Linear Algebra*," Springer, 1st Edition, 2019.
5. Hans Schneider and George Phillip Barker, "*Matrices and Linear Algebra*," Dover Publications, 2nd Edition, 1989.
6. JimDefranza, Daniel Gagliardi,"*Introduction to Linear algebra with applications*," Mc GrawHill, 2009.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/111106051
2. https://nptel.ac.in/courses/111106135

WEB RESOURCES:

1. https://catalogimages.wiley.com/images/db/pdf/9781119570271.excerpt.pdf
2. https://web.northeastern.edu/dummit/docs/linalgprac_5_eigenvalues_and_diagonalization.pdf
3. https://web.auburn.edu/holmerr/2660/Textbook/vectorspace-print.pdf
4. https://textbooks.math.gatech.edu/ila/linear-transformations.html
5. https://linear.axler.net/InnerProduct.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101409	NUMERICAL ANALYSIS, PROBABILITY AND STATISTICS	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course aims to provide an understanding the numerical solutions of linear and nonlinear equations, Numerical techniques of interpolation in various intervals, Numerical techniques of differentiation and Integration. The course also provides an introduction to probability and statistics, random variables, mathematical expectations, distributions, correlation and regression.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Solve equations, derivatives and integrals through numerical methods for the given data.

CO2. Identify the types of random variables and determine their mathematical expectation & probabilities.

CO3. Apply the concept of probability distributions to solve computing problems.

CO4. Apply the concepts of Correlation and Regression in result analysis and Business forecasting.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	2	1	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**1**	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: NUMERICAL SOLUTIONS OF EQUATIONS *(09 Periods)*

Solutions of Algebraic and Transcendental Equations: Bisection Method, Regula-falsi method, Newton-Raphson Method.

Systems of linear algebraic equations: Gauss elimination method, Gauss-Seidel methods, Gauss-Iteration methods.

Module 2: INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION *(10 Periods)*

Interpolation: Finite differences: Forward and backward differences, Newton's forward and backward interpolation formula, Divided difference: Newton's divided difference formula, Lagrange's interpolation formula.

Numerical differentiation, Integration: Numerical differentiation using forward and backward interpolation formula, Numerical integration using Trapezoidal and Simpson's rules.

Module 3: RANDOM VARIABLES *(09 Periods)*

Introduction to Probability, Random variables, Discrete and continuous random variables, Distribution function of random variables, Properties, Probability mass function, Probability density function,Mathematical expectation, Properties of mathematical expectation, Mean and Variance.

Module 4: PROBABILITY DISTRIBUTIONS *(08 Periods)*

Binomial Distribution, Poisson distribution, Normal distribution - Mean, Variance, Standard deviation.

Module 5: CORRELATION AND REGRESSION *(09 Periods)*

Introduction to simple correlation, Covariance, Correlation between two variables,Scatter diagram and its utility, Karl Pearson's coefficient of correlation Computation,Spearman's rank correlation coefficient, Estimation of regression lines.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Solve the following the system of equations by Gauss- Jordan iterative method correct to three decimal places.
   X + Y + 54 Z = 110; 27X +6Y – Z = ; 6X + 15Y + 2Z = 72.
2. If X is a normally distributed with mean 70 and standard deviation 16, find
   P(38 $\leq$ X $\leq$ 46) (ii) P(82 $\leq$ X $\leq$ 94) (iii) P(62 $\leq$ X $\leq$ 86).

RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. J. Ravichandran, Probability and Statistics for Engineers, Wiley India, 1st Edition, 2019.

REFERENCE BOOKS:

1. Richard A Johnson, Miller and Freund's Probability and Statistics for Engineers, Prentice Hall of India, 8th Edition, 2011.
2. M. K. Jain, S.R.K Iyengar, R. K. Jain, Numerical Methods for Scientific & Engineering Computation, New Age International Publishers, 6th Edition, 2012.
3. G. Shankar Rao, Numerical Analysis, New Age International Publishers, 5th Edition, 2018.
4. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 5th Edition 2012.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/127106019
2. https://nptel.ac.in/courses/111106112
3. https://nptel.ac.in/courses/111105041
4. https://nptel.ac.in/courses/111106112

WEB RESOURCES:

1. https://www.pdfdrive.com/introductory-methods-of-numerical-analysis-by-ss-sastry-d148704487.html
2. https://faculty.ksu.edu.sa/sites/default/files/probability_and_statistics_for_engineering_and_the_sciences.pdf
3. http://brharnetc.edu.in/br/wp-content/uploads/2018/11/21.pdf
4. http://www.mi.sanu.ac.rs/~gvm/Teze/Numerical%20methods%20In%20Computational%20Engineering.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA111001	**Internship**	-	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Analyze latest equipment, materials and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.

CO2. Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solving complex engineering problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	3	-	-	3	-	-	-	3
CO2	-	3	-	-	-	3	3	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Correlation Level: 3-High; 2-Medium; 1-Low

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA108001	**Capstone Project**	-	-	-	-	**8**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Create/Design computer science engineering systems or processes to solve complex computer science engineering and allied problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider society, health, safety, environment, sustainability, economics and project management in solving complex computer science engineering and allied problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on computer science engineering systems or processes.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	-	-	3	-	-	-	3
CO2	-	-	-	-	-	3	3	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Correlation Level: 3-High; 2-Medium; 1-Low

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA101001	**COMPUTER FUNDAMENTALS AND ORGANIZATION**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course deals with fundamentals of computers, Data Representations, input and output units, primary and secondary storage devices, programming languages, Binary Arithmetic and Logic circuits.Understand Computer architecture and organization working scenario in addition to Reduced Instruction Set Computer (RISC) platform.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate fundamentals of computer and computer organization concepts to design of modern processors, memories and I/Os.
CO2. Analyze the performance of commercially available computers.
CO3. Develop to use the computer organization techniques in digital systems.
CO4. Identify, formulates, and solve hardware and software computer engineering problems using sound computer engineering principles.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO2	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO COMPUTERS ***(09 Periods)***

Computer basics: Algorithms, simple model of a computer, characteristics of computer, problem solving using computers: flow chart, Program, working of a computer, stored program concept.

Data Representation: Representation of characters in Computers, integers, fractions, Hexadecimal representation of numbers, decimal to binary conversion, error detecting codes.

Input units: Traditional computer Input/ Output units: Keyboard, Display unit, computer mouse, other input technologies: touch pad, touch screen, magnetic Ink Character recognition (MICR), Optical Mark Reading and Recognition (OMR), Flatbed Scanner and barcode.

Module 2: OUTPUT UNITS AND COMPUTER MEMORY ***(09 Periods)***

Computer Output Devices: Flat panel display technology, E-ink display, printers, inkjet printers, dot matrix printers, line printers, plotters, choosing printer.

Computer Memory: Memory cell, Memory Organization, Read Only Memory, Serial Access Memory, Physical Devices used to Construct Memories, magnetic hard disk, Compact disk read only memory, Magnetic tape drive and memory hierarchy.

Processor: Structure of Instructions, Description of Processor, Machine Language Program, Algorithm to Simulate the Hypothetical Computer, Enhancing Hypcom.

Module 3: BINARY ARITHMETIC AND LOGIC CIRCUIT ***(09 Periods)***

Binary Arithmetic: Binary addition, subtraction, Signed Numbers, Two's complement representations of Numbers, additions/subtractions of Numbers in 2's complement Notation, binary multiplications, Binary division, floating point representation of numbers.

Logic circuit: Switching Circuit, AND/OR Operations, NOT Operation, Boolean functions, Postulates, duality Principle, theorems, Precedence operators, canonical Forms for Boolean Functions, Logic circuits, Parallel and Serial adders an Physical devices used to construct gates.

Module 4: COMPUTER ORGANIZATION AND CENTRAL PROCESSING UNIT ORGANIZATION ***(09 Periods)***

Computer Organization and Design: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs. RISC.

Central Processing Unit organization: General Register Organization, Stack organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors.

Module 5: MEMORY ORGANIZATION AND INPUT/OUTPUT ORGANIZATION ***(09 Periods)***

Memory Organization: Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address map, Associative memory-Hardware organization. Match logic. Cache memory-size vs. block size, Mapping functions-Associate, Direct, Set Associative mapping. Replacement algorithms, write policies, Auxiliary memoryMagnetic.

Total Periods: 45

EXPERIENTIAL LEARNING:

a) Understand the Role of Binary arithmetic in digital computers and perform the following operations.
   i. Binary Addition
   ii. Binary Subtraction
   iii. Binary Multiplication
   iv. Binary Division

b) How to represent the following expression into Logic gates and Truth table?

Boolean Expression

$$Q = (A.B).(\overline{A+B}).C$$

c) Illustrate the organization of i5 Processors.

RESOURCES:

TEXT BOOKS:

1. V. Rajaraman, NeeharikaAdabala, *"Fundamentals of Computers"*, PHI Learning Private ltd, 6th Edition, 2015.

2. M. Moris Mano, *"Computer System Architecture"*, 3rd edition, Pearson/PHI, India, 2006.

REFERENCE BOOKS:

1. Priti Sinha, Pradeep K., Sinha*"Computer Fundamentals: Concepts, Systems & Applications"*, 8th Edition, BPB Publications.

2. William Stallings*,"Computer Organization and Architecture- designing for performance"*, 8th edition, Prentice Hall, New Jersy, 2010.

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs61/preview

WEB RESOURCES:

1. https://www.electrical4u.com/binary-arithmetic/
2. https://www.youtube.com/watch?v=JQBRzsPhw2w
3. https://www.techtarget.com/whatis/definition/logic-gate-AND-OR-XOR-NOT-NAND-NOR-and-XNOR

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA101002	**DIGITAL ELECTRONICS**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion and hands on experience onNumber systems, Boolean algebra, Minimization of Boolean functions, Analysis and synthesis of digital circuits; Asynchronous Sequential Logic & Programmable Memories.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Design logical circuits by analyzing various Boolean functions and simplification methods to perform desired logical operations using logical gates.

CO2. Design combinational logical circuits for performing various arithmetic operations and data encoding and decoding in various data lines.

CO3. Analyze various sequential circuits for realizing counters and registers using flip-flops

CO4. Design Asynchronous sequential logic and programmable memories for societal needs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO3	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	1	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**3**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: NUMBER SYSTEMS AND BOOLEAN ALGEBRA ***(10 Periods)***

Digital systems, Binary Numbers, Number base conversions, Complements of numbers, Binary codes, Error detection and correction codes. Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, logic operations & Logic gates.

Module 2: GATE LEVEL MINIMIZATION ***(08 Periods)***

The map method, four variable, Five variable K-map,POS& SOP Simplification, Don't care conditions, NAND & NOR Implementation, Tabular Method- Simplification of Boolean function.

Module 3 COMBINATIONAL LOGIC CIRCUIT DESIGN ***(09 Periods)***

Combinational circuits, Adders, Subtractors, Binary Adder-Subtractor, Decimal Adder, carry look-a–head adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Priority Encoder, Multiplexers.

Module 4 SEQUENTIAL LOGIC CIRCUIT DESIGN ***(10 Periods)***

Sequential Circuits, Latches, Flip-Flops-SR, D, JK & T, Introduction to Registers-Universal Shift Registers, State table and state diagrams, State Reduction & Assignment, Sequence Detector, Design of counters-Modulo-n, Johnson, Ring, Up/Down.

Module 5 ASYNCHRONOUS SEQUENTIAL LOGIC & PROGRAMMABLE MEMORIES ***(08 Periods)***

Analysis of Clocked sequential circuits, State Reduction & Assignment- partition technique, merger chart & merger table, Hazards

Programmable Memories: ROM, PLA, PAL.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Minimization of logic circuits using K-Map.
2. Design of half adder &subtractor and full adder &subtractor.
3. Design of 4 bit
    a. binary adder and
    b. binary adder-subtractor

RESOURCES

TEXT BOOKS:

1. M. Morris Mano, Digital Design, Pearson education, 5th Edition, 2013.
2. Charles H. Roth, Fundamentals of Logic Design, Thomson Publications, 5th Edition, 2004.

REFERENCE BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, PHI Learning Private Limited, 3rd edition, India, 2017
2. ZviKohavi and NirahK.Jha, Switching theory and Finite Automata Theory, Tata McGraw-Hill, 2nd Edition, 1978.

SOFTWARE/TOOLS:

Digital Schematic tool (DSCH2)

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ee75/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs63/preview

WEB RESOURCES:

1. https://www.digitalelectronicsdeeds.com/
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_useful_resources.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA102001	**PROGRAMMING FOR PROBLEM SOLVING**	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on C Programming concepts, Operators and Expressions, Input and Output Functions, Control Structures, Problem Solving Aspects, Arrays and Strings, Functions, Pointers, Structures and Unions and File Handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Design algorithms using problem-solving techniques for given problems.
CO2. Apply functions and Arrays to enhance reusability and data manipulation.
CO3. Develop programs using pointers for efficient memory management.
CO4. Apply structures, unions and file handling concepts to develop societal applications.
CO5. Work independently or in team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	2	3	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	2	3	3	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	3	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO C PROGRAMMING ***(09 Periods)***

Basics of C Programming: Introduction, Structure of a C program, Concept of a variable,

Data types in C, Program statement, Declaration, Storing the data in memory, Tokens, Operators and expressions, Lvalues and Rvalues, Type conversion in C.

Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, formatted input and output functions.

Module 2: CONTROL STATEMENTS AND INTRODUCTION TO PROBLEM SOLVING ***(08 Periods)***

Control Statements: Specifying test condition for selection and iteration, Writing test expression, Conditional execution and selection, Iteration and repetitive execution, goto statement, Special control statements, Nested loops.

Introduction to Problem Solving: Algorithms, Flowcharts, Problem solving aspect, Top-down design, Implementation of algorithms, program verification and efficiency of algorithms.

Module 3: ARRAYS & STRINGS AND FUNCTIONS ***(10 Periods)***

Arrays and Strings: One-dimensional array – Declaration, Initialization, Accessing elements, operations; Multi-dimensional arrays – Declaration, Initialization, Working with 2D arrays; Strings – Declaration, Initialization, Printing strings, String input, Character manipulation, String manipulation; Arrays of strings – Initialization, manipulating string arrays.

Functions: Concept of function, Using functions, Call by value mechanism, working with functions, passing arrays to functions, Scope and extent, Storage classes, Recursion.

Module 4: POINTERS ***(08 Periods)***

Introduction to Pointers: Understanding memory addresses, Address operator (&), Pointer – declaration, Initialization, Indirection operator and dereferencing, Void and Null pointers, Use of pointers, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Pointers to functions, Dynamic memory allocation.

Module 5: USER-DEFINED DATA TYPES AND FILES ***(10 Periods)***

User-Defined Data Types: Structures - Declaration, Accessing the members, Initialization, typedef and its use, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Unions, Enumeration types, Bitfields.

Files: Using files in C, Working with text and binary files, Direct File Input and Output, Files of records, Random access to files of records.

Total Periods: 45

EXPERIENTIAL LEARNING

1. a) Write a C program to perform the arithmetic operations on two integer numbers.
   b) Write a program to evaluate the following expressions by reading the necessary values from the keyboard.

   i. $(ax + b)/(ax - b)$ ii. $2.5 \log x + \text{Cos } 32^0 + | x^2 + y^2|$

   iii. $ax^5 + bx^3 + c$ iv. ae^{kt}

2. a) Write a C program to find the roots of a quadratic equation.

   b) In a town, the percentage of men is 52. The percentage of total literacy is 48 and the total percentage of literate men is 35 of the total population. Write a C program to find the total number of illiterate men and women if the population of the town is 7000.

3. a) Write a C Program to compute an electricity bill based on the following slab rates.

Consumption units	Rate (in Rupees/unit)
0-100	4.0
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8.0

   (***Hint***: Take current and old meter readings from the user to get consumption units)

   b) An insurance company computes the premium amount based on the following;

   i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city, and is a male then the premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.

   ii. If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.

   iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.

   iv. In all other cases the person is not insured.

   Write a C program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

   c) Write a C Program to find the grade for a student using a Switch case. The user needs to enter a subject score (varies from 0 to 100)and then display the grade as described below.

Score	Grade	Score	Grade
> = 90	O	>=50 to< 60	D

>=80	to< 90	A	>=40	to< 50	E
>=70	to< 80	B	< 40		Fail
>=60	to< 70	C			

4. a) A Fibonacci sequence is defined as follows:

   The first and second terms in the sequence are 0 and 1. Sub-sequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first *n* terms of the sequence.

   b) Write a C program to find the sum of individual digits of a positive integer.

   c) Write a C program to read two numbers *x* and *n*, and then compute the sum of the geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots+x^n$. Show appropriate error message for $n<0$. (*Example*: if *n* is 3 and *x* is 5, then the sum is: 1+5+25+125)

   d) Write a C program to print the following pattern.

```
                1
            1   2   1
        1   2   3   2   1
    1   2   3   4   3   2   1
1   2   3   4   5   4   3   2   1
```

5. a) Write a C program to find both the largest and smallest numbers in a list of integers.

   b) Write a C program that uses function to perform the following:

   i) Addition of Two Matrices ii) Multiplication of Two Matrices

6. a) Write a C program to insert a sub-string in to a main string at a given position.

   b) Write a C program to count the lines, words and characters in a given text.

7. a) Write a C program to generate all the prime numbers between 1 and *n*, where *n* is a value entered by the user. Define a separate function to generate prime numbers.

   b) Write C program that uses recursive function to find the following.
   i) Factorial of a given integer ii) GCD of two given integers

8. a) Write a C program to print the elements of an array in reverse order using pointers.

   b) Write a C program to count the number of vowels and consonants in a string using pointers.

   c) Write a C program to store *n* elements in an array and print the elements in sorted order using pointers.

9. a) Write a C program that performs the following operations:

   i. Reading a complex number ii. Writing a complex number

   iii. Addition of two complex numbers iv. Multiplication of two complex numbers

   (**Note:** Represent complex number using a structure.)

   b) Define a structure to store employee details include *Employee-Number, Employee-Name, Basic-pay, Date-of-Joining.* Write a C program for the following.

   i. A function to store 10 employee details.

   ii. A function to implement the following rules while revising the basic pay.

   If Basic-pay<=Rs.5000 then increase it by 15%.

   If Basic-pay> Rs.5000 and <=Rs.25000 then it increase by10%.

   If Basic-pay>Rs.25000 then there is no change in Basic-pay.

   iii. A function to print the details of employeeswhohave completed 20 years of service from the Date-of-Joining.

10 a) Write a C program to reverse the first *n* characters of a given text file.

   b) Write a C program to merge two files into a new file.

11 Develop a phone book application to save users contact information include name, mobile number and email id as well as to edit and delete contact details.

RESOURCES

TEXT BOOKS:

1. PradipDey and Manas Ghosh, "*Programming in C*," Oxford University Press, New Delhi, 2nd Edition, 2013.
2. R. G. Dromey, "*How to Solve it by Computer*," Pearson Education, 1st Edition, 2013.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, "*Programming with C*,"4th Edition, McGraw Hill Education, 2019.
2. YashavantKanetkar, "*Let Us C*,"5th h Edition, BPB Publications, 2017.
3. E. Balagurusamy, "*Programming in C*," McGraw Hill Education Pvt, Ltd, New Delhi, 7th Edition, 2017.
4. Behrouz A. Forouzan and Richard F. Gilberg, "*Computer Science: A Structured Programming Approach Using C*," Cengage Learning, 3rd Edition,2008.

SOFTWARE/TOOLS:

1. Software: Turbo C++/Dev C++

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/106105171/L03.html
2. https://nptel.ac.in/courses/106104128

WEB RESOURCES:

1. Learn C Programming - https://www.programiz.com/c-programming
2. Learn C Programming - https://www.tutorialspoint.com/cprogramming/index.htm
3. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/
4. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/ basic-programming-practice-problems.html
5. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/
6. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/basic-programming-practice-problems.html

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101410	**DISCRETE MATHEMATICS FOR COMPUTER SCIENCE**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course will discuss fundamental concepts such as sets, proof techniques, functions, relations, counting principles, mathematical logics and graph theoretical approaches with applications to computer science.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Identify the mathematical logic through the algebraic skills of expressions, tables and normal forms.

CO2. Demonstrate the basic concepts of Mathematical systems to analyse the proof techniques in mathematical induction.

CO3. Apply the techniques of counting, permutations and combinations for solving various practical problems.

CO4. Apply the concepts of graph theory to solve structural and graphical designs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**2**	**2**	-	-	-	-	-	-	-	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: MATHEMATICAL LOGIC ***(08Periods)***

Propositions and Logical Operations, Truth Tables, Equivalence, Implications, Laws of Logic, Normal Forms: Conjunctive Normal Form, Disjunctive Normal Form, Principle Disjunctive Normal Form, Principle Conjunctive Normal Form.

Module 2: SET THEORY ***(09Periods)***

Sets and Elements, Subsets, Venn Diagrams, Set Operations, Algebra of Sets, Finite Sets, Counting Principle, Classes of Sets, Power Sets, Partitions, Mathematical Induction.

Module 3: RELATIONS AND FUNCTIONS ***(10Periods)***

Relations, Operations on Relations, Equivalence Relation, Partitions and Equivalence Classes, Functions, One-One and Onto Functions, Special Type of Functions, Invertible Functions, Compositions of Functions, Recursively Defined Functions.

Module 4: TECHNIQUES OF COUNTING ***(09Periods)***

Basic Counting Principles, Permutations, Combinations,GeneralizedPermutations and Combinations, Pigeonhole Principle, Generalized Pigeonhole Principle,InclusionExclusion Principle.

Module 5: GRAPHS ***(09 Periods)***

Definition of a Graph, Graph Terminology and special Types of Graphs, Handshaking Theorem, Finite and Infinite graphs, Incidence and Degree, Null graph, Sub graphs,Walks, Paths and Circuits in a graph, Connected graphs.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Demonstrate that R ∧ (P VQ) is a valid conclusion from the premises

   (P V Q), (Q→ R), $(P \rightarrow M)$ and ¬M.

2. Draw the Hasse diagram of the set {2,4,8,16} under the partial ordering relation "divides" and indicate those which are totally ordered

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen,"*Discrete Mathematics and its Applications",* Tata McGraw Hill, 8th Edition, 2019.
2. Jon Pierre Fortney, "*Discrete Mathematics for Computer Science,*" CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johsonbaugh, "*Discrete Mathematics,*" Prentice Hall,8thEdition, 2019.
2. Narasing Deo, "*Graph Theory with application to Engineering and Computer Science*", Prentice Hall India, 2016.
3. J.P. Trembly and R. Manohar, "*Discrete Mathematical Structures with Applications to Computer Science,"* Tata McGraw Hill, 37thEdition, 2017.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/106106094

WEB RESOURCES:

1. https://www.coursera.org/learn/discrete-mathematics
2. https://people.cs.pitt.edu/~milos/courses/cs441/
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA101003	BASICS OF VIRTUALIZATION AND CLOUD TECHNOLOGY	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course gives students an insight into the basics of cloud computing along with virtualization. It will provide the students basic understanding about cloud and virtualization.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate basic concepts of Virtualization and Cloud Technology of Cloud Computing.

CO2. Analyze desktop virtualization, providers with traditional IT service providers, Roots of cloud computing, hardware virtualization and Regularity issues for cloud technology.

CO3. Use Microsoft's Virtualization solutions for cloud virtualization

CO4. Adapt architectural influences using High-performance computing, Utility and Enterprise grid computing for the performance in Cloud environment.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	2	3	-	-	-	-	3	-	-	-	-	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
Course Correlation Level	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High2: Medium; 1: Low

COURSE CONTENT

Module 1: BASICS OF VIRTUALIZATION ***(09 Periods)***

Virtualization and cloud computing: Need of virtualization, cost, administration, fast deployment, reduce infrastructure cost, limitations.

Types of hardware virtualization: Full virtualization, partial virtualization, para virtualization

Desktop virtualization: Software virtualization, Memory virtualization, Storage virtualization, Data virtualization, Network virtualization

Module 2: HYPERVISORS AND VIRTUAL MACHINES ***(10 Periods)***

Server Virtualization: Understanding Server Virtualization, types of server virtualization, Virtual machine basics, types of virtual machines, hypervisor concepts and types.

Module 3: VIRTUALIZATION SOLUTIONS ***(09 Periods)***

Understanding Microsoft's Virtualization solutions: Microsoft's Infrastructure Optimization Model, Virtualization and the Infrastructure Optimization Model, Benefits of Virtualization, Achieving the Benefits of Datacenter Virtualization, Achieving the Benefits of Client Virtualization, Achieving the Benefits of Cloud Virtualization.

Module 4: BASICS OF CLOUD COMPUTING ***(09 Periods)***

Origins of Cloud computing, Cloud components, Essential characteristics, On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

Module 5: CLOUD INSIGHTS ***(08 Periods)***

Architectural influences: High-performance computing, Utility and Enterprise grid computing; Cloud scenarios, Benefits: scalability, simplicity,vendors, security, Limitations, Sensitive information, Application development, security level of third party, security benefits, Regularity issues: Government policies.

Total Periods: 45

EXPERIENTIAL LEARNING:

1.Creating Virtualized Environment using VM ware.

2. Deploying an WebApp/MobileApp in Public Cloud.

3. Invoke an operating System in an Virtualized environment.

RESOURCES

TEXT BOOKS:

1. David Marshall, Wade A. Reynolds, "*Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center,*" Auerbach.
2. Anthony T.Velte, Toby J. Velte Robert Elsenpeter "*Cloud computing a practical approach*", TATA McGraw- Hill, 2010.

REFERENCE BOOKS:

1. Michael Miller, "*Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate*," 2008.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "*Cloud Computing (Principles and Paradigms)*", John Wiley & Sons, Inc. 2011
3. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, "*Cloud computing for Dummies*", Wiley Publishing Inc., 2010

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=Jph3H1wZTKM
2. https://www.digimat.in/nptel/courses/video/106105167/L07.html

WEB RESOURCES:

1. https://www.knowledgehut.com/blog/cloud-computing/virtualization-in-cloud-computing
2. https://www.analyticssteps.com/blogs/what-virtualization-cloud-computing-characteristics-benefits
3. https://www.javatpoint.com/virtualization-in-cloud-computing

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CA105001	COMPUTER HARDWARE AND SYSTEM ESSENTIALS	-	1	2	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on internal components of a computer, assemble a computer system, install an operating system, and troubleshoot using system tools and diagnostic software. Students will also be able to understand various network cables, connectors and TCP/IP networks, and work group.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Identify different hardware components on personal computer and peripheral devices.

CO2 Create network architecture using TCP and UDP protocols for data transmission.

CO3 Devise the solutions for the problems occurred in personal computer in Operating Systems.

CO4 Implement the functionalities of different peripheral devices and networks by configuring multi-functional devices.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	1	1	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3	-	1	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	1	2	-	-	-	-	-	-	-	-	-	3
CO4	3	2	3	1	-	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

EXPERIENTIAL LEARNING

HARDWARE CONFIGURATION

1. Peripherals of the computer
2. Implement the following activities:
   a) Configure settings using BIOS/UEFI tools on a PC.
   b) Identify different components of mother board
   c) Analyze various RAM types, PC extensions cards and storage devices
3. Implement the following activities:
   a) Identify various CPU's, cooling methods and PC connection interfaces
   b) Identification of various power supply, display devices and common PC Connectors
   c) Install and configure common peripheral devices and SOHO multi-function device

PC Networking using Packet Tracer

Network Types and Components, Topologies, Wired and Wireless Transmission, Protocols.

4. a) Identify various types of network cables and connectors and characteristics
   b) Implement the following characteristics of TCP/IP
      i)IPv4 and IPv6 ii)Client side DNS Settings
5. a) Identify following TCP and UDP Ports
      i)21-FTP ii)443-HTTPS iii)80-HTTP iv)Telnet
   b) Analyze the following TCP and UDP protocols
      i)SMD ii)SNMP iii)DHCP
6. a) Configure the following network types
      i) LAN ii) WAN iii) WLAN
   b) Configure network architecture using the following
      i) HUB ii) Switch iii) Router

OPERATING SYSTEMS

Introduction to Operating System, Characteristics of Operating System, Types of Operating System and its components

7. Installation of Windows Operating System
8. Installation of Application and Device Drivers management

TROUBLESHOOTING

Introduction to trouble shooting, Hardware and Software Trouble shooting

9. a) Study the common problems related to the following
      i) Mother Board ii) RAM iii) CPU iV) Power
   b) Troubleshoot the following failures
      i) Read/Write Failure ii) Slow Performance iii) Failure to boot
10. Trouble Shoot the following symptoms of Video, projector and display issues
    i) VGA Mode ii) No Image of Screen iii) Dead Pixels iv) Color patterns
11. Trouble shoot the following issues of wired, wireless and mobile devices
    i) No Connectivity ii) IP conflict iii) Ghost Cursor iv) Stiking Keys

RESOURCES

REFERENCES:

1. David Anfinson, Allan Johnson and Kathleen Czurda, *IT Essentials v7 Companion Guide*, CISCO Press, 2020
2. Brian W. Kernighan, *Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security*, Second Edition, Princeton University Press, 2021
3. Kavin Wilson, *Exploring Computer Systems: The Illustrated Guide to Understanding Computer Systems, Hardware &Networks*, Elluminent Press, 2019

SOFTWARE/TOOLS:

1. Windows 8/10 operating systems
2. Cisco Packet Tracer

VIDEO LECTURES:

1. https://www.edx.org/course/computer-hardware-and-operating-systems
2. https://www.coursera.org/learn/computer-hardware-software

WEB RESOURCES:

1. https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/configuration/15-s/ir-15-s-book.pdf
2. https://www.certexams.com/comptia/a+/cert-notes-aplus-networking.htm
3. https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/4399/Network%20n10-007.pdf
4. https://www.tutorialsweb.com/CertNotes/CompTIA-cert/A+/aplus-prac-10.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG101701	BUSINESS COMMUNICATION AND CAREER SKILLS	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Nature and Scope of Communication, Corporate Communication, Writing Business Messages & Documents, Careers & Résumés, and Interviews.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of professional communication by analyzing and applying the styles and strategies of business communication in Communication Networks, Interpersonal, and Informal communication.

CO2. Analyze the limitations of communication by applying and demonstrating corporate and cross-cultural communication strategies effectively in a business context and Crisis Management situations.

CO3. Apply appropriate strategies and techniques in writing business messages, business letters, and résumé for effective professional communication and career building.

CO4. Demonstrate appropriate communication techniques and answering strategies by analyzing the expectations during presentations and interviews.

CO-POMapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	2	-	-	-	-	3	-	-
CO2	1	2	-	-	2	-	-	-	-	3	1	-
CO3	1	-	-	-	2	-	-	-	-	3	-	-
CO4	1	2	-	-	2	-	-	-	-	3	-	-
Course Correlation Mapping	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**1**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: NATURE AND SCOPE OF COMMUNICATION ***(6 Periods)***

Introduction – Communication Basics – Functions of Communication – Communication Networks – Interpersonal Communication – Informal Communication – Communication Barriers – Roles of a Manager.

Module 2: CORPORATE COMMUNICATION ***(6 Periods)***

Introduction – Corporate Communication – Cross-Cultural Communication; Concept & Styles – Corporate Communication Strategy – Corporate Citizenship – Crisis Communication: Case Study.

Module 3: WRITING BUSINESS MESSAGES & DOCUMENTS ***(6 Periods)***

Introduction – Importance of Written Business Communication – Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Kinds of Business Letters – Common Components of Business Letters – Strategies for Writing the Body of a Letter.

Module 4: CAREERS AND RÉSUMÉS ***(6 Periods)***

Introduction – Career Building – Résumé Formats: Traditional, Electronic and Video Résumé – Sending Résumés – Follow-up Letters – Business Presentations and Speeches: Planning –Structuring – Organizing – Delivery.

Module 5: INTERVIEWS ***(6 Periods)***

Introduction – General Preparation for an Interview – Success in an Interview – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing – Types of Interviewing –Online Recruitment Process.

Total Periods: 30

EXPERIENTIAL LEARNING

1. People often get confused in identifying or using English vocabulary on most occasions. Prepare a list of confusing words and find methods to overcome the difficulties in using those words to uplift the career of professionals.
2. Organizations and institutions use modern technology in communicating with their colleagues, clients, and stakeholders. Make a PowerPoint presentation on the modern communication system of any organization and its role in the success of the organization and its career.
3. As a student in the modern technological world, organizing or attending webinars is inevitable. Analyze the pros and cons of video conferencing by organizing webinars and preparing a report.
4. Form a team and act as a team leader. Prepare a performance appraisal report of the team using visual aids to support the presentation.
5. Make a detailed study on social networking and its impact on modern business and Career.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Meenakshi Raman, Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd edition, 2012.
2. Neera Jain, Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw–Hill

REFERENCE BOOKS:

1. Courtland L. Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.
2. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110105052
2. https://edurev.in/courses/14522_Business-Communication-The-Ultimate-Guide

Web Resources:

1. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
2. http://job-search-search.com/interviewing/behavioral_interviews
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.resumania.com/arcindex.html

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CM101402	ENTREPRENEURIAL DEVELOPMENT	2	-	-	-	2

Pre-Requisite

Anti-Requisite

Co-Requisite

COURSE DESCRIPTION: The course aim is to acquaint with the concepts of Entrepreneurship and business opportunities, business planning, generation of finance and project reports for starting a new business.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate concepts of entrepreneurship and professional behaviour expected of an entrepreneur.

CO2. Demonstrate knowledge about recognising the business opportunities and generation of business ideas.

CO3. Analyze generation and screening of project ideas and assessment of its feasibility and Business planning process.

CO4. Acquainted with the knowledge various sources of funding for new business projects.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: ENTREPRENEURSHIP ***(06 Periods)***

Entrepreneur, entrepreneurship – Types of Entrepreneurship – Traits of entrepreneurship – Factors promoting entrepreneurship- Barriers to entrepreneurship- the entrepreneurial culture- Stages in entrepreneurial process – Women entrepreneurship and economic development- SHG.

Module 2: BUSINESS IDEAS ***(06 Periods)***

Recognizing opportunities – trend analysis – generating ideas – Brainstorming, Focus Groups, Surveys, Customer advisory boards, Day in the life research – Encouraging focal point for ideas and creativity at a firm level-Protecting ideas from being lost or stolen – Patents and IPR.

Module 3: OPPORTUNITY IDENTIFICATION AND EVALUATION ***(07 Periods)***

Opportunity identification and product/service selection – Generation and screening the project ideas – Market analysis, Technical analysis, Cost benefit analysis and network analysis- Project formulation – Assessment of project feasibility- Dealing with basic and initial problems of setting up of Enterprises.

Module 4: BUSINESS PLANNING PROCESS ***(05 Periods)***

Meaning of business plan- Business plan process- Advantages of business planning- preparing a model project report for starting a new venture.

Module 5: FUNDING ***(06 Periods)***

Sources of Finance- Venture capital- Venture capital process- Business angles- Commercial banks- Government Grants and Schemes.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Observation of Business environment and Identification of New business Ideas.
2. Visiting a Business and knowing entire process of commencement of business.

RESOURCES

TEXT BOOKS:

1. Khanka S.S., Entrepreneurial Development, S.Chand& Co. Ltd., New Delhi, 2001.
2. Sangeeta Sharma, Entrepreneurship Development, PHI Learning Pvt. Ltd., 2016.

REFERENCE BOOKS:

1. Barringer, B., Entrepreneurship: Successfully Launching New Ventures, 3rd Edition, Pearson, 2011.
2. Bessant, J., and Tidd, J., Innovation and Entrepreneurship, 2nd Edition, John Wiley &Sons, 2011.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=gCRN8wS8PBM
2. https://www.youtube.com/watch?v=hnBla1FfcLo

WEB RESOURCES:

1. https://ncert.nic.in/ncerts/l/lebs213.pdf
2. http://depintegraluniversity.in/userfiles/Entrepreneurship%20Development.pdf

SCHOOL CORE

Course Code	COURSE TITLE	L	T	P	S	C
22CM101403	INNOVATION AND DESIGN THINKING	2	-	-	-	2

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course introduces design thinking in product innovation. This course is intended to familiarize product design process, introduce the basics of design thinking, to bring awareness on idea generation, to familiarize the role of design thinking in services design.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate fundamental knowledge of Design thinking.

CO2. Analyze characteristics of successful product development

CO3. Demonstrate knowledge on Idea generation techniques

CO4. Analyze the process of design thinking for services.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DESIGN ***(06 Periods)***

Introduction to design, characteristics of successful product development, product development process, identification of opportunities, product planning, Innovation in product development.

Module 2: DESIGNING THINKING ***(06Periods)***

Design Thinking: Introduction, Principles, the process, Innovation in Design Thinking, benefits of Design thinking, design thinking and innovation, case studies.

Module 3 Idea Generation ***(06 Periods)***

Idea generation: Introduction, techniques, Conventional methods, Intuitive methods, Brainstorming, Gallery method, Delphi method, Synectics etc., case studies

Module 4 DESIGN THINKING IN INFORMATION TECHNOLOGY ***(06 Periods)***

Design Thinking in Business process model, Design Thinking for agile software development, virtual collaboration, multi user and multi account interaction, need for communication, TILES toolkit, Cloud implementation.

Module 5 DESIGN THINKING FOR SERVICE DESIGN ***(06 Periods)***

How to design a service, Principles of service design, Benefits of service design, Service blueprint, Design strategy, organization, principles for information design.

Total Periods: 30

EXPERIENTIAL LEARNING

1. What data-driven insights can help us evolve our product?
2. How can we gather ongoing feedback to drive future enhancements?

RESOURCES

TEXT BOOKS:

1. Lagerfeld Kilian., "Design Thinking for Beginners", 1st Edition, Personal Growth Hackers, 2020.

2. PavanSoni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving", 2nd Edition, Penguin Random House India Private Limited, 2020.

3. Marc stickdorn and Jacob Schneider, This is Service Design Thinking, Wiely, 2011

REFERENCE BOOKS:

1. Walter Brenner and Falk Uebernickel, "*Design Thinking for Innovation Researc*h"**,** 1st Edition,Springer, 2016.

2. GK Van Patter and Garry K. VanPatte, "*Rethinking Design Thinking*: *Making Sense of the Future"*,1st Edition, Humantific *Publishing*, 2020.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=4nTh3AP6knM
2. https://www.youtube.com/watch?v=NRQLlznGIKk

WEB RESOURCES

1. https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf
2. https://www.tutorialspoint.com/hi/design_thinking/design_thinking_tutorial.pdf
3. http://www.algarytm.com/it-executives-guide-to-design-thinking:e-book

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG107601	**PROFESSIONAL ETHICS AND HUMAN VALUES**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with personal conviction, and ethics and describes the accepted principles and standards of conduct regarding moral duties and virtues as applied to an organization. Codes of professional ethics guide the stakeholders of an organization about the desirable and undesirable acts related to the profession.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the principles of ethics, professional values, and social responsibility.
CO2. Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.
CO3. Develop suitable strategies to resolve problems that arise in practicing professional ethics and Industrial standards.
CO4. Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.
CO5. Provide solutions to complex problems associated with professional ethics using analysis and interpretation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	2	2	2	2	-	-	-
CO2	2	3	2	-	2	2	2	2	2	-	-	-
CO3	2	-	3	-	2	2	2	2	2	-	-	-
CO4	2	-	-	-	-	2	2	2	2	-	3	-
CO5	2	2	3	2	-	3	2	2	2	-	-	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: PROFESSIONAL ETHICS ***(06 Periods)***

Scope and aim of ethics, Senses of ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus, and controversy.

Module 2: PROFESSIONAL IDEALS AND VIRTUES ***(06 Periods)***

Theories on virtues and ideals, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

Module 3: SOCIAL EXPERIMENTATION ***(06 Periods)***

Experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards and Problems with the law of engineering.

Module 4: RESPONSIBILITIES AND RIGHTS ***(06 Periods)***

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights, and discrimination.

Module 5: HARMONY WITH PROFESSIONAL ETHICS ***(06 Periods)***

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education, Constitution, and Universal Order; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Transition from the present state to Universal Human Order: socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what is naturally acceptable in a relationship – Feeling of respect or disrespect and what is naturally acceptable is to nurture or exploit others.
2. Identify community partners and discuss with a community partner or organization. Prepare a report by identifying and analysing the issues or opportunities.
3. Field experiences may be directed to include a range of time-intensive endeavours that require varying levels of student interaction. Prepare a report on visiting a Juvenile home.
4. Students read a speech in the classroom by former United Nations Secretary-General Kofi Annan on human values.
5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.
6. Bring out the relevance of engineering ethics theory and practice with relevance to current trends.
7. Professional ideals and virtues are important to everyone. Prepare a case study on the professional ideals and virtue of any one of the famous sports personalities from India.
8. Compare the present to the past in engineering experimentations concerning the change in professionalism.

9. Make a study on occupational crime and the role of modern technology in finding solutions.
10. Prepare a case study on how to maintain harmony with different cultural people using professional ethics.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXTBOOKS:

1. Gaur R R, Sangal R & G P Bagaria, *Human Values and Professional Ethics*, Excel Books, New Delhi, 2010.
2. Govindarajan, M., NataGovindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.
3. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.
3. Charles F. Fledderman, *Engineering Ethics*, Pearson Education, 2nd Edition, 2004.
4. R. Subramanaian, *Professional Ethics*, Oxford Higher Education, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jfGIq_EiXzI
2. https://www.youtube.com/watch?v=QFHOtH54oUc
3. https://www.youtube.com/watch?v=JJshY11nX14
4. https://www.youtube.com/watch?v=TyP09S0UEzA
5. https://www.youtube.com/watch?v=0QMwjV_ZVtc

Web Resources:

1. https://siiet.ac.in/wp-content/uploads/2020/09/7.1.10-professional-ethics-manual.pdf
2. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf
3. https://india.oup.com/productPage/5591038/7421214/9780199475070

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CE107601	**ENVIRONMENTAL SCIENCE**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on natural resources, ecosystems, biodiversity, environment pollution and control, social issues and environment, human population and environment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.

CO2. Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.

CO3. Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.

CO4. Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.

CO5. Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-POMapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	2	-	1	1	-	-	-	1	-
CO2	3	3	-	2	-	1	1	1	-	1	-	-
CO3	3	3	-	2	1	1	1	1	-	-	-	1
CO4	3	3	-	3	-	1	1	1	-	1	-	-
CO5	3	3	-	2	1	1	1	1	1	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: NATURAL RESOURCES ***(07 Periods)***

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

Module 2: ECOSYSTEMS AND BIODIVERSITY ***(07 Periods)***

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

Module 3: ENVIRONMENTAL POLLUTION AND CONTROL ***(06 Periods)***

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management – Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

Module 4: SOCIAL ISSUES AND THE ENVIRONMENT ***(06 Periods)***

Sustainable development, Urban problems related to energy, Environmental ethics – Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

Module 5: HUMAN POPULATION AND THE ENVIRONMENT ***(04 Periods)***

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets – Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Visit a nearby villages and know the status of availability of local resources that can be improved through proper education.
2. Make an awareness program in the villages for the development of natural resources, ecosystems and biodiversity.

3. Prepare a document by visiting a local urban waste dumping yard near to the Tirupati city.
4. Visit a local village and find a barren land and make the land into a useful land by planting plants or providing the soil and fertilizers required to improve the soil.
5. Visit a local zoological park and identify the species variety and variability.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. AnubhaKaushik and Kaushik, C.P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. ErachBarucha, *Environmental Studies,* Orient Blackswan, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/109/104/109104047
2. https://www.youtube.com/watch?v=mIPBPG-5dUw

Web Resources:

1. https://nptel.ac.in/courses/122102006
2. https://www.flame.edu.in/academics/ug/program-structure/major-minor courses/environmental-studies
3. https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG107602	ESSENTIAL LIFE SKILLS FOR HOLISTIC DEVELOPMENT	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with different types of thinking skills, self-awareness, coping with stress and emotion, transformational skills, group and team dynamics, and leadership.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand different life skills required in personal and professional life.

CO2 Analyse well-defined techniques to cope with emotions and stress.

CO3 Apply appropriate thinking and problem-solving methods to solve problems.

CO4 Function effectively in a team and as an individual.

CO5 Demonstrate the qualities of an effective leader.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	2	-	2
CO2	2	3	-	-	2	-	-	-	-	2	-	2
CO3	2	3	-	-	2	-	-	-	-	2	-	2
CO4	2	2	-	-	2	-	-	-	3	2	-	2
CO5	2	2	-	-	-	-	-	-	-	2	-	3
Course Correlation Mapping	2	3	2	-	2	-	-	-	3	2	-	2

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: OVERVIEW OF LIFE SKILLS ***(06 Periods)***

Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem-solving, Effective Communication, interpersonal relationships, coping with stress, coping with emotion.
Ethics, Moral & Professional Values:Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

Module 2: STRESS MANAGEMENT ***(06 Periods)***

Stress Management: Stress, reasons, and effects, identifying stress, stress diaries, the four A's of stress management, techniques, **Approaches**: action-oriented, emotion-oriented, acceptance oriented, resilience, Gratitude Training, **Coping with emotions**: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method, and relaxation techniques.

Module 3 TRANSFORMATIONAL SKILLS ***(06 Periods)***

Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Module 4 GROUP AND TEAM DYNAMICS ***(06 Periods)***

Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, and Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5 LEADERSHIP ***(06 Periods)***

Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership,Transactionalvs Transformational Leaders, Leadership Grid, Effective Leaders.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Prepare an attitude test and measure the attitudes of your class.
2. Prepare a Case study on the Campus Interview pressure and stress of students using SWOT analysis.
3. Record and prepare videos of various cultural people and make a comment on their accents.

4. Prepare a short film of a leader of your choice and list out the best qualities.
5. Prepare a presentation on the impact of social media on leadership management.
6. 'Knowledge of present technologies helps us to live a harmonious life.'
   Make a video to justify the statement.
7. Identify life skills needed in our day-to-day life and explain their importance.
8. Come up with strategies to become successful in professional life.
9. Find methods and solutions to overcome the self-pity of a person.
10. Identify the persons who are irregular to class. Find out their problems and come up with solutions.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXTBOOK:

1. Dr. K Alex, "*Soft Skills"*. S Chand & Company Pvt.Ltd.2013.
2. Monmohan Joshi, "*Soft Skills*". Boolkboon.com, First Edition, 2017.

REFERENCE BOOKS:

1 Barun K. Mitra. "Personality Development & Soft Skills", First Edition; Oxford Publishers. 2011.

1 Kalyana. "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd. 2015.

1 Shalini Verma. "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company, 2014.

1 John C. Maxwell. "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc. 2014.

1 Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.

1 Remesh S., Vishnu R.G. "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.

1 Butterfield Jeff. "Soft Skills for Everyone", Cengage Learning India Pvt Ltd; 1 edition, 2011.

1 Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 edition, 2015.

1 The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=xM0fajUl7Bg
2. https://www.youtube.com/watch?v=HwLK9dBQn0g
3. https://www.youtube.com/watch?v=sxX5LoojdJw
4. https://www.youtube.com/watch?v=xJBgqW9-lzc

5. https://www.youtube.com/watch?v=QVwTVM1Iv1c

Web Resources:

1. https://www.clarke.edu/campus-life/health-wellness/counseling/articles-advice/developing-a-positive-attitude/
2. https://www.skillsyouneed.com/ps/personal-swot-analysis.html
3. https://ecampusontario.pressbooks.pub/profcommsontario/chapter/cross-cultural-communication/
4. https://thepeakperformancecenter.com/educational-learning/thinking/#:~:text=There%20are%20several%20core%20thinking,storing%20and%20then%20retrieving%20information.
5. https://www.webmd.com/anxiety-panic/guide/stage-fright-performance-anxiety
6. https://www.ktunotes.in/ktu-syllabus-life-skills/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG107603	**SPOKEN ENGLISH**	-	1	2	-	2

Pre-Requisite : GENERAL ENGLISH

Anti-Requisite

Co-Requisite

COURSE DESCRIPTION: This course deals with the development of fluency and intelligibility in spoken English. Through individual and group activities, students work on improving pronunciation, practicing conversation strategies, and delivering oral presentations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge of functional English for effective communication.

CO2 Analyze different types of vocabulary for fluency in communication

CO3 Apply correct usage of English grammar in writing and speaking.

CO4 Apply speaking strategies in terms of usage of English with accuracy, appropriacy, and fluency.

CO5 Analyze techniques to us e communication skills for effective presentation.

CO-PO Mapping Table:

Learning Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	2	-	3	-	-	-
CO2	2	3	-	-	-	-	2	-	3	-	-	-
CO3	2	-	3	-	3	-	2	-	3	-	-	-
CO4	2	-	-	-	3	-	2	-	3	-	-	-
CO5	2	3	2	-	3	-	2	-	3	-	-	-
Course Correlation Mapping	2	3	-	-	3	-	2	**-**	3	**-**	-	-

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: FUNCTIONAL ENGLISH - I

Concepts of Functional Spoken English,Self Introduction; Listening and Speaking: Do's and Don'ts; Expressions I: Ability, Admiration,Agreement,Annoyance, Appreciation,Pleasure, Sarcasm.

Module 2: FUNCTIONAL ENGLISH - II

Expressions II :Satisfaction, Surprise, Approval, Certainty, Doubt, Gratitude, Possibility, Fear, Worry, Condolences; Asking for: Advice, Clarification, Direction, Information, Permission; Making: Predictions, recommendations

Module 3: VOCABULARY BUILDING - I

Vocabulary for day-to-day conversations: Vegetables, Groceries, Fruits, Weather, Parts of a Human body, Dresses, Furniture; Relations: Birds, Cries of Animals.

Module 4: VOCABULARY BUILDING - II

Food, Hospitality, Houses, Rooms, Tools, Airport, News Paper, Books, Gems, Corporate Vocabulary, Jobs, Occupations, Diseases; British and American spelling; Slang Words and Technical Jargons.

Module 5: FUNCTIONAL GRAMMAR - I

English Grammar and the Indian Student, Parts of Speech.

Module 6: FUNCTIONAL GRAMMAR - II

Verb forms: Tenses, Voice and Speech.

Module 7: FUNCTIONAL GRAMMAR -III

Universal Auxiliaries: Sentence Structure,WHQuestions, framing of Questions with answers; Question Tags, Subject and verb agreement, Spotting Errors.

Module 8: FUNCTIONAL GRAMMAR -IV

Framing of Questions with answers; Question Tags, Subject and verb agreement, Spotting Errors.

Module 9: COMMUNICATION SKILLS - I

Polite, Courteous and diplomatic expressions, Good manners and Etiquette,

Module 10: COMMUNICATION SKILLS - II

Conversation Techniques, Narrating Stories.

RESOURCES

TEXTBOOKS:

1. L. Adinarayana and V. Prakasam, *"Spoken English",* Neelkamal Publications Pvt. Ltd., NewDelhi, 2008.
2. Ram Bhasker Raju, "*The Complete Book on Spoken English"*Goutham Buddha Publications, Hyderabad, 2002.

REFERENCE BOOKS:

1. Sabina Pillai, Spoken English for my World, Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, Speak in English,Scitech Publications, Chennai, 2009.

VIDEO LECTURES:

1. https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills
2. https://www.fluentu.com/blog/english/websites-to-learn-english/

WEB RESOURCES:

1. https://study.sagepub.in/kakarla_fec
2. https://www.theconfidentteacher.com/2018/04/five-useful-vocabulary-websites/
3. https://ling.sprachwiss.uni-konstanz.de/pages/home/lfg/resources.html
4. https://www.makeuseof.com/tag/improve-communication-skills-7-websites/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MG107401	INNOVATION, INCUBATION, AND ENTREPRENEURSHIP	2	-	-	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: To sensitize students on the prospects, opportunities, and challenges in entrepreneurship and the potential for value creation from prospective idea

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Understand the basics of generating new business ideas
CO2 Explain the concept of design thinking and product innovation.
CO3 Illustrate the roles of digital technology in entrepreneurship.
CO4 Understand the need for startup economics and market conditions
CO5 Evaluate the reasons for successful entrepreneurship.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	1	-	-	-	-		1			-
CO3	2	2	1	-	-	-	-	1	-	-	2	
CO4	3	1	1	-	-	-	-	-	-	-	-	1
CO5	2	2	-	-	-	1	-	-	-	-	-	1
Course Correlation Mapping	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	1	**-**	**2**	**1**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction ***(06 Periods)***
Concept & Definition, Taking product or service ideas to creating value: Why should one choose
to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship

Module 2: Product Innovation ***(06 Periods)***
Product innovation process, engineering design process and the concept of frugal engineering for developing innovative affordable products, effective user-interface.

Module 3: Digital Technology Entrepreneurship ***(06 Periods)***
Industry 4.0 landscape and innovations using digital technologies like AI, IOT, AR/VR, Cloud, SAAS, User Applications.

Module 4: Startup Economics & Market considerations ***(06 Periods)***

Economic consideration for starting a venture, Understanding Feasibility analysis, Understanding market, targeting customer and positioning product

Module 5: Successful Business Incubation ***(06 Periods)***

Business model innovation, Business process management , competitive advantages, Business model canvas, Bootstrapping.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Create and present a prototype of a new product of your choice.
2. Present at least three cases of successful business Ideas in recent times
3. Discuss in the group Entrepreneurship opportunities in terms of Orientation and Develop mentation.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Robert D. Hisrich,*Entrepreneurship*,
2. Kuratko&Hodgetts,*Entrepreneurship- Theory, Process & Practice*, Thompson South-Western Publication

REFERENCE BOOKS:

1. Peter Drucker, *Innovation and Entrepreneurship*, Harper Collins
2. Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, *Technology Entrepreneurship Taking Innovation to the Marketplace*, Elsevier
3. Prof. Nigel Cross, *Bloomsbury Design Thinking Understanding How Designers Think and Work*, 2019 Edition

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_mg63/preview
2. https://onlinecourses.nptel.ac.in/noc22_de08/preview

Web Resources:

1. nhttps://ciie.iitism.ac.in/files/CIIE-POLICY.pdf
2. https://www.nios.ac.in/media/documents/249_Enterpreneurship/English_pdf/249_Enterpreneurship_Lesson_16.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102002	**DATABASE MANAGEMENT SYSTEMS**	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This Course providestheoretical concepts and hands-onexperience on Databasesystems, Databasedesign, Relational model, Relational algebra, SQL queries, Constraints and triggers, PL/SQL, Schema refinement and normal forms, Transaction management, Concurrency control,Overviewofstorageand indexing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze and applytheconceptsofER-modellingandnormalizationtodesignviabledatamodelsforagivenproblem.
CO2. Formulaterelationaldatabaseschemas,applysuitableintegrityconstraints,for queryingdatabases.
CO3. Use SQL to store, query, and manipulate data in relational databases.
CO4. Develop PL/SQL blocks to centralize database applications for maintainability and reusability.
CO5. Analyze transaction processing, concurrency control and storage methods for database management.
CO6. Work Independently and Communicate Effectively in Oral and Written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN ***(08 Periods)***

Introduction to Database Systems: Database system applications, Purpose of database systems, View of data - Data abstraction, Instances and schemas, Data models; Database languages - Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.

Introduction to Database Design: Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.

Module 2: RELATIONAL MODEL AND RELATIONAL ALGEBRA ***(08 Periods)***

Relational Model: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.

Relational Algebra: Preliminaries, Relational Algebra operators.

Module 3: SQL AND PL/SQL ***(10 Periods)***

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constrains in SQL, Triggers and active databases.

PL/SQL: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions, Cursors, Database triggers.

Module 4: SCHEMA REFINEMENT AND TRANSACTIONS (10 Periods)

Schema Refinement: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

Transactions: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability.

Module 5: CONCURRENCY CONTROL, STORAGE AND INDEXING ***(09 Periods)***

Concurrency Control: Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Deadlock Handling.

Storage and Indexing: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; Comparison of file organizations.

Total Periods: 45

EXPERIENTIAL LEARNING

1) Design and analyze an ER-Model for the following use case.

   Roadway Travels is in business since 1977 with several buses connecting different places in India. Its main office is in Hyderabad. The company wants to computerize its operations in the following areas:

   a) Reservations
   b) Ticketing
   c) Cancellations

   Reservations:

   Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. In case the ticket is not available, await listed ticket is issued to the customer. This ticket is confirmed against the cancellation.

   Cancellation and Modification:

   Cancellations are also directly handed at the booking office. Cancellation charges will be charged. Wait listed tickets that do not get confirmed are fully refunded.

2) a) Implement Single Row functions-Character, Numeric and Date functions.

   b) Implement Data Definition Language commands-Create, Alter, Drop, Truncate, and Rename.

   c) Implement Data Manipulation Language commands-Insert, Select, Update, and Delete.

3) Implement various types of integrity constraints-NOTNULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.

4) a) Implement group functions with different operators such as aggregate operators, group by, having and order by.

   b) Implement nested and correlated nested queries using set operators and set comparison operators.

5) a) Creation of views, synonyms, sequence, indexes and save point

   b) Implement various types of joins-outer join and inner join.

Basic PL/SQL:

6) Construct PL/SQ block for the following:

   a) To determine whether a number is palindrome

   b) To determine whether a number is an Armstrong number

   c) To find greatest of three numbers

   d) To display Fibonacci series

Control Structures:

7) a) Write a programming PL/SQL to update the salary of a specific employee by 8% if the salary

exceeds the mid-range of the salary against this job and update up to mid-range if the salary is less than the mid-range of the salary, and display a suitable message.

b) Write a PL/SQL program to display the description against a student‘s grade using CASE statement.

Exception Handling:

8) a) Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.

b) Construct the user-defined exceptions to get the salary of an employee and check it with the job‘s salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If the salary is above the range, raise the exception ABOVE_SALARY_RANGE.

Functions:

9) a) Write a function that accepts won numbers A and B and performs the following operations.
- Addition
- Subtraction
- Multiplication
- Division

b) Write a PL/SQL block that updates salary of an employee in Employee table by using in cr function which takes employee number as argument and calculates increment and returns increment based on the following criteria.
- If salary<=3000, increment=30%of salary
- If salary > 3000 and <= 6000, increment = 20% of salary
- Else increment = 10% of salary

Procedures:

10) a) Write a procedure that accepts two numbers and displays their sum

b) Write procedures to demonstrate IN, IN OUT and OUT parameters

Cursors:

11) a) WriteablockinPL/SQLtocreateaCursorthatdisplaystheemployeenameandnumber ofjobshe/shehasdoneinthepast.

b) Write a program in PL/SQL to create a cursor to display the name and salaryof each employee in the EMPLOYEES table whose salary is less than that’ specifiedbyapassed-inparametervalue.

Triggers:

12) Developasuitablestudentdatabaseapplicationbyconsideringappropriateattributes. Couple of attributes to be maintained is the attendance of a student in eachsubject for which he/she

has enrolled and internal assessment Using TRIGGERSfor the following:

a) Whenever the attendance is updated, check if the attendance is less than85%;ifso,notifytheconcernedheadofthedepartment.

b) Whenever, the marks in an internal assessment test are entered, check if themarksarelessthan40%;ifso,notifytheconcernedheadofthedepartment.

RESOURCES

TEXT BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management Systems*," McGrawHill,3rd Edition,2014.
2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, "*Database System Concepts*," McGrawHill,7thedition,2019.

REFERENCE BOOKS:

1. IvanBayross,*SQL,PL/SQL:"ThePrograммingLanguageofOracle*,"BPBpublications,4th Edition,2017.
2. RamezElmasri,ShamkantB.Navathe,"*FundamentalsofDatabaseSystems*", 7thEdition,Pearson,2015.
3. Thomas Connolly, Carolyn Begg, "*Database Systems*," Pearson, 6th edition, 2019.
4. S.K.Singh, "*Database System Concepts, Design and Applications*," 1st Edition, Pearson Education, 2006.
5. SatishAnsani,"*OracleDatabase11g: Hands-on SQLandPL/SQL*," PHI,2010.
6. Dr.Rajiv Chopra, "*Database Management Systems*," Sultan Chand, 2016.
7. PranabKumarDasGupta,P.RadhaKrishna,"*DatabaseManagementSystemOracleSQLandPL/SQL*,PHI,"2nd Edition,2009.

VIDEO LECTURES:

1. https://swayam.gov.in/nd1_noc19_cs46/preview
2. https://nptel.ac.in/courses/106105175
3. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4. https://www.youtube.com/watch?v=MDQxqYVXiVU
5. https://www.youtube.com/watch?v=c5HAwKX-suM

WEB RESOURCES:

1. https://www.classcentral.com/course/swayam-introduction-to-database-systems-17660
2. https://www.scaler.com/topics/dbms/
3. https://www.academia.edu/27988617/Database_Management_System_DBMS_Tutorial
4. https://nptel.ac.in/courses/106104135
5. https://downloads.mysql.com/docs/mysql-tutorial-excerpt-5.7-en.pdf
6. https://docs.oracle.com/cd/E11882_01/server.112/e40540/intro.htm#CNCPT88786

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102003	DATA WAREHOUSING AND DATA MINING	3	-	2	`-	4

Pre-Requisite - Database Management Systems

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION

Data Mining Fundamentals; Data Preprocessing; Operational Database Systems and Data Warehouses; Mining Frequent Patterns; Classification and Prediction; Clustering; Data warehousing and Mining tools, New Trends and Research Frontiers.

COURSE OUTCOMES

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

CO1. Understand the concepts ofData Warehousing architecture, Multidimensional models and OLAP operations.

CO2. Analyze data preprocessing techniques to produce refined data.

CO3. Apply Association rules and classification techniques for data categorization.

CO4. Make use of clustering techniques for grouping similar data items and identify outliers.

CO5. Design and develop applications using Data Mining trends.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1–DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING

(09 Periods)

Data Warehouse, Operational Database Systems versus Data Warehouses, A Multi tired Architecture, A Multidimensional Data Model, Stars, Snowflakes and Fact Constellations: Schemas, Role of Concept hierarchies, Measures, OLAP Operations, from online Analytical processing to Multidimensional Data Mining, Indexing OLAP Data.

Module 2–DATA MINING AND DATA PREPROCESSING (08 Periods)

Introduction to Data Mining, kinds of data, kinds of patterns, major issues in Data Mining, Data Pre-processing, Data Cleaning, Data Integration , Data Reduction, Data Transformation and Discretization.

Module 3–ASSOCIATIONS AND CLASSIFICATION (10 Periods)

Basic Concepts, Frequent itemset Mining Methods, pattern evaluation methods- From Association Mining to Correlation Analysis, Classification, Decision Tree Introduction, Bayesian Classification Methods, Rule Based Classification, Prediction: Linear Regression.

Module 4- CLUSTER ANALYSIS (09 Periods)

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods-k-Means and K-Medoids, Hierarchical methods-Agglomerative and divisive method, Density-Based Method-DBSCAN, Grid-Based Method-STING, Outlier Analysis.

Module 5- DATA MINING TRENDS (09 Periods)

Mining Complex Data Types: Mining sequence data, Mining other kinds of data: Spatial, Text, Multimedia and Web data.

Data Mining Trends: Mining Complex Data Types, Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design and implement data acquisition process to perform Source Qualifier Transformation
2. Design and implement data acquisition process to perform Filter Transformation
3. Design and implement data acquisition process to perform Joiner Transformation
4. Design and implement data acquisition process to perform Aggregator Transformation
5. Design and implement data acquisition process to perform Sorter Transformation
6. Design and implement data acquisition process to perform Router Transformation
7. Design and implement data acquisition process to perform Union Transformation
8. Design and implement data acquisition process to perform Transaction control Transformation
9. Design and implement data acquisition process to perform Rank Transformation
10. Design and implement data acquisition process to perform Normalizer Transformation
11. Implement the following Data mining techniques.

Data cleaning techniques

a) smoothing by bin means

b) smoothing by bin medians

c) smoothing by bin boundaries

RESOURCES

TEXT BOOK:

Jiawei Han, MichelineKamber and Jian Pei, "Data Mining: Concepts and Techniques," Elsevier, 3rd Edition, 2013.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India, 2006.
2. G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition,

Prentice Hall of India, 2006.

3. Tan P.N, Steinbach M. and Kumar V., Introduction to Data Mining, Addision-Weseley, 2006.

SOFTWARE/TOOLS:

Python

Library : Sci kit Learn;

Computing platform : Jupyter Notebook

VIDEO LECTURES:

1. http://nptel.ac.in/courses/106106093/35
2. http://nptel.ac.in/syllabus/syllabus_pdf/106106105.pdf
3. http://nptel.ac.in/video.php?subjectId=106106093
4. http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106106093&p=4

WEB RESOURCES:

1. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/
2. https://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-eries-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf
3. https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA101004	**COMPUTER COMMUNICATION**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course covers basic concepts of data communications, data and signals in Computer communication. Layered Tasks, The OSI Model, TCP/IP Protocol Suite and addressing are used for network modelling. Analog and Digital Signals are used for transmitting of data without attenuation, Distortion and Noise. Multiplexing and Spread spectrum for reliable bandwidth utilization along with IEEE standards and protocols.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate concepts of data communications, data and signals, network models and protocols & standards in Computer communication.

CO2. Apply digital-to-digital conversion, analog-to-digital conversion, digital-to-analog conversion, analog-to-analog conversion for reliable data communication.

CO3. Analyze network models, analog and digital signals, periodic analog signals, digital signals, digital transmission, transmission modes and analog transmission for transmitting the data over Communication channel.

CO4. Use multiplexing for bandwidth utilization, protocols & standards and Wired LANs(Ethernet) IEEE standards in Computer communication in compliance with communication standards

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	3	3	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**3**	**3**	**-**	**3**	**3**	**-**	**-**	-	**-**	**-**	**-**	**-**	-	**3**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: DATA COMMUNICATIONS AND PROTOCOLS & STANDARDS ***(09 Periods)***

Concepts of Data Communications: Components, Data Representation, Dataflow

Networks: Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks, Interconnection of Networks.

PROTOCOLS AND STANDARDS:Protocols, Standards, Standards Organizations, Internet Standards.

Module 2: NETWORK MODELS ***(09 Periods)***

Layered Tasks: Sender, Receiver, Carrier, Hierarchy.

The OSI Model:Layered Architecture, Peer-to-Peer Processes, Encapsulation.

TCP/IP Protocol Suite: Physical and Data Link Layers, Network Layer, Transport Layer, Application Layer.

Addressing: Physical Addresses, Logical Addresses, Port Addresses, Specific Addresses.

Module 3: DATA AND SIGNALS ***(09 Periods)***

Analog and Digital: Analog and Digital Data, Analog and Digital Signals, Periodic and Non-periodic Signals.

Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth.

Digital Signals: Bit Rate, Bit Length, Digital Signal as a Composite Analog Signal, Transmission of Digital Signals.

Transmission Impairment: Attenuation, Distortion, Noise.

Module 4: DIGITAL TRANSMISSION ***(10 Periods)***

Digital-To-Digital Conversion: Line Coding, Line Coding Schemes, Block Coding, Scrambling.

Analog-To-Digital Conversion: Pulse Code Modulation (PCM), Delta Modulation(DM).

Transmission Modes: Parallel Transmission, Serial Transmission, Analog Transmission.

Digital-To-Analog Conversion: Aspects of Digital-to-Analog Conversion, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Amplitude Modulation.

Analog-To-Analog Conversion: Amplitude Modulation, Frequency Modulation, Phase Modulation.

Module 5: BANDWIDTH UTILIZATION: MULTIPLEXING AND SPREADING ***(08 Periods)***

Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Time-Division Multiplexing

Wired LANs(Ethernet):IEEE STANDARDS :Data Link Layer,Physical Layer; STANDARD ETHERNET : MAC Sublayer , Physical Layer; Changes in the standard :Bridged Ethernet , Switched Ethernet , Full-Duplex Ethernet

Total Periods:45

EXPERIENTIAL LEARNING

1. Configure Peer - to - peer network with at least three hosts.

2. Create desired standard network cable including Cross cable and test it by using cable tester.

3. Establishing Connection of Computers Using Wireless Media

RESOURCES

TEXT BOOK:

1. Behrouz A. Forouzan, "*Data Communications and Networking*", 5th Edition, Tata McGraw-Hill, 2013.

REFERENCE BOOKS:

1. William Stallings, *"Data and Computer Communications*", 10th Edition, Prentice-Hall, 2013.
2. Alberto Leon-Garcia and Indra Widjaja,"*Communication Networks - Fundamental Concepts and Key architectures,*" 2ndEdition, Tata McGraw-Hill, 2004.
3. William Stallings,"Data and Computer Communication," 8thEdition, Pearson Education, 2007.
4. Larry L. Peterson and Bruce S. Davie,"*Computer Networks – A Systems Approach,"* 4th Edition, Elsevier, 2007.
5. Nader F. Mir,"*Computer and Communication Networks,*" Pearson Education, 2007.

SOFTWARE/TOOLS:

1. UTP/STP cable.
2. Connector (Mainly RJ45 connector)
3. Networks toolkit (Mainly Crimping tool.)
4. Line tester or cable tester.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105082 : Layered Architectures
2. https://www.digimat.in/nptel/courses/video/106105082/L35.html
3. https://nptel.ac.in/courses/106105082 : Data and Signals
4. https://nptel.ac.in/courses/106105082 : Digital Signal
5. https://nptel.ac.in/courses/106105082 : Analog Signals
6. https://www.digimat.in/nptel/courses/video/106105082/L28.html

WEB RESOURCES:

1. https://ncert.nic.in/textbook/pdf/lecs111.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102004	DATA STRUCTURES	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on data structure concepts like arrays, stack, queues, trees, graphs and real-time applications of data structures. This course also examines algorithms for sorting, searching graphs, hashing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze and develop solutions using linear data structures such as arrays, linked lists for efficient data organization and manipulation.

CO2. Analyze, implement and conduct investigations on data structures such as trees, graphs, hash tables for efficient search and retrieval of data.

CO3. Select and apply appropriate techniques for searching and sorting problems.

CO4. Apply knowledge to select appropriate data structures for modelling information in data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: LINKED LISTS ***(07 Periods)***

Overview of data structures and algorithms, Linear and non-linear data structures, Big O notation, Linked lists Definition, Operations; Single linked lists, Circular linked lists, Doubly linked lists, Sorted lists, Linked lists efficiency, Applications of linked lists.

Module 2: STACKS AND QUEUES ***(09 Periods)***

Stacks: Definition, Operations, Implementation using arrays and linked lists, Applications Reversing a word, Delimiter matching, Parsing arithmetic expressions.

Queues: Definition, Operations, Applications, Implementation using arrays and linked lists, Circular queue, Double-ended queues, Priority queues.

Module 3: BINARY TREES AND SEARCH TREES ***(11 Periods)***

Tree terminology, Binary trees, Trees represented as arrays, Binary search trees - Concepts, Advantages, Operations, Finding maximum and minimum values, Efficiency; Balanced and unbalanced trees, AVL search trees Concepts, Operations; Red-Black trees Concepts, Rotations, Inserting a node, Efficiency.

Module 4: SEARCHING AND SORTING ***(09 Periods)***

Searching: Linear search, Binary search.

Sorting: Bubble sort, Selection sort, Insertion sort, Sorting objects, Shell sort, Partitioning, Quick sort, Merge sort, Heap sort, radix sort, count sort, enumeration sort.

Module 5: GRAPHS AND HASHING ***(09 Periods)***

Graphs: Concepts, Representation, Operations, Depth-first search, Breadth-first search, Minimum spanning trees.

Hashing: Introduction, Open addressing, Separate chaining, Characteristics of good hash functions - Quick computation, Random and Non-random keys, Folding; Hashing efficiency.

Total Periods: 45

EXPERIENTIAL LEARNING

1. A college has N number of students and the following details of all the students are maintained – register number, name, branch, phone number. Write a program to store the details of the students using a singly linked list. Develop functions to perform the following operations on the data.

    a) Insert new student's details
    b) Display the details of the students
    c) Display the total number of students
    d) Delete a given student's information

2. Department of CSE has readers club named 'Aalochana'. Students can be granted membership in readers club on their request. Similarly, one may cancel their membership of the club. Members of the club can rent books from the club. Write a program to create data structure to maintain readers club members information (Hall ticket number, name) using singly linked list. In singly linked list, the header node should store details of head of readers club and last node should store details of in-charge of readers club. Develop functions to perform the following operations on the data.

    a) Store details of head and in-charge of the readers club
    b) Grant and cancel memberships of students
    c) Display total number of members
    d) Display the details of the members
    e) Display the sorted list of details of the members (sort based on their names in alphabetical order)

3. A company has N number of employees and it maintains the following details of each of its employees: ID, department, salary, phone number. Develop a menu driven program using doubly linked list to store the employees' data. Develop functions to perform the following operations on the data.

    a) Add and delete employees
    b) Display total number of employees
    c) Display details of employees with salary more than Rs. 50,000
    d) Display the phone number of the employee given the ID

4. a) Alexa has two stacks of non-negative integers, stack and stack where index denotes the top of the stack. Alexa challenges Nick to play the following game:

        i. In each move, Nick can remove one integer from the top of either stack.
        ii. Nick keeps a running sum of the integers he removes from the two stacks.
        iii. Nick is disqualified from the game if, at any point, his running sum becomes greater than some integer max_sum given at the beginning of the game.
        iv. Nick's final score is the total number of integers he has removed from the two stacks.

    b) Write a program to check whether a string is palindrome or not using stack data structure.

    c) Mostly syntax errors in a computer program arise due to unbalanced braces (such as (), {}, []). Write a program using stack to check whether a given expression has balanced braces or not.

5. a) Develop a menu driven program to perform the following operations on a queue of characters (Array and linked list implementations of queue with maximum size MAX)

        i) Insert an element
        ii) Delete an element
        iii) Display the status
        iv) Demonstrate overflow and underflow situations (in array implementation)

    b) A restaurant based on its human resources can accept a maximum of N number of food orders. The food orders are served in first come first serve basis. The food orders once placed cannot be cancelled. Write a program to simulate the food ordering and serving system in the restaurant using circular queue.

6. Write a program to perform the following operations on the binary search tree.

    a) Construct binary search tree by inserting the values {6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2} in the given order.
    b) Display the nodes of the tree using inorder, preorder and postorder traversal techniques.
    c) Display the smallest number stored in the tree.
    d) Search the tree for a given number.

7. There are train paths between cities. If there is a train between city A and city B then there is a route between the cities. The cost of the route is the distance between city A and city B. Represent the train travel route information as a graph. The node can be represented by the name of the city. Write a program to perform the following operations.

    a) Store the details of train travel route information using adjacency list or adjacency matrix representation.
    b) Traverse the graph and display the details of all trains between the cities along with the cost using breadth-first method.
    c) Traverse the graph and display the details of all trains between the cities along with the cost using depth-first method.

8. Store register numbers of students who attended placement training program in a random order in an array. Write a function to search whether a student has attended placement training program or not using

    a) Linear search
    b) Binary search

9. A list of customer names could be sorted into alphabetical order by surname, or a list of people could be put into numerical order by age. Sorting a list of items can take a long time, especially if it is a large list. A computer program can be created to do this, making sorting a list of data much easier. Apply proper sorting mechanisms like quick and shell to sort the data.

10. a) Write a program to sort a given set of integers using merge sort.

    b) Write a program to read the marks obtained by students in a mathematics examination and store the data using a heap data structure. Find out the maximum and minimum marks obtained by the students.

11. Apply suitable data structure concepts (like hashing) for mapping large chunks of data into small tables.

    a) Separate Chaining Method
    b) Open Addressing Method

12. Consider an online movie ticket booking system through which customers can book tickets to watch movies at theatres. The database stores the details of each transaction of ticket booking with the details - ID, customer name, customer phone number, movie name, theatre name, date of show, time of show, number of tickets booked, starting seat number, total amount. Write a menu driven program to perform create the database and given an ID, display a client's phone number. Use a hash table implementation to quickly search through the database.

RESOURCES

TEXT BOOKS:

1. Robert Lafore, "*Data Structures & Algorithms in Java,*" 2nd Edition, Pearson, 2007.
2. Goodrich, Tamassia, Goldwasser, "*Data structures & Algorithms in Java,*" 6th Edition, Wiley, 2014.

REFERENCE BOOKS:

1. John R. Hubbard, "*Programming with Java,*"McGraw Hill, 2ndEdition, 2009.
2. DebasisSamanta, "*Classic Data Structures*,"Prentice Hall, 2ndEdition, 2009.

SOFTWARE/TOOLS:

1. Software: J2SDK 1.7
   - **Eclipse or Net beans**
2. Java compatible web browser

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105175
2. https://www.edx.org/course/introduction-to-data-structures
3. https://github.com/suhassrivats/Udacity-Data-Structures-and-Algorithms
4. https://www.linkedin.com/learning/programming-foundations-algorithms

WEB RESOURCES:

1. https://www.javatpoint.com/data-structure-tutorial
2. https://medium.com/javarevisited/10-data-structure-and-algorithms-articles-programmer-should-read-this-week-585404a9403b
3. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_pdf_version.html
4. https://www.w3schools.in/data-structures/intro
5. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_tutorial.pdf
6. https://lecturenotes.in/subject/81/data-structure-using-c-ds
7. https://code.tutsplus.com/series/data-structures-succinctly-part-1--cms-551
8. https://www.geeksforgeeks.org/data-structures/
9. https://visualgo.net/en

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102005	**PYTHON PROGRAMMING**	3	-	2	-	4

Pre-Requisite : PROGRAMMING FOR PROBLEM SOLVING

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Basics of Python programming, Control structures, Sequences, Sets, Dictionaries, Regular expressions, Functions, File handling, Object-oriented programming, Exception handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.
CO2. Apply the concepts of regular expressions for searching patterns in strings.
CO3. Develop and use Python modules to provide solutions to problems.
CO4. Apply the knowledge of file operations in Python for file processing.
CO5. Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.
CO6. Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	-		-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	-	-	-	**3**	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO PYTHON PROGRAMMING ***(07 Periods)***

Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input and output in Python.

Module 2: CONTROL STRUCTURES ***(08 Periods)***

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.

Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

Module 3 SEQUENCES, SETS, DICTIONARIES AND REGULAR EXPRESSIONS ***(11 Periods)***

Sequences: Lists and operations – Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists; Tuples – Creating, Searching and sorting, Nested tuples; Strings – Initializing a string and string operations, String handling methods, String formatting.

Sets: Set creation, Set operations.

Dictionaries: Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

Regular Expressions: Regular expressions, Sequence characters in regular expressions, Quantifiers in regular expressions, Special characters in regular expressions.

Module 4 FUNCTIONS AND FILE HANDLING ***(09 Periods)***

Functions: Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.

File Handling: Types of files, Opening and closing files, Reading and writing data.

Module 5 OBJECT ORIENTED PROGRAMMING AND EXCEPTION HANDLING ***(10 Periods)***

Object Oriented Programming: Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.

Exception Handling: Errors in a python program, Exceptions, Exception handling, Types of exceptions, Except block, Assert statement, User defined exceptions.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design a python script to perform the various computations for the amount payable by the customer for Challenger Computers Store. A customer buying two numbers of SSD device, one SSD device cost is Rs. 3575/-. The stores offer 15% of the total cost. The customer has to pay 9% CGST, and 9% SGST. Prepare the Net Amount to be payable by the customer.

2. Design a python script to compute and generate the electricity bill as per the following slab rates. Collect the meter reading inputs, such as current unit and previous unit.

Consumption Units	**Rate (in Rupees/Unit)**
0-200	3.0
201-250	4.5
251-300	5.2
301-400	6.5
Above 400	7.0

3. Design a python script to display the sum of numbers divisible by 4. The code must allow the user to accept a number and add it to the sum if it is divisible by 4. It should repeatedly accepting numbers as long as the user wants to provide an input using an appropriate iterative statement and should display the final sum.

4. Food Corner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo.
Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:

Distance in kms	**Delivery charge in Rs per km**
For first 3kms	0
For next 3kms	3
For the remaining	6

Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer.

- Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.
- Distance in kms must be greater than 0.
- Quantity ordered should be minimum 1.
- If any of the input is invalid, bill amount should be considered as -1.

5. a) A list has the AP City Names [Tirupati, Kurnool, Kadapa]. Design a python script and perform the operations like, add 3 more AP City names Chittoor, Nellore, Guntur, insert Hyderabad in 3rd position, delete any two city names, update all city names as in Uppercase. Displays the list data, whenever an operation completes.

b) Design a python script for given an integer tuple, for each element in the tuple, check whether there exists a smaller element on the next immediate position of the tuple. If it exists print the smaller element. If there is no smaller element on the immediate next to the element then print -1.

Example: Input: 4 2 1 5 3 Output: 2 1 -1 3 -1

6. a) Sets n1 has the data {1, 3, 5, 7, 9}, n2 has the data {9, 5, 6, 8},
wd1=set(["Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"]),

wd2=set(["Mon", "Tue", "Wed"]).

Design a python script to perform intersection, difference, and symmetric difference operations on the sets n1 and n2, and to perform superset, and subset operations on the sets wd1, and wd2.

b) The dictionary city_pin has the data {'Tirupati': 517101, 'Hyderabad': 500002, 'Chittoor': 517001,'Nellore': 524001}. Design a python script using lambda function to sort the dictionary on city name and produce the output and sort the dictionary on pincode and produce the output.

c) The string has the data, Wel_str = "Welcome to AI ML DS". Design a python script to search the pattern "AI" using regular expression search and display the three location numbers of the pattern. First shows the pattern starts location, second shows the pattern end location, and the last shows pattern span locations.

7. a) Design a python script for the mathematical puzzle, Towers of Hanoi. The puzzle has three rods and n disks. To move the entire stack to another rod, obeying the three rules (i) Only one disk can be moved at a time, (ii) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e., a disk can only be moved if it is the uppermost disk on a stack, (iii) No disk may be placed on top of a smaller disk.

b) Design a python script to display the numbers that do not appear in the Fibonacci series of n numbers where n is given by the user. (If n is 8 then up to 8 Fibonacci numbers has to be printed Ex: 1 1 2 3 5 8 13 21 and in this series missing numbers should be traced and printed, Ex: missing numbers are: 4 6 7 9 10 11 12 14 15 16 17 18 19.

8. a) Design a function Learner_Age_Days with two formal parameters name, age and it computes Learner's age in days, then displays learners name and age in days.

(i) Design a driver code to call the function using positional arguments, keyword arguments

(ii) Apply the necessary changes in Learner_Age_Days function, and design a driver code to call the function using default arguments.

b) Design a python script using lambda and filter functions to construct an odd numbers list from numbers 1 to 10, and construct a negative numbers list from range of numbers -7 to 7 and to find the biggest number from a numbers list.

9. a) Design a python script to create a new file Collect_Literals_Phython.txt, collect the data from the keyboard about the contents of collection literals list, tuple, sets, dictionaries details, then write all the data into that file, and then close that file. Afterwards Open the Collect_Literals_Phython.txt file in read mode, read the entire contents of the file

Collect_Literals_Phython.txt, then display all the contents of that file in monitor.

b) The file feat_python1.txt has the contents of features of the Python programming language. Design a python script to open that file feat_python1.txt in read mode, open the new file in feat_python2.txt in write mode, then read entire contents of the file feat_python1.txt, then copy all the contents of that file into the new file feat_python2.txt

10. a) Construct a Python script to implement the below requirements. Create a base class Basic_Info with data members name, rollno, gender and two member functions getdata() and display(). Derive a class Physical_Fit from Basic_Info which has data members height and weight and member functions getdata() and display(). Display all the information using object of derived class.

b) Design a Python script to implement the below specifications, compute, and produce required output. Define a class REPORT with the following specification

Private members

Admno : 4-digit admission number

Name : 20 characters

Marks : A list of 5 floating point values

Average : average marks obtained

GETAVG() a function to compute the average obtained in five subjects.

Public members

READINFO() function to accept values for Adno, Name, Marks. Invoke the function GETAVG ().

DISPLAYINFO() function to display all data members of report on the screen. You should give function definitions. Write driver code to demonstrate all the functions.

11. 1. The below scenarios will create Logical Error/Exception, and it will forcibly stop the execution in middle of the program. Design a Python Script to handle these operations exceptions effectively, and avoid to stop the script execution in the middle.
   i. The variable num has the data 100, the value of num dividing by the value 0.
   ii. To importing a library file matheqn, this library file not available in Python.
   iii. A num_List has the values[10,20,30].To print the fifth value of num_List[5]
   iv. A dictionary has the data, Dict_Univ = {'1':"MBU", '2':"Tirupathi", '3':"CSE"}. to print the fifth key value Dict_Univ[5]

2. Design a python script to collect the 10 students Python course mark. Check that entered mark is negative, then throw a user defined exception called Negative, otherwise store into the mark in the List Python_mark[].

RESOURCES

TEXT BOOKS:

1. R. Nageswara Rao, *Core Python Programming*, 3rd Edition, Dreamtech Press, 2021.
2. Paul J. Deitel, Harvey Deitel, Python for Programmers with Big Data and Artificial Intelligence Case Studies, Pearson, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem Solving Focus*, Wiley India, 2016.
2. Christian Hil, Learning Scientific Programming with Python, 2nd Edition, Cambridge University Press, 2020.

SOFTWARE/TOOLS:

1. Python 3.10
2. Jupyter Notebook/JupyterLab/IDLE/Google CoLab

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

2. https://www.coursera.org/specializations/python

3. https://www.coursera.org/learn/python-for-applied-data-science-ai

4. https://www.youtube.com/watch?v=WGJJIrtnfpk

5. https://www.youtube.com/watch?v=_uQrJ0TkZlc

6. https://www.udemy.com/topic/python/

7. https://freevideolectures.com/course/2512/python-programming

WEB RESOURCES:

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

2. https://www.programiz.com/python-programming

3. https://www.geeksforgeeks.org/python-programming-language/

4. https://www.javatpoint.com/python-lists

5. https://www.learnpython.org/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA104001	**OBJECT ORIENTED PROGRAMMING THROUGH C++**	3	-	2	4	5
Pre-Requisite	PROGRAMMING FOR PROBLEM SOLVING					
Anti-Requisite						
Co-Requisite						

COURSE DESCRIPTION: This course provides a detailed discussion on basic characteristics of Object Oriented Programming through C++. It covers basic Object Oriented Programming paradigms like Classes and Objects in custom application development. The OOP concepts types of overloading and inheritance are also covered. It provides hands-on experience inimplementation of OOP features and other programming concepts like handling pointers, file and exceptions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of Object oriented programming.

CO2. Apply function and operator overloading techniques for code optimization.

CO3. Apply inheritance and virtual functions to implement dynamic binding.

CO4. Develop robust applications using exception handling mechanism and file I/O.

CO5. Develop reliable applications to solve real world problems using Object oriented programming constructs.

CO6. Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	3	-	3
CO3	3	2	2	3	2	-	-	-	-	-	-	-	3	-	3
CO4	3	2	3	3	2	-	1	-	-	-	-	-	3	-	3
CO5	3	2	3	3	2	-	1	-	-	-	-	-	3	-	3
CO6	-	-	-	-	-	-	-	-	3	3	-	-	3	-	3
Course Correlation Mapping	**3**	**2**	**3**	**3**	**2**	-	**1**	-	3	**3**	-	-	3	-	3

Correlation Levels: 3: High; 2: Medium;1: Low

COURSE CONTENT

Module 1: C++ Fundamentals ***(10 Periods)***

Need of Object-Oriented Programming - Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions : Simple Functions, Passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays, Strings.

Module 2: OOP Fundamentals ***(09 Periods)***

Classes and Objects: Classes, Friend functions, Friend classes, Inline functions, Parameterized constructors, Static Class Members, The Scope resolution operator, nested and local classes, Passing Objects to functions, returning objects, object assignment. Arrays, Pointers, References: Array of Objects, Pointers to objects, the This pointer.

Module 3 Function and Operator Overloading ***(09 Periods)***

Function Overloading: Copy Constructors, and Default Arguments: Function Overloading, Overloading Constructors, Copy constructors, Default Function Arguments.

Operator Overloading: Creating a member operator function, operator overloading using a friend function, overloading new and delete, overloading some special operators, and comma operator.

Module 4 Inheritance And Virtual Functions ***(09 Periods)***

Inheritance: Base Class Access Control, Inheritance and protected members, inheriting multiple base classes, constructors, destructors, and inheritance, granting access, virtual base classes.

Virtual Functions: Pointers to objects, Pointers to derived classes, Virtual Functions, Pure Virtual Functions.

Module 5 File I/O and Exceptions ***(08 Periods)***

Files: File Pointers - Error handling in File I/O - File I/O with member Functions - Overloading the extraction and Insertion Operators - Multi File Programs

Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception

Total Periods: 45

EXPERIENTIAL LEARNING

1. a. Write a C++ program to identify appropriate data types and variables to find the size of various datatypes. Display the variables along with their size.

   b. Write a C++ program to take name, address as character array, age as int, salary as float and contains inline functions to set the values and display it.

2. a. Write a C++ program to display names, roll no and grades of 3 students whohave appeared in examination. Declare the class of name, roll no and grade. Create an array of class objects, read and display the contents of array.

   b. Create a class TIME with members hours, minutes, seconds. Take input, add two time objects passing objects to function and display the resultant time in hours, minutes &seconds.

3. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.Write a C++ program to read the data of N employee and compute Net salary of eachemployee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

POLYMORPHISM

4. a. Create a base class basic_info with data members name,roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.

   b. Consider two complex number in the form a+bi and c+dj, Write a program overload binary + operator to perform addition of the complex numbers.

INHERITANCE

5 a. Write a C++ Program to calculate the area and perimeter of rectangles using concept of Hierarchical inheritance. Area class is derived from base class Rectangle. Perimeter class is also derived from base class Rectangle.

   b. Write a C++ program to create Employee and Student inheriting from Person using Hierarchical Inheritance. The Person class should contain the common attributes of Employee and Student class.

6. Design three classes STUDENT, EXAM and RESULT. The STUDENT class has data members such as rollno, name. Create a class EXAM by inheriting the STUDENT class. The EXAM class adds data members representing the marks scored in six subjects. Derive the RESULT from the EXAM class and has its own data members such as total marks. Write a C++ program to model this relationship.

7. Create a base class called SHAPE. Use this class to store two double type values. Derive two specific classes called TRIANGLE and RECTANGLE from the base class. Add to the base class, a member function getdata() to initialize base class data members and another member function display to compute and display the area of figures. Make display a virtual function and redefine this function in the derived classes to suit their

requirements. Using these three classes design a program that will accept driven of a TRIANGLE or RECTANGLE interactively and display the area.

FILE I/O

8. a. Write a C++ program named store_temps.cpp that creates a file named raw_temps.txt with temperature data. Fill thefile with at least 50 temperature readings.

   b. Assuming that a text file named FIRST.TXT contains some text written into it, write a function named copyupper() in C++, that reads the file FIRST.TXT and creates a new file named SECOND.TXT contains all words from the file FIRST.TXT in uppercase.

9. Write a C++ program that accepts two file names and produces a new file that is thecontents of the first file followed by the contents of the second; that is, the programconcatenates the two files.

EXCEPTION HANDLING

10. Add an exception handler (try/catch/throw) to the class that throws an error message (e.g. "value out of range") in the getValue function that is caught and handled in the main program. Implement two version of the program. In version1, throw the error in getValue, catch the error in the main, display an error message in the main, and then allow the program to terminate. In the second version, perform the same basic actions (throw and catch) but keep re-invoking the getValue function from the main program until the user enters a valid value.

PROJECT BASED LEARNING:

Faculty shall provide Projects relevant to the contents of the course.

Sample Projects:

1. Bookshop inventory system

The project is to build the bookshop inventory system in C++ that helps to keep track of all the book records in a shop. Below are the features to be implemented:

- Add new book and the details of the book are:
  - Book ID
  - Name of book
  - Name of Author
  - Number of books
- Delete a book
- Update anexistingbook detail
- Display summary of all the books
- Search a book

2. Online Examination Management System

The project is to build the online examination management system in C++ that helps to conduct online proctored examinations. Below are the features to be implemented:

- Add New Students
- Student Login

    - Registration for examination
    - Attempting the questions
- Faculty Login
    - Uploading the questions
- Proctor Login
    - Online monitoring of students
- Admin View
    - Consolidation of marks
    - Release of results

RESOURCES

TEXT BOOKS:

1. Herbert Schildt,"C++ - The Complete Reference", 4th edition, Tata McGraw Hill, 2018.
2. E.Balaguruswamy "Object Oriented Programming with C++", 6th edition, Tata McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Cohoon and Davidson, "C++ Program Design: An introduction to Programming and object – Oriented Design", 3rd Edition, Tata McGraw Hill, 2003.
2. Robert Lafore, "Object-Oriented Programming in C++", 4th edition, Pearson Education, 2008.
3. Walter Savitch,**"**Problem Solving with C++", 9th edition, Pearson Education, 2015.

SOFTWARE/TOOLS:

1. Software: Dev C++

VIDEO LECTURES:

1. https://www.coursera.org/learn/c-plus-plus-a#syllabus
2. https://www.udemy.com/free-learn-c-tutorial-beginners/
3. https://onlinecourses.nptel.ac.in/noc21_cs02/preview

WEB RESOURCES:

1. http://www.cplusplus.com/files/tutorial.pdf
2. http://mazonka.com/shared/Straustrup4th.pdf

PROGRAM CORE

Course Code **JAVA PROGRAMMING**

22CA102006

L	T	P	S	C
3	-	2	-	4

Pre-Requisite : **Object Oriented Programming with C++**

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Representation of Java Classes and methods; Inheritance and Polymorphism using Java, Creation of Packages and Interfaces; Implementation of Utility Classes and Input/output; Exception handling mechanism and multithreading; Event handling techniques and GUI applications by using AWT.

COURSE OUTCOMES

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

CO1. Understand the basic concepts of classes, objects, methods of JAVA Programming to build Java applications.

CO2. Analyze inheritance and polymorphism to solve real world problems.

CO3. Design and develop GUI Applications using AWT.

CO4. Apply utility classes, Java collections, exception handling and multithreading concepts to develop real time applications.

CO5. Work together to customize the real world applications. Communicate effectively about complex computing activities by writing documentation.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	1	2	2	3	3	-	-	-	-	-	2	-	-	-	3
CO5	-	-	-	-	-	-	2	-	-	-	2	-	3	-	-
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	-	**-**	**2**	**-**	**2**	2	**2**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

Module 1: **INTRODUCTION TO JAVA PROGRAMMING** **(09 Periods)**

Introduction to Java Programming: History of Java, Java Buzzwords, Object-Oriented Programming, First Simple Program, Data Type, Variables, Operators, Control Statements, Arrays, Introducing Classes: Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, this Keyword, Garbage Collection, finalize() Method; Overloading Methods, Access Control, static Keyword, final Keyword, Introducing Nested and Inner Classes, String Class.

Module 2: **INHERITANCE AND POLYMORPHISM** **(09 Periods)**

Inheritance and Polymorphism: Inheritance Basics, Using super, Creating Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract Classes, final with Inheritance, Object Class.

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces; Defining an Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Interfaces can be Extended.

Module 3 **EXCEPTION HANDLING AND MULTITHREADING** **(09 Periods)**

Exception Handling: Fundamentals of Exception Handling, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating your own Exception Subclasses', Chained Exceptions.

Multithreading: Java Thread Model, Thread life Cycle, Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming and Stopping Threads.

Module 4 **UTILITY CLASSES AND INPUT/OUTPUT** **(09 Periods)**

Utility Classes: Introduction to Java Collections, Overview of Java Collection Frame Work, Commonly Used Collection Interfaces: Set, List, Queue, Map; Commonly used Collection Classes: Hash Set, LinkedHashSet, Linked List, Stack, Array List, Vector, Hash table; Iteration over Collections: Iterator Interface, List Iterator Interface and Enumeration Interface; String Tokenizer, Date, Calendar.

Input/output: Stream Classes: Byte Streams, Character Streams, Console Class, Stream I/O, Serialization.

Module 5 **EVENT HANDLING AND GUI PROGRAMMING WITH JAVA** **(09 Periods)**

Event Handling: Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces.

GUI Programming with Java: Abstract Window Toolkit (AWT): AWT Classes, Windows Fundamentals, Working with Frame Windows, Graphics and Color, AWT Controls: Labels, Buttons, Check Boxes, Lists, Scroll Bars, Text Field, Text Area, Layout Managers; Applets: Applet Basics, Applet Architecture, Applet Skeleton, Applet Display Methods, Passing Parameters to Applets.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a Java program that prints all real solutions to the quadratic equation ax2 + bx+ c = 0. Read in a, b, c and use the quadratic formula. If the discriminant b2-4ac is negative, display a message stating that there are no real solutions.

2. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer.
3. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use StringTokenizer class of java.util)
4. Write a Java program to illustrate method overloading.
5. Write a Java program to implement the matrix ADT using a class. The operations supported by this ADT are:

a) Reading a matrix. c) Addition of matrices.

b) Printing a matrix. d) Subtraction of matrices.

e) Multiplication of matrices.

6. Write a Java program that uses functions to perform the following operations:

   a. Inserting a sub-string in to the given main string from a given position.
   b. Deleting n characters from a given position in a given string.

7. Write a Java program that illustrates the following:

a) Creation of simple package. b) Accessing a package.

8. Write a Java program that illustrates the following:

a) Handling predefined exceptions

b) Handling user defined exceptions

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

10. Write a java program to demonstrate various GUI components in java (AWT) with appropriate Event Handling.

11. Develop an applet in Java that displays a simple message.

12. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.

RESOURCES

TEXT BOOK:

1. Herbert Schildt, "*The Complete Reference Java*", Tata McGraw-Hill, 7th Edition, 2007.

REFERENCE BOOKS:

1. B. Eswar Reddy, T. V. Suresh Kumar and P. Ragavan, *"Object Oriented Programming with Java,"* Pearson Sanguine Publications, 2nd Edition, 2011.
2. H. M. Dietel and P. J. Dietel, *"Java How to Program,"* Pearson Education/ PHI, 5th Edition, 2009.

Video Resource:

1. https://nptel.ac.in/courses/106105191
2. https://www.udemy.com/course/java-tutorial/
3. https://www.udemy.com/course/java-the-complete-java-developer-course/
4. https://www.udemy.com/course/the-complete-java-development-bootcamp/

Web Resource

1. https://www.tutorialspoint.com/java/java_tutorial.pdf
2. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf
3. https://book.huihoo.com/goalkicker.com/JavaBook/JavaNotesForProfessionals.pdf

Course Code	Course Title	L	T	P	S	C
22CA102007	COMPUTER GRAPHICS	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Basics of Graphics; Graphical User Interfaces; Three Dimensional Viewing Devices; Virtual Reality systems; Raster-Scan Systems; Random-Scan System;2-D transformations;3-D transformations; Graphics Programming.

COURSE OUTCOMES

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

CO1. Understand the fundamentals of animation, graphic design and its related technologies to develop the applications.

CO2. Analyze the importance of viewing and projections to create user friendly applications.

CO3. Design and develop applications related to Computer Graphics using OpenGL.

CO4. Apply algorithms to scan, convert the basic geometrical primitives, transformations and clipping.

CO5. Work independently or in teams to solve problems with effective Communication.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	1	2	2	3	3	-	-	-	-	-	2	-	-	-	3
CO5	-	-	-	-	-	-	2	-	-	-	2	-	3	-	-
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**2**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION (**7 Periods)**

Applications of Graphics: CAD, Presentation Graphics, Computer Art, Entertainment, Education and Training, Visualization, Image Processing.

Module 2: GRAPHICAL USER INTERFACE (**7 Periods)**

Overview of Graphics Systems: CRT, Flat Panel Displays, Three-Dimensional Viewing Devices, Virtual Reality systems, Raster-Scan Systems, Random-Scan Systems.

Module 3: INTERACTIVE INPUT DEVICES AND COMPUTER GRAPHICS ALGORITHM (9 Periods)

Input Devices: Keyboards, Mouse, Data Glove, Digitizers, Touch Panels; Hard Copy Devices: Printers, Plotters.

Output Primitives: Bresenham's Line Algorithm, Midpoint Circle Algorithm; Filled Area Primitives: Boundary-Fill Algorithm, Flood-Fill Algorithm; Character Generation; Homogeneous Coordinates.

Module 4: TWO DIMENSIONAL AND THREE-DIMENSIONAL TRANSFORMATIONS (12 Periods)

Two Dimensional Geometric Transformations; Translation, Rotation, Scaling, Reflection, Shear;

Two-Dimensional Viewing: Cohen Sutherland Line Clipping Three Dimensional Geometric Transformations; Translation, Rotation, Scaling, Reflection, Shear;

Three-Dimensional Viewing: Projections, Parallel Projections, Perspective Projections, View Volumes and General Projection Transformations.

Module 5: GRAPHICS PROGRAMMING (10 Periods)

Graphics Programming: OpenGL, Command Syntax, Drawing and filling images, patterns, Filling regular and irregular shapes, Outputting Text, Justifying Text, Animation. Drawing with mouse, Building mouse cursors, freehand drawing using mouse, menus using mouse.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a program for 2D line drawing as Raster Graphics Display.
2. Write a program for display basic 2D geometric primitives.
3. Write a program to display a filled square.
4. Write a program to display a series of concentric circle sofvaryingradius.
5. Write a program for line draw in gas Raster Graphics Display.

6. Write a program for circle drawing as Raster Graphics Display.
7. Write a program to draw a line using Bresenham line drawing algorithm
8. Write a program to draw a circle using Midpoint algorithm. Modify the same for drawing an arc and sector.
9. Write a program to rotate a point about origin.
10. Write a program to rotate a triangle about origin.

RESOURCES

TEXT BOOKS:

1. D.Hearn,M.P.Baker, "ComputerGraphics C Version," Pearson Education, 2nd Edition.
2. Donald Hearn & M. Pauline Baker, "Computer Graphics with OpenGL", Pearson Education, 4th Edition, 2018.
3. M.Woo, J.Neider, T.Davis, D.Shreiner, "OpenGL ProgrammingGuide," 3rd Edition, Pearson Education.

REFERENCE BOOKS:

1. Edward Angel – "Interactive Computer Graphics – A Top-down Approach using OpenGL", Pearson Education, 5th Edition, 2000
2. Foley, J. D., A. V. Dam, S. K. Feiner, J. F. Hughes, "Computer Graphics Principle and Practices," Addison Wesley Longman, Singapore Pvt. Ltd.,
3. Robert R & Snow D "Flash CS4 Professional Bible," Wiley Publishing.
4. A.V. Dan, F.H. Jones, J.D. Foley, S.K. Feiner, "Computer Graphics Principles & Practices in C", 2nd Edition, Pearson.
5. D. F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill.
6. D. F. Rogers, & J. A. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, McGraw Hill.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc20_cs90/preview
2. https://digimat.in/nptel/courses/video/106106090/L01.html
3. https://www.youtube.com/watch?v=6LjVtIcSbK8
4. http://www.cse.iitm.ac.in/~vplab/computer_graphics.html

WEB RESOURCES:

1. https://www.geektonight.com/computer-graphics-notes/
2. https://www.dgp.toronto.edu/~hertzman/418notes.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA102008	**DATA ANALYTICS**	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

This course provides a detailed discussion and understanding the need of Big Data Analytics, challenges and different analytical architectures, Installation and understanding of Hadoop Architecture and its ecosystems, Processing of Big Data with Advanced architectures.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- **CO1.** Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
- **CO2.** Access and Process Data on Hadoop Distributed File System
- **CO3.** Manage Job Execution in Hadoop Environment
- **CO4.** Ability to understand the importance of Big Data in Social Media and Mining
- **CO5.** Analyze the value from the Data

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	-	-	1	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**		**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Correlation Levels: **3: High;** **2: Medium; 1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO BIG DATA ANALYTICS ***(09 Periods)***

Overview of Big Data Analytics, Data Science, Big Data Characteristics,Architecture of Big Data Systems, Advantages of Big Data and Challenges faced by Big Data Systems.

Module 2: BIG DATA TECHNOLOGIES ***(09 Periods)***

Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

Module 3: HADOOP ***(09 Periods)***

Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Module 4: HADOOP ARCHITECTURE ***(09 Periods)***

Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node

Module 5: HDFS and MAP REDUCE FRAMEWORK ***(09 Periods)***

HDFS Architecture, Hadoop Configuration, Map Reduce Framework

Total Periods: 45

EXPERIENTIAL LEARNING

1. Perform setting up and Installing Hadoop in its standalone operating mode
2. Perform setting up and Installing Hadoop in its Pseudo and Fully Distributed operating mode
3. By Using web-based tools to monitor the Hadoop Setup.
4. Perform Hadoop Commands
5. Implement the File Management task by adding the files and directories in Hadoop
6. Implement the Retrieving file task in Hadoop
7. Implement the Removing file task in Hadoop.

RESOURCES

TEXT BOOKS:

1. Big Data Analytics by G Sudha Sadasivam and R. Thirumahal, Oxford Higher Edition.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.

REFERENCE BOOKS:

1. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.
2. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)

SOFTWARE/TOOLS:

1. Hadoop (https://hadoop.apache.org/releases.html)
2. Cassandra (http://cassandra.apache.org/download/)

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
2. https://www.upgrad.com/**data**-science/pg-programme
3. https://www.youtube.com/watch?v=CaqJ65CIoMw

WEB RESOURCES:

1. Big Data Analytics Tutorial (tutorialspoint.com)
2. hackerrank-solutions · GitHub Topics · GitHub
3. What is Big Data - javatpoint
4. What is Big Data? - GeeksforGeeks

Course Code	Course Title	L	T	P	C
22CA101005	**FUNDAMENTALS OF DATA SCIENCE**	2	-	-	2

Pre-Requisite **--**

Anti-Requisite **--**

Co-Requisite **--**

COURSE DESCRIPTION: Basic Terminologies of data science, Computation using NumPy, Data exploration using Pandas, Data transformation, Data wrangling, Plotting and visualization using Matplotlib, Data aggregation, Time series analysis.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Demonstrate knowledge on the concepts of data science to perform mathematical computations using efficient storage and data handling methods in NumPy.

CO2. Apply Data Preparation and Exploration methods using Pandas to perform data manipulation.

CO3. Create data visualization using charts, plots and histograms to identify trends, patterns and outliers in data using Matplotlib and Seaborn.

CO4. Develop methods to analyze and interpret time series data to extract meaningful statistics.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	3	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	3	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	3	3	-	-	-	-	-	-	-	-	3	-

Correlation Level: 3-High; 2-Medium; 1-Low

DETAILED SYLLABUS:

UNIT I– INTRODUCTION TO DATA SCIENCE (6 Periods)

Basic terminologies of data science, Types of data, Five steps of data science, Arrays and vectorized computation using NumPy - The NumPy ndarray: A multidimensional array object,Universal functions: Fast element-wise Array functions,Array-oriented Programming with arrays, File input and output with arrays,Linear algebra, pseudorandom number generation.

UNIT II – DATA EXPLORATION WITH PANDAS (6 Periods)

Process of exploring data, Pandas data structures – Series, Data frame, Index objects; Essential functionality,Summarizing and computing descriptive statistics - Correlation and covariance,Unique values, Value counts and membership; Data loading, Storage, and file formats - Reading and writing data in text format , Binary data formats , Interacting with web APIs,Interacting with databases.

UNIT III – DATA CLEANING, PREPARATION AND DATA WRANGLING (6 Periods)

Handling missing data, Data transformation, String manipulation - String object methods, Regular expressions, Vectorized string functions in Pandas; Data wrangling: join, Combine and reshape - Hierarchical indexing, Combining and merging datasets, Reshaping and pivoting.

UNIT IV – DATA VISUALIZATION WITH MATPLOTLIB (6 Periods)

Plotting and visualization- A brief matplotlib API primer,Plotting with Pandas and Seaborn, Other python visualization tools;Data aggregation and Group operations- GroupBy mechanics, Data aggregation,Apply: General split-apply-combine, Pivot tables and Cross-tabulation.

UNIT V – TIME SERIES ANALYSIS (6 Periods)

Date and time data types and tools,Time series basics,Date ranges, Frequencies, and shifting.Time zone handling, Periods and period arithmetic,Resampling and frequency Conversion – Downsampling,upsampling and interpolation,Resampling with periods;Moving window functions.

Total Periods: 30

EXPERIENTIAL LEARNING

1. An illustrative application of utilizing ndarray operations in the simulation of random walks
2. Explain about Integer Indexing and Panel Data using pandas

TEXT BOOKS:

1. Wes McKinney, Python for Data Analysis, O'Reilly, 2nd Edition, 2017.

REFERENCE BOOKS:

1. Sinan Ozdemir, Principles of Data Science, Packt Publishers, 2nd Edition, 2018.
2. Rachel Schutt, Cathy O'Neil,*Doing Data Science: Straight Talk from the Frontline*, O'Reilly, 2014.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/106/106/106106212/
2. https://onlinecourses.nptel.ac.in/noc22_cs32/preview

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc19_cs60/preview
2. https://towardsdatascience.com/
3. https://www.w3schools.com/datascience/
4. https://github.com/jakevdp/PythonDataScienceHandbook

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA101006	**SOFTWARE ENGINEERING**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion on concepts of Software Engineering, Software Process Models, Conventional and Agile Process Models, Software Requirements Engineering Process, System Analysis, Architectural Design, User Interface Design and Re-engineering, Software Testing, Risk and Quality Management

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate concepts of software engineering and analyze process models required to develop a software system.

CO2. Analyze software requirements and model requirements for the given scenario.

CO3. Apply design concepts and metrics for software development.

CO4. Apply testing strategies and techniques for quality software.

CO5. Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	3	3	2	-	-	2	-	3	-	-
CO3	2	3	3	2		2	2	-	-	-	3	-	3	-	-
CO4	2	-	-	-	2	3	-	-	-	-	-	-	3	-	-
CO5	2	3	-	-	2	3	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	-	**-**	**3**	**-**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: SOFTWARE ENGINEERING AND SOFTWARE PROCESS (11 Periods)

A Generic view of process:The Nature of Software, Software Engineering- Software Engineering Layers; The Software Process, Software Engineering Practice, Software myths.

Process models: A Generic Process Model, Prescriptive Process Models-The Waterfall Model, Incremental Process Models, Specialized Process Models; The Unified Process, Agile Development-Agility, Agile Process, Extreme Programming (XP), Scrum, Dynamic System Development Method, Agile Modeling (AM), Agile Unified Process (AUP).

Module 2: REQUIREMENTS ENGINEERING AND MODELING (07 Periods)

Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specifications, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Requirements Modeling: Requirements Analysis, Data Modeling Concepts, Flow-Oriented Modeling, Scenario based Modeling, UML Models that supplement the Use Case, Case study on Requirements modeling for Web and MobileApps.

Module 3 DESIGN ENGINEERING AND METRICS (09 Periods)

Design using UML: Class Diagram - Terms and concepts, Use case Diagram - Terms and concepts, Activity Diagrams - Terms and concepts, Interaction diagrams - Terms and concepts, State machine Diagram- Terms and concepts, Component Diagram- Terms and concepts, Deployment Diagram- Terms and concepts.

Process and Project Metrics: Metrics in the process and project domains, Software Measurement, Metrics for software quality.

Module 4 SOFTWARE TESTING STRATEGIES AND APPLICATIONS (08 Periods)

Testing strategies: A strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Validation testing, System testing, The art of debugging.

Testing Conventional Applications: Software testing fundamentals, White box testing- Basis path testing, Control structure testing; Black box testing, Object oriented testing methods.

Module 5 RISK, QUALITY MANAGEMENT AND REENGINEERING **(10 Periods)**

Risk and Quality Management: Reactive and Proactive risk strategies, Software risks, Risk Mitigation Monitoring and Management (RMMM), RMMM plan, Formal Technical Reviews (FTR), Software Quality Assurance (SQA)-Tasks, Goals and Metrics; Software reliability.

Reengineering: Introduction, Business Process Reengineering (BPR), Software Reengineering, Restructuring, Reverse engineering, Forward engineering.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Identify Functional and Non-Functional Requirements for:
    a. Online Ticket Reservation for Railways
    b. Recruitment Procedure for Software Industry
2. **Online Ticket Reservation for Railways**

    Problem Statement: Computer plays an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description. Model using Visual modelling tools in different views i.e. component view, Deployment view.

3. **Recruitment Procedure for Software Industry**

    Problem Statement: In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company. The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate. Model using Visual modelling tools in different views i.e. Use case view, logical view

RESOURCES

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach," McGraw-Hill International Edition, 8thEdition, 2015.
2. Ian Sommerville, "Software Engineering," Pearson Education, 9thEdition, 2011.

REFERENCE BOOKS:

1. Grady Booch, James Rum Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," 2ndEdition, Pearson Education, 2009.
2. K. K. Aggarwal and Yogesh Singh, "Software Engineering, "New Age International Publishers, 3rdEdition, 2007.
3. ShelyCashman Rosenblatt, "Systems Analysis and Design," Thomson Publications, 6thEdition, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105087/
2. https://nptel.ac.in/courses/106105182/

WEB RESOURCES:

1. AgileModeling :https://www.techtarget.com/searchsoftwarequality/definition/agile-software-development
2. Functional and Non-Functional Requirements: https://www.linkedin.com/learning/software-design-developing-effective-requirements/functional-vs-non-functional

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CA101007	**USER EXPERIENCE / INTERFACE (UX/UI) DESIGN**	2	-	-	-	2

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: User experience (UX),usability and UI design.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand Importance and Characteristics of User interface design

CO2. Create User Interface Design process AND Business functions

CO3. Design System menus, navigation schemes

CO4. Demonstrate screen-based controls and device-based controls

CO5. Identify prototypes and test plans of user interface

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	3	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	3	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: THE IMPORTANCE OF USER INTERFACE: ***(06 Periods)***

Defining the User Interface, The Importance Of Good Design, The Benefits of Good Design, A Brief History of The Human-Computer Interface-Introduction of The Graphical User Interface, The Blossoming of The World Wide Web, A Brief History of Screen Design

CHARACTERISTICS OF GRAPHICAL AND WEB USER INTERFACES: The Graphical User Interface, The Web User Interface, Principles of User Interface Design.

Module 2: THE USER INTERFACE DESIGN PROCESS: ***(06 Periods)***

Obstacles and Pitfalls in the Development Path, Usability, The Design Team.

KNOW YOUR USER OR CLIENT: Understanding How People Interact with Computers, Important Human Characteristics in Design, Perception, Memory, Sensory Storage, Visual Acuity, Human Considerations in Design-The User's Knowledge and Experience.

Module 3: UNDERSTAND THE BUSINESS FUNCTION: ***(6 Periods)***

Business Definition and Requirements Analysis, Determining Basic Business Functions, Design Standards or Style Guides, System Training and Documentation Needs.

UNDERSTAND THE PRINCIPLES OF GOOD SCREEN DESIGN: Human Considerations In Screen Design, Interface Design Goals, Statistical Graphs

Module 4: DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES: ***(06 Periods)***

Structures of Menu, Functions Of Menus, Formatting And Phrasing Of Menus, Navigating Menus, Kinds Of Graphical Menus, Window Characteristics, Components Of A Window, Types Of Windows, Window Operations, Web Systems.

Module 5: SELECTING THE PROPER DEVICE-BASED CONTROLS: ***(06 Periods)***

Characteristics of Device-Based Controls, Presentation Controls, Write Clear Text and Messages, Provide Effective Feedback and Guidance and Assistance, Create Meaningful Graphics, Icons AndImages.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Plan and conduct a usability test for a specific feature of a digital product.
2. Evaluate the accessibility of an existing website or application. Identify potential accessibility issues and propose design changes to enhance inclusivity.

RESOURCES

TEXT BOOKS:

1. The Essential Guide to User Interface Design, Second Edition, Wilbert O. Galitz, 2002.

REFERENCE BOOKS:

1. User Interface Design, A Software Engineering Perspective, Soren Lauesen.

2. User Interface Design and Evolution, Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha, 2005

VIDEO LECTURES:

1. https://www.coursera.org/learn/UXdesign
2. https://www.edx.org/course/UX-design
3. https://www.udemy.com/course/UX

WEB RESOURCES:

1. https://www.coursera.org/articles/ui-vs-ux-design
2. https://www.simplilearn.com/how-to-become-ui-ux-designer-article
3. https://intellipaat.com/blog/ui-ux-design-tutorial/

PROGRAM ELECTIVE

(22CA101008) DECISION SUPPORT SYSTEMS

L	T	P	S	C
3	-	-	-	3

Pre-Requisite Software Engineering

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Decision Support Systems Development, Collaborative Computing Technologies, Enterprise Information Systems, Knowledge Acquisition, Representation & Reasoning, Advanced intelligence system, Implementing MSS in the E-Business ERA and Integration, Impacts and the future of management support systems.

COURSE OUTCOMES

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

CO1. Understand the concepts of DSS and its corresponding systems, technologies and their framework for the implementation of computerized DSS.

CO2. Analyze the configuration and modeling of DSS and MSS to provide the structure of the decision trees.

CO3. Apply collaborative computing technologies, enterprise information systems and knowledge management systems developing Decision Support Systems.

CO4. Make use of Artificial Intelligence and expert systems for knowledge acquisition, representation and reasoning in rule based systems.

CO5. Implement Management Support Systems in E-Business, E-Commerce, L-Commerce, Intra-business, Legal and Ethical Issues in E-commerce.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	3	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	3	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1:DECISION MAKING AND COMPUTERIZED SUPPORT (9 periods)

Management support systems: Managers and Decision-Making ,Managerial Decision-Making and Information Systems ,Managers and Computer Support, Computerized Decision Support and the Supporting Technologies, A Framework for Decision Support ,The Concept of Decision Support Systems, Group Support Systems ,Enterprise Information System, Knowledge Management Systems, Expert Systems, Artificial Neural Networks, Advanced Intelligent Decision Support Systems, Hybrid Support Systems.

Decision making systems modeling- support: Phases of decision Making Process.

Module 2: DECISION SUPPORT SYSTEMS (9periods)

Decision Support Systems: DSS Configurations, What Is a DSS, Characteristics and Capabilities of DSS, Components of DSS, The User, DSS Hardware, DSS Classifications.

Modeling and Analysis: MSS Modeling, Static and Dynamic Models, Certainty, Uncertainty, and Risk. Decision Analysis of a Few Alternatives (Decision Tables and Decision Trees), The Structure of MSS Mathematical Models.

Module 3: COLLABORATIVE COMPUTING TECHNOLOGIES (9 periods)

Collaborative Computing Technologies: Group Support Systems, Group Decision-

Making, Communication and Collaboration, Communication Support, Group Support Systems, Group Support Systems Technologies, Group systems Meeting room and Online, The GSS Meeting Process.

Enterprise Information Systems: Concepts and Definitions, The Evolution of Executive and Enterprise Information Systems, Executive Roles and Information Needs**.**

Module 4: INTELLIGENT DECISION SUPPORT SYSTEMS (9 periods)

Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Evolution of Artificial Intelligence, The Artificial Intelligence Field, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems.

Knowledge Acquisition, Representation & Reasoning: Methods of Knowledge Acquisition from Experts, Knowledge Verification and Validation, Representation of Knowledge, Reasoning in Rule-Based Systems.

Module 5: IMPLEMENTING MSS IN THE E-BUSINESS ERA (9 periods)

Implementing MSS in the E-Business ERA: E-Commerce Mechanisms: Auctions and Portals, Business-to-Consumer Applications, Market Research, e-CRM, and Online Advertising, Intrabusiness, Business-to-Employees, and People-to-People, E-Government, E-Learning, and Customer-to-Customer EC, M-Commerce, L-Commerce, and Pervasive Computing, Legal and Ethical Issues in E-Commerce.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Components of a Decision Support System
2. What are 8 Decision Support System Examples To Guide Decision-Making
3. Explain the attributes, characteristics, components and benefits.

TEXT BOOK:

1.Efraim Turban, Jay EAronsonand Ting-PengLiang, *Decision Support Systems and Intelligent Systems*, Prentice Hall India, 7thEdition, 2007.

REFERENCE BOOKS:

1. V. S. Janakiraman and K. Sarukesi, *Decision Support Systems*, PHI Learning, 1st Edition, 2009.
2. Efrem G Mallach, *Decision Support Systems and Data Warehouse Systems*, McGraw Hill, 2008.

VIDEO LECTURES:

1.http://nitttrc.edu.in/nptel/courses/video/110104168/L40.html

2.https://archive.nptel.ac.in/courses/110/106/110106150/

WEB RESOURCES:

1. https://www.tutorialspoint.com/management_information_system/decision_support_system.htm
2. https://www.toppers4u.com/2020/11/decision-support-systems-components.html
3. https://onlinecourses.nptel.ac.in/noc20_mg59/preview

(22CA101009) ADVANCED DATABASES

L	T	P	S	C
3	-		-	3

Pre-Requisite -- Database Management Systems

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Parallel Databases; Object-Based Databases; Distributed Databases; XML; Emerging Database Technologies and Applications.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Understand the concepts of parallelism to design parallel systems on multicore processors.

CO2. Apply object oriented concepts to design object based databases.

CO3. Design distributed databases by analyzing various data fragmentations.

CO4. Create XML databases for web based applications.

CO5. Implement emerging database technologies for the development of applications.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: PARALLELDATABASES (09Periods)

Introduction,I/OParallelism,InterqueryParallelism,IntraqueryParallelism,Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors.

Module 2: OBJECT-BASEDDATABASES (09 Periods)

Overview,ComplexDataTypes,StructuredTypesandInheritanceinSQL,TableInheritance, Array and Multi set Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

Module 3: DISTRIBUTEDDATABASES (09Periods)

Features of Distributed versus Centralized Databases, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed databases, Distributed Database Design.

Module 4: XML (09 Periods)

Structure of XML data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications. (graph database)

Module 5: EMERGINGDATABASETECHNOLOGIESANDAPPLICATION (09 Periods)

Mobile Database, Geographic Information Systems, Genome Data Management, Multimedia Database; NoSQL-An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Evaluate the security of a database system.
2. Plan and execute the migration of a database from one system to another
3. Design a distributed database system for a scenario involving multiple data centers.

RESOURCES

TEXT BOOKS:

1. A.Silberschatz,H.F.KorthandS.Sudarshan,"*DatabaseSystemConcepts,"* TataMcGraw Hill, 7th Edition,2019.
2. StefandCeriandGiuseppePelagatti,"*DistributedDatabasesPrinciplesandSystems,"* McGraw Hill, 1st Edition,2008.

REFERENCE BOOKS:

1. Ramea Elmasri and Shamkant B. Navathe," *Fundamentals of database Systems*," Pearson Education, 5th Edition, 2007.
2. Gaurav Vaish, "*Getting Started with NoSQL*," Packt Publishing, 1st Edition,2013.

VIDEO LECTURES:

1. https://youtu.be/7M0CdMfUEmQ
2. https://youtu.be/tFS0qiimHPY
3. https://youtu.be/yTZBtde3zoI

WEB RESOURCES:

1. https://www.geeksforgeeks.org/difference-between-centralized-database
2. https://www.geeksforgeeks.org/parallelism-in-query-in-dbms
3. https://www.geeksforgeeks.org/object-based-databases

(22CA102009) LINUX Administration

L	T	P	S	C
2	-	2	-	3

Pre-Requisite Computer Communication

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Concepts on Linux Programming; Basic Commands in Linux; Shell Programming; Process, Signals and File System Structure; Inter process Communications and Socket Programming for Client-Server Interaction.

COURSE OUTCOMES

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

CO1. Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.

CO2. Analyze the program arguments, environment variables and different types of information in Linux environment to maintain network programming.

CO3. Design interactive shell scripts related to Linux Environment for solving specified computational problems.

CO4. Apply system calls for process management and commands to manage file system.

CO5. Make use of processes, threads and signals to create and manage new processes.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	3	-	3	-	-	3	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO LINUX (06 Periods)

The GNU project and the Free Software Foundation, Linux distributions, Programming Linux - Linux programs, Text editors, The C Compiler; Basic commands -- cat, tail, head , sort, nl, uniq, grep, cut, paste, join, tee, pg, comm, cmp, diff, cp, mv, ln, rm, unlink, tty, clear, date , cal, mkdir, rmdir, du, df, find, umask, ps, who, sed

Module 2: LINUX ENVIRONMENT (06 Periods)

Program arguments - getopt, getopt_long. Environment variables - Use of environment variables, The environmental variable, Time and Date, User information, Host information.

Module 3: SHELL PROGRAMMING (06 Periods)

Necessity of shell programming, Pipes and redirection - Redirecting output, Redirecting input, Pipes, The Shell as a programming language - Interactive programs, Creating a script, Making a script executable, Shell syntax – Variables, Conditions, Control structures, Functions, Commands, Command execution.

Module 4: FILE SYSTEM STRUCTURE (06 Periods)

Linux File Structure and Commands: File structure - Directories, Files and devices, System calls and Device drivers; Library functions - Low-level file access, write, read and open commands, Initial permissions, Other system calls for managing files; File and directory maintenance commands - chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd.

Module 5: PROCESS AND SIGNALS (06 Periods)

Process structure - Process table, Viewing processes, System processes, Process scheduling; Starting new processes - Waiting for a process, Zombie processes, Input and output redirection, Threads; Signals - Sending signals, Signal sets.

Total Periods: 30

EXPERIENTIAL LEARNING

1. To Install Ubuntu Linux
2. General Purpose Utilities Commands
3. File System, Text Processing Commands And Vi Editor
4. Sed, Grep,Egrep,Fgrep
5. Basic Shell Scripting
6. Shell Scripting

RESOURCES

TEXT BOOKS:

1. Neil Matthew and Richard Stones, Beginning Linux Programming, Wiley Dreamtech, 4th4thEdition, 2008.
2. Sumitabha Das, Your UNIX: The Ultimate Guide, Tata McGraw

REFERENCE BOOKS:

1. Richard Petersen, Linux: The Complete Reference, Tata McGraw w-Hill, 6thEdition, 2007.
2. YashwanthKanitkar, Unix Shell programming, BPB Publications, 1stEdition.

SOFTWARE/TOOLS:

1. Ubuntu
2. Linuxmint

VIDEO LECTURES :

1. https://www.youtube.com/watch?v=Wgi-OfbP2Gw
2. https://www.youtube.com/watch?v=bz0ZCUv5rYo

WEB RESOURCES:

1. https://www.javatpoint.com/linux-tutorial
2. https://www.guru99.com/unix-linux-tutorial.html
3. https://www.simplilearn.com/linux-programming-for-beginners-article

(22CA101010)INTERNET OF THINGS

L	T	P	S	C
3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Basic concepts of IoT, evolution, characteristics, advantages and disadvantages of IoT, ADC and DAC Principle, IoT sensors and actuators, working with arduino board, applications of IoT in different domains.

COURSE OUTCOMES

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

CO1. Understand the basic concepts of IoT to work with IoT environment.

CO2. Analyze the principles of ADCs and DACs to implement in the development of devices.

CO3. Design IoT devices with sensors and actuator technologies for effective results.

CO4. Make use of the Arduino board to develop IoT devices for different domains.

CO5. Develop various IoT related used cases and applications to solve real world problems.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	3	-	-	3	3	-
CO2	3	3	3	3	-	-	-	-	-	3	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	3	-	-	3	3	-
CO4	3	3	3	3	-	-	-	-	-	3	3	3	3	3	-
CO5	3	3	3	3	-	-	-	-	-	3	3	3	3	3	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BASICS OF IOT **(08 Periods)**

Definition of "Internet of Things", Technological trends which have led to IoT, impact of IoT on society, History of IOT, How IOT works,IOT Applications, Characteristics of IoT, Challenges of IoT, Advantages of IoT, Disadvantages IOT, evolution of IOT.

Module 2: ADCS AND DACS **(11 Periods)**

DAC principle, weighted register DAC, R L1,L2,L3 -2R ladder DAC, performance characteristics of DAC, ADC principle, flasf ADC, successive approximation ADC, counter type ADC, dual slope ADC, performance characteristics of ADC.

Module 3: IOT SENSORS AND ACTUATORS **(09 Periods)**

Various IOT Sensors and actuators and technologies, Temperature sensors Moisture sensors, Light sensors, Acoustic and noise sensors, Water level sensors, Proximity sensors, motion sensors, Gyroscope, Chemical sensors, Image sensors.

Module 4: ARDUINO BOARD **(07 Periods)**

Introduction to Arduino board, interfacing sensors and actuators to Arduino board.

Module 5: IOT USE CASES AND APPLICATIONS **(10 Periods)**

Smart homes, wearables, smart city, smart grid, industrial internet, connected cars, connected health, smart retail, smart supply chain, smart farming.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Compare and contrast different communication protocols used in IoT.
2. Discuss how sensor data is collected, processed, and transmitted to a central hub.
3. Identify potential security risks in an IoT ecosystem and propose strategies to mitigate these risks.

RESOURCES

TEXT BOOKS:

1. Internet of Things: A Handson Approach ArshdeepBahga and Vijay Madisetti Universities Press 2nd Edition.
2. Internet of Things: Architecture and Design Principles Rajkamal McGraw Hill Education 1st edition.

REFERENCE BOOKS:

1. IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things David Hanes , Gonzalo salgueiro Cisco Press Kindle Edition 2017
2. Designing the Internet of Things Adrian McEwen, Hakim Cassimally Paperback 1st edition
3. Analytics for the Internet of Things(IoT) Andrew Minteer Kindle Edition 1st edition

VIDEO LECTURES :

1. http://www.nptel.ac.in/(https://youtu.be/WUYAjxnwjU4?list=PLaxu2gn9WXMf_ln5pMvxjf043jzof4-i&t=13)
2. http://www.iitk.ac.in/ (https://youtu.be/p7kYStiASLo?list=PLbRMhDVUMngdcL)

WEB RESOURCES:

1. http://www.nptel.ac.in/ (https://nptel.ac.in/courses/108108098/)
2. http://www.edureka.com/ (https://youtu.be/LlhmzVL5bm8?list=PL9ooVrP1hQOGccf)

(22CA101011) DIGITAL FORENSICS

L	T	P	S	C
3	-	-	-	3

Pre-Requisite Computer Communication
Anti-Requisite --
Co-Requisite --

COURSE DESCRIPTION

Computer Forensics Fundamentals, Types of Computer Forensics Technology; Types of Computer Forensics Systems, Vendor and Computer Forensics Services; Computer Forensics Evidence and Capture; Computer Forensics Analysis, Reconstructing Past Events, Networks; Countermeasures.

COURSE OUTCOMES

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

CO1. Understand the concepts of Computer Forensics and Techniques.

CO2. Analyze the types of Computer Forensics Systems and Services.

CO3. Apply Data Recovery, Evidence Collection and Data Seizure, Computer Image Verification and Authentication for Computer Forensics Evidence and Capture

CO4. Design Computer Forensics for Reconstructing Past Events and Networking Forensics Scenarios.

CO5. Make use of Countermeasures and tools for Computer Forensics.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	-	-	1	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3	3	3	-

Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**		**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO COMPUTER FORENSICS (09 Periods)

Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence.

Module 2: TYPES OF COMPUTER FORENSICS TECHNOLOGY (09 Periods)

Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised, Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls, Biometric Security Systems.

Module 3: FORENSIC SYSTEMS (09 Periods)

Internet Security Systems, Intrusion Detection Systems,Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems,Identity Management Security systems, Identity Theft, Biometric Security Systems, Homeland Security Systems.

Module 4: COMPUTER FORENSICS AND EVIDENCE (09 Periods)

Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden DataWhy Collect Evidence, Collection Options, Obstacles, Types of Evidence,The Rules of Evidence,VolatileEvidence,GeneralProcedure,Collection and Archiving,Methods of Collection,Artifacts.

Module 5: FORENSIC ANALYSIS AND COUNTERMEASURES (09 Periods)

Discovery of Electronic Evidence -Electronic Document Discovery: A Powerful New Litigation ToolIdentification of Data-Timekeeping,Forensic Identification and Analysis of Technical Surveillance Devices,Weapons of the Future, The Global Positioning System,Snoop, Sniff, and Snuff Tools,Email Wiretaps Like Carnivore Can Steal Sensitive Correspondence,IW Weapons of the Future,Nanotechnology

Total Periods: 45

EXPERIENTIAL LEARNING

1. Simulate a scenario where a cybercrime has occurred. Outline the step-by-step process for collecting digital evidence from various sources such as computers, smartphones, and cloud storage.
2. Analyze a corrupted file system to recover data relevant to an investigation. Discuss the tools and techniques used in file system forensics and how they contribute to reconstructing digital artifacts.
3. Investigate a network security incident. Analyze network logs, packet captures, and other relevant data to identify the source of an attack. Discuss the challenges and methodologies in network forensics.

RESOURCES

TEXT BOOK:

John R. Vacca, *Computer Forensics –Computer Crime scene Investigation*, Cengage Learning, 2nd Edition, 2010.

REFERENCE BOOKS:

1. Darren R. Hayes, *A Practical Guide to Computer Forensics Investigations*, Pearson Education, 1st Edition, 2015.
2. Cory Altheide and Harlan Carvey, *DigitalForensics with Open Source Tools*, Elsevier, 2011.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=giv0DQDSsjQ
2. https://www.youtube.com/watch?v=aujOftqpptI
3. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

WEB RESOURCES:

1. https://uomustansiriyah.edu.iq/media/lectures/6/6_2019_03_13!10_35_05_PM.pdf
2. https://www.smartzworld.com/notes/computer-forensics-pdf-notes-cf/

(22CA101012)COMPUTER NETWORKS

L	T	P	S	C
3	-	-	-	3

Pre-Requisite Computer Communications

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

Concepts of Computer Networks, The Physical Layer, The Data Link Layer, The Network Layer, The Transport Layer, The Application Layer.

COURSE OUTCOMES

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

CO1. Understand the concepts of Networking, reference models, transmission media.

CO2. Apply error and flow control techniques and implement congestion control mechanisms and transport protocols for reliable data communication.

CO3. Analyze design issues of layers, techniques for quality of service, elements of transport and application Protocols ensuring the communication procedures.

CO4. Examine the layered and e-mail architectures, networking protocols and e-mail message formats in compliance with communication standards.

Co-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	2	3	1	3	1	-	-	-	-	-	-	-	-	3
CO3	2	3	3	-	2	2	-	-	-	-	-	-	-	-	3
CO4	-	1	1	-	-	2	-	-	-	-	-	-	-	-	2

Correlation Levels: 3: High; 2: Medium;1: Low

COURSE CONTENT

Module 1: NETWORK CONCEPTS AND PHYSICAL LAYER ***(09 Periods)***

Network Concepts: Uses of Computer Networks, Network Hardware, Network Software, Reference Models-OSI, TCP/IP.

The Physical Layer: Guided Transmission media-Magnetic Media, Twisted Pairs, Coaxial Cable, Fiber Optics. Wireless Transmission-The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission and Light Transmission.

Module 2: THE DATA LINK LAYER ***(09 Periods)***

The Data Link Layer: Data Link layer design issues, Error Detection and Correction, Elementary Data Link Protocols - Unrestricted simplex protocol, Simplex stop-and-wait protocol, Simplex protocol for a noisy channel. Sliding Window protocols - One-bit sliding window protocol, Protocol using Go back N, Protocol using Selective Repeat.

Module 3: THE NETWORK LAYER ***10(Periods)***

Network layer design issues, Routing Algorithms-Optimality principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks. Congestion Control Algorithms, Internetworking, The Network layer in the Internet-The IP Version 4 protocol, IP Addresses

Module 4: THE TRANSPORT LAYER ***(10 Periods)***

The Transport service, Elements of Transport protocols - Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing and Crash recovery, The Internet Transport protocols - Introduction to UDP, Remote Procedure Call, Introduction to TCP, The TCP Service Model, TCP protocol and TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Sliding Window, TCP Timer Management, TCP Congestion Control.

Module 5: THE APPLICATION LAYER ***(07 Periods)***

DNS - The Domain name space, Resource records and Name servers; Electronic Mail-Architecture and services, the user agent, message formats, message transfer and Final Delivery.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a C program to implement the algorithm for parity method for error control.
2. Write a C program to implement the algorithm on hamming method for error correction (both single and block errors).
3. Write a C program to implement the algorithm for check sum computation

RESOURCES

TEXT BOOK:

1. Andrew S. Tanenbaum and David J. Wetherall*, "Computer Networks,"* Pearson Education, 5th Edition, 2015.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, *"Data Communications and Networking,"* The McGraw-Hill, 4th Edition, 2011.
2. James F. Kurose and Keith W. Ross, "*Computer Networking: A Top-Down Approach*," Pearson Education, 6th Edition, 2017.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://www.youtube.com/watch?v=6_PINy02_g0

WEB RESOURCES:

1. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html
2. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf
3. https://www01.ibm.com/servers/resourcelink/svc0302a.nsf/pages/zVMV7R1sc246333/$file/kijl0_v7r1.pdf
4. http://ns2simulator.com/ns2-tcp-congestion-control/

(22CA102010) NETWORK ADMINISTRATION

L	T	P	S	C
2	-	2	-	3

Pre-Requisite Computer Communication

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION

Network administrator professional ethics, Recent trends in network administration, Hardware features and strategies of Work Station, Server and Service launch and disaster recovery, infrastructure maintenance, service recommendations of upgrading, centralizing, monitoring, email, print, data storage, web maintenance, preparing enterprise level network.

COURSE OUTCOMES

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

CO1. Understand the importance of Network Administration and the recent trends in administration.

CO2. Analyze the features andstrategies of hardware in service launch and disaster recovery.

CO3. Design the architecture for the creation of data centers.

CO4. Apply techniques to configure types of services in networking.

CO5. Implement different utility commands of Linux and create enterprise level network setup.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	3	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	2	-	2	-	2	-	-	-	-	2	3	-	3
CO3	3	2	3	2	1	-	-	-	-	-	2	-	3	-	2
CO4	2	2	3	2	-	-	-	2	-	-	-	-	3	2	-

CO5	3	3	-	3	3	-	-	-	-	-	3	-	-	-	3
Course Correlation Mapping	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**3**	1	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: NETWORK ADMINISTRATOR (06 Periods)

Network administrator as a Profession, Network administrator professional ethics, Recent trends in network administration.

Module 2: WORK STATION, SERVER AND SERVICES (06 Periods)

Workstation:Architecture design, Hardware strategies, OS installation.

Servers:Hardware Strategies, Hardware Features & Specifications.

Service: Requirements, Planning and Engineering, Service Launch, Disaster Recovery.

Module 3 INFRASTRUCTURE (06 Periods)

Network Architecture, Network Operations, Datacenters overview.

Module 4 SERVICE RECOMMENDATION (06 Periods)

Server Upgrade, Centralizing a service, Service Monitoring, Namespaces, Email Service, Print Services, Data Storage, Backup and Restore, Software Repository, Web Services.

Module 5 ENTERPRISE LEVEL NETWORK (06 Periods)

Preparing procurement plan/document for enterprise level network setup.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Installation and configuration of VM Ware.
2. Installing OS in VM Ware.
3. Implement Directory command in Linux.

4. Implement Network Command in Linux.

5. Implement File Handling utilities in Linux.

6. Write shell script to generate Fibonacci Series.

7. Write shell script to find factorial of a number.

8. Write shell script to find whether the given input is palindrome or not.

9. Write shell script to generate student grade sheet.

10. Write shell script to generate electricity bill.

RESOURCES

TEXT BOOK:

1. Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup, "*The Practice of System and Network Administration,*" Addison-Wesley Professional, 3rdEdition.

REFERENCE BOOKS:

1. Jordan Krause, "*Mastering Windows Server 2019: The complete guide for IT Professionals to install and manage Windows Server 2019 and deploy new capabilities,"* Packt*,* 2nd Edition, 2019.

2. 2. MD. Tanvir Rahman, "*Ubuntu and Centos Linux Server Administration*,"2019.

3. 3. Sumitabha Das, "*UNIX-Concepts & Applications*," Tata McGraw Hill, 4th Edition,2017.

VIDEO LECTURES:

1. https://www.udemy.com/topic/unix/
2. https://www.coursera.org/learn/unix

WEB RESOURCES:

1. https://cs3157.github.io/www/2022-9/guides/unix-setup.html
2. https://www.cyberciti.biz/tips/unix-linux-programming-faqs-howto.html

(22CA102011)OPEN SOURCE PROGRAMMING

L	T	P	S	C
2	-	2	-	3

Pre-Requisite -- Java Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION

HTML, Creating Table, frames, Style, Display Properties, Linux Essential Commands , File system, Shell Script, Java script, Data type, Arrays, Operators and Expressions, Loops, functions, Dialog box, MY SQL , Database and Tables ,Table, PHP Scripting, File and Folder Access– Cooking–Sessions , MySQL .

COURSE OUTCOMES

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

CO1. Understanding the HTML Tags

CO2. Demonstrate Linux and Shell Scripting.

CO3. Apply control statements for different logics on java script.

CO4. Discuss to maintain database using Mysql

CO5. Design applications using PHP.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3												1	2	1
CO2	3	2	3	2									2	2	1
CO3	3	2	2	2	3								1	1	2
CO4	1	2	3	2	3								2	1	
CO5	1	2	3	2									3	2	

Correlation Level: 3-High 2-Medium 1-Low

COURSE CONTENT

Module 1: HTML **(6 Periods)**

Introduction to HTML, List, Creating Table, Linking document frames, Graphics to HTML Doc , Stylesheet, Style sheet basic, Adding style to document, Style sheet properties, Font,text, list, color andbackgroundcolor, box, Display Properties.

Module 2: LINUX **(6 Periods)**

Introduction : Linux Essential Commands – File system Concept – Standard Files – The Linux SecurityModel – Vi Editor – Partitions Creation – Shell Introduction – String Processing – Investigation andManagingProcesses–NetworkClients–InstallingApplication.

Module 3: JAVASCRIPT **(6 Periods)**

Introduction to Javascript –Advantages of Javascript –JavaScript Syntax-Datatype-Variable– Array – Operators and Expressions- Loops - functions – Dialog box.

Module 4:MYSQL **(6 Periods)**

Introduction to MY SQL – The show Databases and Table – The USE command – Create Database and Tables – Describe Table – Select, Insert, Update, and Delete statement – Some Administrative detail – Table Joins – Loading and Dumping a Database.

Module 5:PHP **(6 Periods)**

PHP Introduction – General Syntactic Characteristics – PHP Scripting – Commenting your code – Primitives, Operations and Expressions – PHP Variables – Operations and Expressions Control Statement – Array – Functions – Basic Form Processing – File and Folder Access – Cooking – Sessions – Database Access with PHO – MySQL - MySQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Write a javascript to design a simple calculator to perform the following operations- sum, product, difference, and quotient
2. Write a javascript that calculates the squares and cubes of the numbers from 0 to 10 and outputs html text that displays the resulting values in an html table format.
3. Develop and demonstrate a html5 file that includes javascript script that uses functions for the following problems

a. Parameter: a string

b. Output: the position in the string of the left-most vowel

c. Parameter: a number

d. Output: the number with its digits in the reverse order

4. Write a php program to sort the student records which are stored in the database using selection sort.
5. Write the php programs to Implement simple calculator.
6. Write a shell script that accept a list of file names as arguments count and report the occurrence of each word.
7. Write a shell script to find the factorial of given integer
8. Write a shell script that list the all files in a directory.
9. a)Write a shell script that accept a file name starting and ending line numbers as arguments and display all the lines between given line no.

b) Write a shell script that delete all lines containing a specified word.

10. Write the php programs to perform the following operations:

a) Find the transpose of a matrix.

b) Multiplication of two matrices.

c) Addition of two matrices.

TEXT BOOKS:

1. T. A. Powell, Complete Reference HTML (Third Edition),TMH, 2002.
2. Unix Concepts and Applications by Sumitabha Das, Tata McGraw Hill Education, 2006.

REFERENCE BOOKS:

1. The official Ubuntu Book, 8th Edition.
2. Setting Up LAMP : Getting Linux, Apache, MySQL, and PHP and Working Together", Eric Resebrock, Eric Filson, Published by John Wiley and Sons, 2004.

3. Bayross, Web Enable Commercial Application Development Using HTML, DHTML, Javascript, Pen CGI, BPB Publications, 2000

4. J. Jaworski, Mastering Javascript, BPB Publications, 1999.

VIDEO LECTURES:

1. https://www.coursera.org/learn/open-source-software-development-methods
2. https://www.udemy.com/course/oss-developers/

WEB RESOURCES:

1. Docker Project Home: http://www.docker.com
2. Linux kernel Home: http://kernel.org
3. Open Source Initiative: https://opensource.org/
4. Linux Documentation Project: http://www.tldp.org/
5. Github: https://help.github.com/
6. The Linux Foundation: http://www.linuxfoundation.org/

Course Code	Course Title	L	T	P	S	C
22CA102012	**SCRIPTING LANGUAGES**	2	-	2	-	3

Pre-Requisite Python Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

Scripting language's flexibility has allowed developers to create innovative software. Most engineering students were required to learn the scripting languages to promote their study and complex problem solving in order to keep up-to - date with the competition.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Ability implement basic JavaScript programs with simple and composite data types

CO2. Ability to write simple JavaScript code to automate system administration tasks and rapidly develop simple applications using object models and event handling mechanisms.

CO3. Design client side validation using JavaScript.

CO4. Create patterns and evaluate it using PHP script.

CO5. Ability to implement the authentication methods to enable security for the web application.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	-	-	1	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3	3	3	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**		**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO JAVASCRIPT ***(06 Periods)***

Introduction to JavaScript: adding JavaScript to XHTML documents-Usage considerations-History and uses of java script- Core language features: Variables- basic data types-Composite types: objects, arrays, functionsExpressions-flow control-Loops.

Module 2: OBJECT MODELS AND EVENT HANDLING ***(06 Periods)***

JavaScript regular expressions: RegExpobject-String methods for Regular expressions-Advanced regular expressions-Limitations-Object modelDocument object-simple event handling-Standard document object modelEvent Handling.

Module 3: APPLIED JAVASCRIPT ***(06 Periods)***

Windows, frames, overlays-Form handling-User interface elements-Ajax and remote JavaScript-Browser management-Media management-Trends and practices-writing quality code-Security-Security policy-Performance.

Module 4: FUNDAMENTALS OF PHP ***(06 Periods)***

Introduction-simple PHP program-Converting between data types-Arithmetic operators-Initializing and manipulating arrays-String comparisons-String processing with regular expressions-Reusing code and writing functions.

Module 5: OBJECT ORIENTED PHP AND WEB APPLICATION SECURITY ***(06 Periods)***

Object Oriented PHP-Error and exception handling-Form processing and business logic-Reading from a database-Cookies-Dynamic content-Web application security risks-Building a secure web application-Implementing authentication methods with PHP. Interacting with file system and server network and protocol functions-Session control-Integrating java script and PHP

Total Periods: 30

EXPERIENTIAL LEARNING

1. Write a Ruby script to create a new string which is n copies of a given string where n is a nonnegative integer
2. Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
3. Write a Ruby script to print odd numbers from 10 to 1

4. Write a Ruby script to print the elements of a given array
5. Write a TCL script to find the factorial of a number
6. Write a TCL script that multiplies the numbers from 1 to 10
7. Write a Perl script to find the largest number among three numbers.
8. Write a Perl script to print the multiplication tables from 1-10 using subroutines.
9. Write a Perl script to print the file in reverse order using command line arguments

RESOURCES

TEXT BOOKS:

1. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition,London, ISBN:9780072253573, 2013
2. Harvey Deitel, Paul Deitel, Abbey Deitel,"Internet and World Wide Web How To Program", fifth edition, Pearson Education, ISBN: 13:978-0-273-76402-1, 2012.

REFERENCE BOOKS:

1. David Flanagan, "JavaScript: The Definitive Guide", Sixth Edition,O'Reilly Media, ISBN: 978-0-596-80552-4, 2012.
2. Luke Welling, Laura Thomson," PHP and MySQL Web Development", fifth edition, Addison Wesley, ISBN: ISBN 13: 9780321833891, 2016.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/117/106/117106113/
2. https://www.coursera.org/specializations/introduction-scripting-in-

WEB RESOURCES:

1. https://www.coursera.org/in/articles/scripting-
2. https://www.engati.com/glossary/scripting-language

Course Code	Course Title	L	T	P	S	C
22CA102013	**PROGRAMMING WITH C#**	2	-	2	-	3

Pre-Requisite Programming for Problem Solving

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Introduction to .NET and Building blocks to the .NET Platform; Concepts of C# Programming; Implementation of interfaces, creating custom delegates and Events.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand .NET Framework, principles of C#, Microsoft Visual C# and Visual Studio.
CO2. Using of basic concepts like Arrays, strings, enumerators in program.
CO3. Implementing Object oriented Programming Concepts.
CO4. Using of Delegates, events handling and error handling concepts.
CO5. Implementing the thread concepts and using of libraries.

CO-PO-PSO Mapping Table

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	1	3	1	-	1	-	-	1	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3	3	3	-
Course Correlation Mapping	3	3	3	3	3		-	3	-	-	-	3	3	3	3

3- High mapping **2-Medium Mapping** **1- Low Mapping**

Detailed Syllabus:

UNIT-I: INTRODUCTIONTO .NET IDE (6 Periods)

Introduction to Visual Studio ,Benefits of the .NET platform, Building blocks of the .NET platform, Overview of .NET assemblies, Common type system, Common language specification, Platform-independent nature of .NET,The role of the .NET framework, Building .NET application using visual studio, Common Language Runtime (CLR)

UNIT-II: INTRODUCTION TO C# (6 Periods)

Introducing C#, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations.

UNIT-III: OBJECT ORIENTED ASPECTS OF C# (6 periods)

Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading.

UNIT-IV: C# ADVANCED FEATURES (6 Periods)

Delegates ,Lambdas, lambda Expressions, Events ,Event Publisher, Event Listener, Regular Expressions ,Generics, Collections, Errors and Exceptions, Reflection

UNIT- V: MULTITHREADED AND CONFIGURING.NET ASSEMBLIES (6 periods)

Namespace-System, Input Output, Multi-Threading: Thread Life cycle, Steps to create a thread, Private Assemblies, Shared Assemblies, and Versioning.

Total Periods: 30

EXPERIENTIAL LEARNING:

1. Write a program to C# to find the smallest single digit factor for a given value.
2. Write a program in C# to print a number if it is prime; otherwise display the largest factor of that number.
3. Write a program in C# to find the magnitude of a number.
4. Program in C# to find the second largest element in a single dimensional array.
5. Write a C# program to reverse a given string .

6. Write a C# program to which reads a set of strings into the rows a two dimensional array and then prints the string having more number of vowels.

7. Write a C# programs to demonstrate the concepts of Structures and Enumerations.

8. Write a C# programs to demonstrate the concepts of Constructors and Inheritance.

9. Write a C# programs to demonstrate the concepts of Polymorphism.

10. Write a C# programs to demonstrate the concepts of Partial classes and Extension methods.

11. Program in C# to build a class which implements an interface which already exists

12. Write a C# programs to demonstrate the concepts of Delegates.

13. Write a C# program to implement Assemblies.

14. Write a C# program to implement Multithreading and Thread Synchronization

Resources

TEXT BOOKS:

1. Balagurusamy, "Programming with C#", TMH
2. Andrew Troelsen, *"Pro C# 5.0 and the .NET 4.5 Framework,"* 6th Edition, Apress, 2013

REFERENCE BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# and .NET 4.5", Wiley, First Edition2012
2. "C# for Programmers", Deitel and Deitel, Pearson
3. "Programming C#, 3rd Edition " Jesse Liberty , O'really
4. "Understanding .NET", Chappell, David, , Addison Wesley, 2006.

VIDEO LECTURES:

1. https://www.udemy.com/course/c-net-for-beginners/
2. https://openclassrooms.com/en/courses/5670356-learn-programming-with-c

WEB RESOURCES:

1. https://www.w3schools.com/cs/index.php
2. https://learn.microsoft.com/en-us/dotnet/csharp/programming-guide/
3. https://www.programiz.com/csharp-programming

Course Code	Course Title	L	T	P	S	C
22CA102014	UNIX SHELL PROGRAMMING	2	-	2	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

This course provides a detailed discussion and hands-on experience on how to understand and make effective use of Unix utilities and Shell scripting language (bash) to solve Problems and to write Shell programming to automate the shell commands and to develop the skills necessary to write systems programs related to file system and managing process creation and to learn various powerful text editors in Unix/Linux.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Develop a deeper understanding of operating systems, their functions and services.

CO2. Understanding the basic set of commands and utilities in Linux/UNIX systems.

CO3. Learn the Linux/UNIX library functions and system calls.

CO4. Effectively use Text editors for shell programs and Shell Scripts.

CO5. Describe the work with UNIX utilities and to develop shell scripts.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Unix Environment ***(06 Periods)***

The operating system, The UNIX operating system, knowing your system , The UNIX Architecture, features of UNIX, locating commands, internal and external commands, command structure, understanding the man documentation.

Module 2: Unix Commands ***(06 Periods)***

Cal, date, echo, printf, bc, script, Email basics, mailx, passwd, who, uname, tty, sty. **The process**: Processbasics,**ps**:Processstatus,mechanismofprocesscreation,internalandexternal commands, running jobs in background, process states and Zombies, **nice**, killing processes with signals, job control, **cron, time**.

Module 3: FileSystemandits attributes ***(06 Periods)***

Listing file attributes, directory attributes, file owner ship, file permissions, directory permissions,
changingfileownership,filesystemandInodes,hardlinks,symboliclinks,locatingfiles,
modificationandaccesstime.

Module 4: TheVIEditor ***(06 Periods)***

VI Basics, Input mode-Entering and Replacing text, Saving and Quitting – The ex-mode, Navigation, Editing text, Undoing Last Editing Instructions, Repeating the last command, searching text in the editor, Substitution - search and replace.

Module 5: Shell Script ***(06 Periods)***

Basic types of statements in a shell script, How do you execute a shell script, Examples of simplescripts,Workingwithscriptvariables,includingcommand-
linearguments,Commandsubstitution, Expressions involving variables,Other forms of input to shell variables or commands in a script,
Flow-of-controlstatements

Total Periods: 30

EXPERIENTIAL LEARNING

1. Workingwith unixcommands
2. Workingwith vieditor
3. Creatingdocument invi editor

4. Practicing–Howto compileand run Cor C++programs
5. Shellprograms Basics
6. Shellprogramsusingdecisionstatements,loops,positionalvariables
7. Shellprogramsusingarrays andstrings
8. ShellprogramapplyingUNIX commands
9. Shellprogramwithfunctions
10. Shellprogramforfile operations

RESOURCES

TEXT BOOKS:

1. Sumitabha Das, Your UNIX/LINUX: The Ultimate Guide , Edition 2012,Tata McGraw Hill.
2. YashwanthKanitkar, Unix Shell programming, BPB Publications, First Edition.

REFERENCE BOOKS:

1. Andrew Mallett-Mastering Linux Shell Scripting, 2015, PACKT Publisher.
2. Paul Love, Joe Merlino, Craig Zimmerman, Jeremy C. Reed, Paul Weinstein. Beginning Unix, 2015, Wiley Publisher.

SOFTWARE/TOOLS:

1. https://learn.microsoft.com/en-us/windows/wsl/install
2. https://www.geeksforgeeks.org/essential-linuxunix-commands/

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=k4Ww6gFeF0M
2. https://www.youtube.com/watch?v=vLPdBp9vv9Y
3. https://www.youtube.com/watch?v=lqYSCSgFefM&list=PL6UwySlcwEYIZGsbXnUxsojD0yeUA67lb

WEB RESOURCES:

1. https://www.unixtutorial.org/basic-unix-commands
2. https://www.udemy.com/course/bash-shell-scripting-crash-course-for-beginners
3. https://www.javatpoint.com/basic-unix-commands
4. https://www.geeksforgeeks.org/essential-linuxunix-commands

Course Code	Course Title	L	T	P	S	C
22CA102015	**PHP AND MYSQL PROGRAMMING**	2	-	2	-	3

Pre-Requisite Java Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

This course is designed to understand advancedScripting languages like PHP and MYSQL in web technologies to develop interactive, dynamic and scalable web applications for societal needs.

COURSE OUTCOMES: After successful completion of the course, students will be able:

CO1. To understand basic Bundle server installation & functionality.

CO2. To understand the basic Web Programming: including PHP programming

CO3. Apply PHP technologies for handling device independent web application development.

CO4. To understand the PHP webforms for sending data across server.

CO5. To understand the database programming using PHP and MYSQL.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	3	3	3	3	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3		3
CO4	3	3	3	3	3	3	-	3	-	-	3	3	3	3	3
CO5	3	3	3	3	3	3	-	3	-	-	3	3		3	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BASICS OF PHP ***(06 Periods)***

Basic Knowledge of websites, Introduction of Dynamic Website, Introduction to PHP, Why and Scope of PHP, XAMPP and WAMP Installation.

Module 2: INTRODUCTION TO PHP **(06 Periods)**

Data Types, Variables, Constants, Expressions, String Interpolation, Control Structures, Functions, Arrays, Embedding PHP Code in Web Pages, Object Oriented PHP.

Module 3: Handling Html Form with PHP **(06Periods)**

Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission

Module 4: PHP WEB FORMS **(06 Periods)**

PHP Web forms: PHP and Web Forms, Sending Form Data to a Server, Working with Cookies and Session Handlers

Module 5: PHP with MySQL **(06 Periods)**

Interacting with the Database, Prepared Statement, and Database Transactions.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Installation of WAMP/XAMPP web server.
2. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.
3. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.

4. Write a PHP code to read the username and password entered in the Login form of the online book store and authenticate with the values available in cookies. If user enters a valid username and password, welcome the user by username otherwise display a message stating that, entered details are invalid.
5. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.
6. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database.

RESOURCES

TEXT BOOKS:

1. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, First Edition, 2011
2. W. Jason Gilmore, Beginning PHP and MySQL, APress, Fourth Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, First Edition, 2015. (e-book)
2. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010.
3. Andrea Tarr, PHP and MySQL, Willy India, First Edition, 2012.

SOFTWARE/TOOLS:

1. A apache Tomcat
2. Eclipse

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp32/preview
2. https://www.coursera.org/courses?query=php

WEB RESOURCES:

1. https://www.tutorialspoint.com/php/index.htm
2. https://www.javatpoint.com/php-tutorial
3. https://www.geeksforgeeks.org/php-tutorials/

(22CA101013) GAME THEORY

L	T	P	S	C
3	-	-	-	3

Pre-Requisite - Computer Graphics

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Basics of Game theory, Dominant Strategies, Nash Equilibrium, Mixed Strategies and Probability, Static games and Strategic Interactions, Dynamic games and Sequential Rationality, Bargaining and Negotiation, Auction theory, Oligopoly and market competition, Cooperative Game Theory, Applications of game theory in various fields (economics, politics, biology, etc.)

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the concepts of game theory, dominant strategies and applications of Nash equilibrium and extensive form representation of games.

CO2. Select appropriate strategies for the development of applications and interactions.

CO3. Analyze the working of Dynamic games and sequential rationality, bargaining theory and evolutionary game theory.

CO4. Apply Auction theory and Mechanism design, Oligopoly and different models to meet the industrial organization.

CO5. Design and develop applications of game theory in various domains using different models, strategies and theories.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	1	3	1	-	2	-	-	-	-	-	-	-	3	-	3
CO3	-	3	2	2	-	-	-	-	-	-	-	-	3	3	2
CO4	-	2	3	2	2	-	-	-	-	-	-	-	3	3	-

CO5	-	-	3	3	-	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	**2**	**3**	**3**	**2**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	2	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Game Theory, Dominant Strategies and Nash Equilibrium & Extensive Form Games and Perfect Information (10 Periods)

Introduction to Game Theory: Overview of game theory and its applications, Types of games: simultaneous, sequential, and repeated games, Payoff matrix and strategies.

Dominant Strategies and Nash Equilibrium: Dominant strategies and their implications, Nash equilibrium concept and its applications, Finding Nash equilibrium in simple games.

Extensive Form Games and Perfect Information: Extensive form representation of games, Sub-game perfection and backward induction, Examples of extensive form games.

Module 2: Mixed Strategies and Probability & Static Games and Strategic Interactions (09 Periods)

Mixed Strategies and Probability: Introduction to mixed strategies, Computing mixed strategy equilibrium, Applications of mixed strategies in games.

Static Games and Strategic Interactions: Static games and their strategic interactions, Best response and dominated strategies, Strategies for cooperative and non-cooperative games.

Module 3 Dynamic Games and Sequential Rationality, Bargaining and Negotiation and Evolutionary Game Theory (09 Periods)

Dynamic Games and Sequential Rationality: Sequential games and decision trees, Perfect and imperfect information, Sub-game perfect Nash equilibrium.

Bargaining and Negotiation: Introduction to bargaining theory, Nash bargaining solution, Alternatives to the Nash bargaining solution.

Evolutionary Game Theory: Introduction to evolutionary game theory, Replicator dynamics, Evolutionary stability and the concept of fitness.

Module 4 Auctions and Mechanism Design and Oligopoly and Market Competition (09 Periods)

Auctions and Mechanism Design: Auction theory and types of auctions, Revenue equivalence and optimal bidding strategies, Mechanism design and incentive compatibility.

Oligopoly and Market Competition: Oligopoly and market structure, Cournot and Bertrand models, Game theory in industrial organization.

Module 5 : Cooperative Game Theory and Game Theory Applications and Wrap-up (08 Periods)

Cooperative Game Theory: Cooperative games and coalitional behavior, Core, Shapley value, and Nash bargaining solution, Applications of cooperative game theory.

Game Theory Applications and Wrap-up: Applications of game theory in various fields (economics, politics, biology, etc.).

Total Periods: 45

EXPERIENTIAL LEARNING

1. List the applications of Game theory in education.
2. Description of evolution of different game theories.

RESOURCES

TEXT BOOKS:

1. Steven Tadelis "Game Theory: An Introduction" Princeton University Press, 2013.
2. Robert Gibbons "Game Theory for Applied Economists" Princeton University Press, 1992.
3. Martin J. Osborne and Ariel Rubinstein "A Course in Game Theory" MIT Press, 1994.

REFERENCE BOOKS:

1. Roger B. Myerson "Game Theory: Analysis of Conflict", Harvard University Press, 2013.

2. Kevin Leyton-Brown and Yoav Shoham "Essentials of Game Theory: A Concise, Multidisciplinary Introduction" Morgan & Claypool Publishers, 2008.

3. Herbert Gintis "Game Theory Evolving: A Problem-Centered Introduction to Modeling Strategic Interaction" Princeton University Press, Second Edition, 2009.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110104063
2. https://www.coursera.org/learn/game-theory-1

WEB RESOURCES:

1. https://plato.stanford.edu/entries/game-theory/
2. https://www.gametheory.net/
3. https://ocw.mit.edu/courses/sloan-school-of-management/
4. http://www.gametheoryexplorer.org/

Course Code	Course Title	L	T	P	S	C
22CA102016	**BIG DATA PROGRAMMING**	2	-	2	-	3

Pre-Requisite Java Programming/Python Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. UUnderstand the fundamentals of Big cloud and data architectures.

CO2. Analyze methods of loading voluminous data into Big Data framework using Flume and Sqoop

CO3. Demonstrate the functions of Map Reduce Framework on any huge amount of Data

CO4. Apply Ecosystem tools for querying structured and unstructured Data.

CO5. Manage Data using HBase Framework.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(06 Periods)***

Introduction to Big Data - Challenges of Conventional Systems - Nature of Data - Small data - Medium data -Big Data - Small data vs Big data - Sources of Big Data - Big Data Characteristics - Big Data Analytics - Importance of Big Data, Big Data in the Enterprise - Big Data Enterprise Model - Building a Big Data Platform - Big data in Social and Behavioral sciences

Module 2: HDFS, HADOOP AND HADOOP INFRASTRUCTURE ***(06 Periods)***

Hadoop and Databases - Typical Datacenter Architecture - Adding Hadoop to the Mix - Key Benefit -· Flexibility: Complex Data Processing - HDFS - Hadoop Infrastructure - Architecture - Different in Data Model and Computing Model - HDFS Files and Blocks, Components of HDFS - Hadoop framework - HDFS - Map Reduce Framework - Data Loading techniques - Hadoop Cluster Architecture - Hadoop Configuration files - Hadoop Cluster modes - Single Node - Multi Node - Fully distributed node.

Module 3: HADOOP MAP REDUCE FRAMEWORK ***(06 Periods)***

Relationship between Map Reduce and HDFS - Relationship between Map Reduce and HDFS - Clients, Data Nodes, and HDFS Storage - Map Reduce workloads. Hadoop framework - Hadoop data types - Hadoop map reduce Paradigm - Map and Reduce Tasks - Map reduce Execution framework - Practitioners and Combiners - Input formats (Input Splits and Records, Text Input, Binary Input, Multiple Inputs)- Output Formats (Text Output, Binary Output, Multiple Output)- Hadoop Map reduce programming - Advanced Map reduce concepts - Counters, Custom Writable - Unit testing framework - Error Handling - Tuning - Advanced Map reduce.

Module 4: HADOOP IMPLEMENTATION AND HADOOP ECO SYSTEM TOOLS ***(06 Periods)***

Hadoop Implementation - · Job Execution - · Hadoop Data Types - · Job Configurations - · Input and Output Formats -ECO system tools - Pig's Data Model, Pig Latin, Developing & Testing Pig Latin Scripts - Writing Evaluation, Filter, Load & Store Functions - Hive - Hive Architecture - Comparison with Traditional Database - HiveQL: Data Types, Operators and Functions - Hive Tables - Querying Data - Advance Hive, NoSQL Databases - HBase - Loading Data in Hbase - Querying Data in Hbase

Module 5: HADOOP PROJECT ENVIRONMENT ***(06 Periods)***

HBase: Introduction to HBase, Client API's and their features, Available Client, HBase Architecture, Map Reduce -Integration. HBase: Advanced Usage, Schema Design, Advance Indexing, Coprocessors, Hadoop 2.0 -MRv2 - YARN - Name Node High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN, Upgrade your existing MRv1 code to MRv2, Programming in YARN framework-cover Apache Oozie Workflow Scheduler for Hadoop

Total Periods: 30

EXPERIENTIAL LEARNING

1. InstallationofSingle Node HadoopClusteronUbuntu
2. HadoopProgramming:WordCountMapReduceProgramUsingEclipse
3. ImplentingMatrixMultiplicationUsingOneMap-ReduceStep.
4. ImplementingRelationalAlgorithmonPig.
5. ImplementingdatabaseoperationsonHive.
6. ImplementingBloomFilterusingMap-Reduce
7. ImplementingFrequentItemsetalgorithmusingMap-Reduce.
8. ImplementingClusteringalgorithmusingMap-Reduce
9. ImplementingPageRankalgorithmusingMap-Reduce

RESOURCES

TEXT BOOKS:

1. WA Gmob, "Big Data and Hadoop", Kindle Edition, 2013
2. Strata, "Big Data Now", O'Reily Media Inc., Kindle Edition, 2012.
3. Eric Miller, "A Overview of Map Reduce and its impact on Distributed Data", Kindle Edition, 2012.

REFERENCE BOOKS:

1. BartBaesens,"AnalyticsinaBigDataWorld:TheEssentialGuidetoDataScienceand itsApplications," WileyPublications,2014.
2. Paul Zikopoulos, IBM, Chris Eaton and Paul Zikopoulos "Understanding Big Data:AnalyticsforEnterpriseClassHadoopandstreamingData,"TheMcGraw-HillCompanies,2012.

SOFTWARE/TOOLS:

1. **Jdk tool**

VIDEO LECTURES:

1. https://youtu.be/nnnloKX5r84
2. https://youtu.be/g_x4D2V1MP4
3. https://youtu.be/4ClrUJr0G30
4. https://youtu.be/icCA1RNDFKs

WEB RESOURCES:

1. https://www.simplilearn.com/introduction-to-big-data-and-hadoop-tutorial
2. https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html
3. https://www.developer.com/java/understanding-mapreduce-types-and-formats.html
4. https://prismoskills.appspot.com/lessons/System_Design_and_Big_Data/Chapter_01-_Hadoop.jsp
5. https://www.simplilearn.com/introduction-to-zookeeper-tutorial
6. https://www.simplilearn.com/introduction-to-big-data-and-hadoop-tutorial
7. https://www.simplilearn.com/introduction-to-big-data-and-hadoop-tutorial
8. https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html
9. https://www.developer.com/java/understanding-mapreduce-types-and-formats.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101014	MACHINE LEARNING	3	-	-	-	3

Pre-Requisite --Data Warehousing and Data Mining

Anti-Requisite --

Co-Requisite --

COURSEDESCRIPTION:

Concept learning, General to specific ordering, Decision tree learning, Support vector machine, Artificial neural networks, Multilayer neural networks, Bayesian learning, Instance based learning, reinforcement learning.

COURSEOUTCOMES:

Aftersuccessfulcompletionofthiscourse,thestudentwillbeableto:

CO1. Analyze the concept learning algorithms to automatically infer a general description for a given learning problem.

CO2. Analyze the underlying mathematical models within machine learning algorithms and learning tasks.

CO3. Evaluate and apply suitable machine learning algorithms for various types of learning tasks.

CO4. Design efficient neural architectures to model patterns for a given learning problem.

CO5. Select and apply machine learning algorithms to solve societal problems such as face recognition, text classification.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2												3	
CO2	2	3												3	

CO3	2	3	2	1										3	
CO4	3	3	3	1										3	
CO5	2	3	2			2								3	

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT:

UNIT–I: CONCEPT LEARNING AND GENERAL-TO-SPECIFIC ORDERING

(9 periods)

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning, Concept learning task, Concept learning as search, FIND-S, Version spaces and candidate elimination algorithm, Inductive bias.

UNIT–II: DECISION TREE LEARNING AND KERNEL MACHINES (9 periods)

Decision Tree Learning: Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesis space search, Inductive bias in decision tree learning, Issues in decision tree learning.

Kernel Machines: Support vector machines – SVMs for regression, SVMs for classification, Choosing C, A probabilistic interpretation of SVMs.

UNIT–III: ARTIFICIAL NEURAL NETWORKS (9 periods)

Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Convergence and local minima, Representational power of feedforward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion, An Example - Face Recognition.

UNIT–IV: BAYESIAN LEARNING (10 periods)

Bayes theorem and concept learning, Maximum likelihood and least-squared error hypothesis, Maximum likelihood hypotheses for predicting probabilities, Minimum Description Length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, An Example – Learning to classify text; Bayesian belief networks, EM Algorithm.

UNIT–V: INSTANCE BASED LEARNING AND REINFORCEMENT LEARNING

(8 periods)

Instance Based Learning: k-Nearest Neighbor learning, Locally weighted regression, Radial basis functions, Case-based reasoning.

Reinforcement Learning: The learning task, Q-learning, Nondeterministic rewards and actions, Temporal difference learning, Generalizing from examples, Relationship to dynamic programming.

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Implement Simple and Multiple Linear Regression Models
2. Implement Naïve Bayes Classification in Python
3. Write a python program to implement K-Means clustering Algorithm.

RESOURCES

TEXT BOOKS:

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 2013.
2. Kevin P. Murphy, *Machine Learning*: *A Probabilistic Perspective*, MIT Press, 2012.

REFERENCE BOOKS:

1. EthemAlpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
2. Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms,* Cambridge University Press, 2014.

VIDEO LECTURES:

1. https://swayam.gov.in/nd1_noc19_cs52/preview
2. https://www.udemy.com/course/machinelearning/

WEB RESOURCES:

1. https://www.tensorflow.org/resources/learn-ml
2. https://sgfin.github.io/learning-resources/

(22CA101015) CLOUD COMPUTING

L	T	P	S	C
3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Virtualization, Cloud Computing Fundamentals, Deployment Models; Cloud Computing Architecture; Cloud Computing Mechanisms; Cloud Security; Working with Clouds; and Case Studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the importance of virtualization and how this has enabled the development of Cloud Computing.

CO2. Analyze the cloud computing models, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Implement different types of Virtualization technologies and Service Oriented Architecture systems

CO4. Apply modern technologies & tools of Cloud Computing in solving resource sharing problems in industry.

CO5. Identify security and privacy issues in cloud computing.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	1	3	2	-	2	-	2	-	-	-	-	2	3	-	3
CO3	-	2	3	2	1	-	-	-	-	-	2	-	3	-	2
CO4	1	2	3	2	-	-	-	2	-	-	-	-	3	2	-
CO5	-	-	-	-	-	2	2	-	-	-	3	-	-	-	3
Course	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	1	**3**

Correlation Mapping															

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO VIRTUALIZATION (07 Periods)

Virtualization: Introduction to Virtualization, objectives of virtualization, benefits of virtualized technology, Adding guest Operating system.

Virtualization Technologies: Ubuntu, VMware, Microsoft Hyper-V.

Module 2: DEFINING CLOUD COMPUTING (10 Periods)

Defining Cloud Computing: Defining Cloud Computing, Cloud Types - The NIST model, The Cloud Cube Model, Deployment models, Service models, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the Role of Open Standards.

Understanding Cloud Architecture: Exploring the Cloud Computing Stack, Compos ability, Infrastructure, Platforms, Connecting to the Cloud.

Module 3 UNDERSTANDING SERVICES AND APPLICATIONS (10 Periods)

Understanding Services And Applications By Type : Defining Infrastructure as a Service (IaaS), IaaS workloads, Pods, aggregation, and silos, Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), SaaS characteristics.

Understanding Abstraction and Virtualization: Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Virtual machine types, VMware vSphere,

Module 4 EXPLORING PLATFORM AS A SERVICE (10 Periods)

Using Amazon Web Services: Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2), Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2.

Managing the Cloud: Administrating the Clouds, Management responsibilities, Lifecycle management, Emerging Cloud Management Standards, DMTF cloud management standards, Cloud Commons and SMI.

Module 5 Understanding Cloud Security (8 Periods)

Understanding Cloud Security: Securing the Cloud, The security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance, Establishing Identity and Presence, Identity protocol standards, Windows Azure identity standards, Presence.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Compare Cloud Delivery Models.
2. Compare Cloud Deployment Models
3. Impact of cloud computing on real world environment.

RESOURCES

TEXT BOOKS:

1. Barrie Sosinsky, *"Cloud Computing Bible,"* Wiley India Pvt Ltd, 1st Edition, 2011.
2. Ivanka Menken Ivanka Menken, *"Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book",* Emereo Publishing, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Anthony T. Velte, Toby J. Velte Robert Elsenpeter, *"Cloud Computing: A practical Approach"*, Tata Mc Graw Hill, ISBN: 9780071626941, 1st Edition, 2010.
2. John W. Rittinghouse, James F. Ransome, *"Cloud Computing implementation, Management and Security"*, CRC Press, ISBN: 9788120341609, Taylor & Francis group, 1st Edition 2010.
3. George Reese, *"Cloud Application Architectures",* Oreilly publishers, 1st Edition, 2010.
4. David S. Linthicum, *"Cloud Computing and SOA Convergence in your Enterprise",* Addison- Wesley, 1st Edition, 2010.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

2.https://www.coursera.org/specializations/cloud-computing

3.https://www.udemy.com/course/introduction-to-cloud-computing-on-amazon-aws-for-beginners/

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

2. htpps:// trailhead.salesforce.com/en/home
3. https://mkyong.com/tutorials/google-App- engine-tutorial/
4. https://www.awsacademy.com

(22CA102017) MS AZURE ADMINISTRATION

L	T	P	S	C
2	-	2	-	3

Pre-Requisite Cloud Computing

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Azure AD objects, access control, Azure subscriptions and governance, Configure access to storage, Azure storage accounts, Azure files and Azure blob storage, Create and configure Virtual Machines, Containers, Monitoring and backup resources.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the concepts of Azure identities and governance in the maintenance of users and their roles.

CO2. Analyze the problems to implement and manage storage.

CO3. Design & Deploy Azure compute resources.

CO4. Apply techniques to configure and manage virtual networking.

CO5. Implement backup and recovery techniques in MS Azure.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	3	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	2	-	2	-	2	-	-	-	-	2	3	-	3
CO3	3	2	3	2	1	-	-	-	-	-	2	-	3	3	2
CO4	2	2	3	2	-	-	-	2	-	-	-	-	3	2	-
CO5	-	-	-	3	3	2	2	-	-	-	3	-	-	-	3
Course Correlation Mapping	3	2	2	3	1	1	1	1	-	-	1	1	3	1	3

Correlation Levels: **3: High; 2: Medium; 1: Low**

COURSE CONTENT

Module 1: MANAGE AZURE IDENTITIES AND GOVERNANCE (06 Periods)

Manage Azure AD objects: Create users and groups, Manage licenses in Azure AD, Create administrative units, Manage user and group properties, Manage device settings and device identity, Perform bulk updates, Manage guest accounts, Configure self-service password reset.

Manage access control: Create custom role-based access control (RBAC) and Azure AD roles, Provide access to Azure resources by assigning roles at different scopes, Interpret access assignments.

Manage Azure subscriptions and governance: Configure and manage Azure policy, Configure resource locks, Apply and manage tags on resources, Manage resource groups, Manage subscriptions, Manage costs by using alerts, budgets, and recommendations, Configure management groups.

Module 2: IMPLEMENT AND MANAGE STORAGE (06 Periods)

Configure access to storage: Configure network access to storage accounts, Create and configure storage accounts, Generate shared access signature tokens, Configure stored access policies, Manage access keys, Configure Azure AD Authentication for a storage account, Configure storage encryption.

Manage data in Azure storage accounts: Create import and export jobs, Manage data by using Azure Storage Explorer and AzCopy, Implement Azure Storage redundancy, Configure object replication.

Configure Azure files and Azure blob storage: Create an Azure file share, Configure Azure Blob Storage, Configure storage tiers, Configure blob lifecycle management.

Module 3 DEPLOY AND MANAGE AZURE COMPUTE RESOURCES (06 Periods)

Automate deployment of resources by using templates: Modify an ARM template, Deploy a template, Save a deployment as an ARM template, Deploy virtual machine (VM) extensions.

Create and configure VMs: Create a VM, Manage images by using the Azure Compute Gallery, Configure Azure Disk Encryption, Move VMs from one resource group to another, Manage VM sizes, Add data disks, Configure VM network settings, Configure VM availability options, Deploy and configure VM scale sets.

Create and configure containers: Configure sizing and scaling for Azure Container Instances, Configure container groups for Azure Container Instances, Create and configure Azure Container Apps, Configure storage for Azure Kubernetes Service (AKS), Configure scaling for AKS, Configure network connections for AKS, Upgrade an AKS cluster.

Create and configure an Azure App Service: Create an App Service plan, Configure scaling settings in an App Service plan, Create an App Service, Secure an App Service, Configure custom domain names, Configure backup for an App Service, Configure networking settings, Configure deployment settings.

Module 4 CONFIGURE AND MANAGE VIRTUAL NETWORKING (06 Periods)

Configure virtual networks: Create and configure virtual networks and subnets, Create and configure virtual network peering, Configure private and public IP addresses, Configure user-defined network routes, Configure Azure DNS.
Configure secure access to virtual networks: Create and configure network security groups (NSGs) and application security groups (ASGs), Evaluate effective security rules, Implement Azure Bastion, Configure service endpoints, Configure private endpoints.
Configure load balancing: Configure Azure Application Gateway, Configure an internal or public load balancer, Troubleshoot load balancing.
Monitor virtual networking: Monitor on-premises connectivity, Configure and use Azure Monitor for Networks, Use Azure Network Watcher, Troubleshoot external networking, Troubleshoot virtual network connectivity.

Module 5 MONITOR AND MAINTAIN AZURE RESOURCES (06 Periods)

Monitor resources by using Azure Monitor: Configure and interpret metrics, Configure Azure Monitor Logs, Query and analyze logs, Set up alerts and actions, Configure monitoring of VMs, storage accounts, and networks by using VM insights.
Implement backup and recovery : Create an Azure Recovery Services vault, Create an Azure Backup vault, Create and configure backup policy, Perform backup and restore operations by using Azure Backup, Configure Azure Site Recovery for Azure resources, Perform failover to a secondary region by using Azure Site Recovery, Configure and review backup reports.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Manage_Azure_AD_Identities
2. Manage_Subscriptions_and_RBAC
3. Manage_Governance_via_Azure_Policy
4. Manage_Azure_Resources_by_Using_ARM_Templates
5. Implement_Virtual_Networking
6. Implement_Intersite_Connectivity
7. Implement_Network_Traffic_Management
8. Manage_Azure_Storage

9. Manage_Virtual_Machines

10. Implement_Data_Protection

RESOURCES

TEXT BOOKS:

1. Harshul Patel, Michael Washam, Jonathan Tuliani and Scott Hoag, "*Microsoft Azure Administrator,"*Microsoft Press, 1st Edition, 2021.
2. Jim Cheshire, "*Microsoft Azure Fundamentals*," Microsoft Press, 2nd Edition, 2020.

REFERENCE BOOKS:

1. IT Specialist, "*Hands-On Labs Based on Real World Case Studies: AZ-104: The Complete Beginner's Guide to Mastering Microsoft Azure Services," Microsoft, 1st* Edition, 2021.
2. Henry Stromm, "*Learn Microsoft Azure for Beginners,"*Kindle, 2020.
3. Timothy L. Warner, "*Microsoft Azure ForDummie," For Dummies,* 1st Edition, 2020.

VIDEO LECTURES:

1. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/introduction-to-data-engineering-using-azure/
2. https://www.coursera.org/specializations/microsoft-azure-fundamentals-az-900
3. https://www.udemy.com/course/microsoft-certified-azure-administrator/

WEB RESOURCES:

1. https://github.com/MicrosoftLearning/AZ-104-MicrosoftAzureAdministrator/blob/master/Instructions/Labs

2. https://learn.microsoft.com/en-us/training/modules/configure-azure-active - directory/

3. https://learn.microsoft.com/en-us/training/modules/configure-user-group-accounts/

4. https://www.edusum.com/microsoft/az-104-microsoft-azure-administrator

(22CA102018) CLOUD PRACTITIONER

L	T	P	S	C
2	-	2	-	3

Pre-Requisite - Cloud Computing

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

A Course provides a detailed discussion on Fundamental of Cloud and AWS Environment. Able to work with AWS Resources along with various services of core computing, Database, and Networking of AWS adopting EC2 Pricing Models. A course also covers to Automate AWS Workloads with the Imperative Approach and the Declarative Approach with launch Configurations and Launch Templates, Auto Scaling Groups, Scaling Actions and Configuration Management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO6. Understand the concepts of Cloud and AWS Environment, Cloud Architectures to work with AWS in Virtual Private Cloud.

CO7. Apply AWS resources to work with AWS Management Console for AWS Console Mobile Application.

CO8. Analyze core compute services,EC2 pricing models, core storage and database services for AWS Implementation.

CO9. Identify and use core networking services for automating AWS Workload with AWS CLI, EC2 in cloud.

CO10 Work independently or in team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO4	2	3	3	-	3	-	-	-	-	-	-	-	-	3	3

CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**-**	**-**	**3**	**3**
Course Correlation Mapping	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**3**	**-**	**-**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: FUNDAMENTAL OF CLOUD AND AWS ENVIRONMENT (06 Periods)

Fundamental of Cloud: Concepts of Cloud Computing, Highly Available and Scalable Resources, Professionally Secured Infrastructure, Metered Payment Model.

AWS Environment: AWS Regions, Regionally Based Services, Globally Based Services, Service Endpoint, Availability Zones, Availability Zone Designations, Availability Zone Networking, Availability Zones and High Availability, Edge Locations, Edge Locations and CloudFront, Regional Edge Cache Locations, The AWS Shared Responsibility Model, Managed Resources, Unmanaged Resources, Service Health Status, AWS Acceptable Use Policy.

Module 2: WORKING WITH AWS RESOURCES (06 Periods)

Working with AWS Resources: The AWS Management Console, Accessing the AWS Management Console, Opening a Service Console, Working with Shortcuts, Selecting a Region, The Account Name Menu, Resource Groups, Tag Editor, Tagging Strategies, The AWS Console Mobile Application, The AWS Command Line Interface, Requirements, Installation, Software Development Kits, Mobile Software Development Kits, Internet of Things Device Software Development Kits , CloudWatch, CloudWatch Metrics. CloudWatch Alarms, CloudWatch Dashboards, CloudWatch Logs, CloudWatch Events, API and Non-API Events, Management and Data Events, Event History, Trails, Log File Integrity Validation.

Module 3 THE CORE COMPUTE SERVICES AND EC2 PRICING MODELS (06 Periods)

The Core Compute Services: Deploying Amazon Elastic Compute Cloud Servers, Amazon Machine Images, EC2 Instance Types, Server Storage: Elastic Block Store and Instance, Store Volumes.

EC2 Pricing Models: Simplified Deployments through managed Services, Amazon Lightsail, AWS Elastic Beanstalk, Deploying Container and Serverless Workloads, Containers, Serverless Functions.

Module 4 THE CORE STORAGE SERVICES (06 Periods)

The Core Storage Services: Simple Storage Service, Objects and Buckets,S3 Storage Classes, Access Permissions, Encryption, Object Life Cycle Configurations, S3 Glacier, Archives and Vaults, Retrieval Options, AWS Storage Gateway, File Gateways, Volume Gateways, Tape Gateways, AWS Snowball, Hardware Specifications, Security, Snowball Edge.

Module 5 THE CORE DATABASE SERVICES (06 Periods)

The Core Database Services: Database Models, Relational Databases, Structured Query Language, Non-relational (No-SQL) Databases, Amazon Relational Database Service, Database Engines Licensing, Instance Classes, Scaling Vertically, Storage, Scaling Horizontally with Read Replicas, High Availability with Multi-AZ, Backup and Recovery, Determining Your Recovery Point Objective, DynamoDB, Items and Tables, Scaling Horizontally.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Amazon User Account Creation by access URL with account number. Add Security credentials with Enabling Multi-Factor Authentication to Secure Your Access.

2. Create an EC2 instance and invoke Ubuntu operating system with a set of configuration on amazon web services under IaaS.

3. Create New Amazon Elastic Block Store (Amazon EBS) EBS Volume to EC2 Instance for provides persistent block storage volumes for use with Amazon EC2 instances in the AWS Cloud.

4. Creating Amazon Machine Image (AMI) for provides the information required to launch an instance, which is a virtual server in the cloud.

5. Create your First EC2 windows instance

6. Assign Elastic IP Addresses to Instance (Static IP Address)

7. Amazon Elastic File System: Amazon Elastic File System (Amazon EFS) provides simple, scalable file storage for use with Amazon EC2. With Amazon EFS, storage capacity is elastic, growing and shrinking automatically as to add and remove files, to applications to store as they require, when they need it.

8. Create AWS S3 Bucket – (Object Storage) Amazon Simple Storage Service (Amazon S3) which is storage for the Internet. Use Amazon S3 to store and retrieve any amount of data at any time, from anywhere on the web.

i) AWS S3 Lifecycle Management

ii) S3 Bucket Replication to Cross-Region

iii) S3 Bucket Policies to control Access

RESOURCES

TEXT BOOKS:

1. Ben Piper and David Clinton "AWS Certified Cloud Practitioner," John Wiley & Sons, Inc., ISBN: 978-1-119-49070-8,2019.

2. Cloud Practitioner (CLF-C01) Cert Guide, 1/E by Anthony Sequeira, PEARSON INDIA

3. AWS Certified Cloud Practitioner by Neville Dawson, Dilaber Consulting Ltd

REFREFERENCE BOOKS:

1. Dennis Hutten "AWS: The Beginners Guide to Amazon Web Services",ASIN : B0757XM97V,2017.

2. Gordon Wong, "AWS Basics: Beginner's Guide," Createspace Independent Pub, ISBN: 978-1542885751, February 2017.

3. Aurobindo Sarkar and Amit Shah, "Learning AWS," ISBN:978-1784394639, Packt Publishing,2015

4. Bernard Golden, "Amazon Web Services for Dummies, ISBN:: 978-1118571835,Dummies; 1st edition,2013.

5. Andreas Wittig and Michael Wittig "Amazon Web Services in Action", Manning; 2nd edition, 2018.

SOFTWARE/TOOLS:

1. Amazon EC2
2. Amazon S3
3. Amazon DynamoDB
4. AWS Aurora

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=SOTamWNgDKc
2. https://www.youtube.com/watch?v=3hLmDS179YE
3. https://www.youtube.com/watch?v=XjPUyGKRjZs

WEB RESOURCES:

1. https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2
2. https://aws.amazon.com/training/digital/aws-cloud-practitioner-essentials/

(**22CA101016**) **CRYPTOGRAPHY**

L	**T**	**P**	**S**	**C**
3	-	-	-	3

Pre-Requisite **Computer Networks**

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Cryptographic protocols; Encryption techniques for confidentiality; Mathematics of symmetric and asymmetric algorithms; Hash functions for integrity; digital signature schemes.

COURSE OUTCOMES:*After successful completion of this course, the students will be able to:*

CO1. Apply cryptographic protocols to ensure authentication in network systems.

CO2. Analyze the efficiency of cryptographic techniques based on security attacks.

CO3. Choose suitable key management scheme for efficient key exchange between the authenticated parties.

CO4. Implement algorithms using information, complexity, and number theories for ensuring the security requirements-CIA.

CO5. Evaluate Message Digest and Secure Hash Algorithms using hash functions for data Integrity.

CO6. Analyze well known digital signature algorithms for securing communication.

CO-PO and PSO Mapping Table:

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO 1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-		-	-	-	-	-	-	-	-	-	3
CO2	1	3	1	-	1	-	-	-	-	-	-	-	-	-	3
CO3	3	3	1	-		-	-	-	-	-	-	-	-	-	3
CO4	2	2	3	1	1	-	-	-	-	-	-	-	-	-	1
CO5	2	2	3	1	1	-	-	-	-	-	-	--	-	-	2
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	2.3	2.6	2	1	1	-	-	-	-	-	-	-	-	-	2.5

Level of correlation of the course	3	3	2	1	1	-	-	-	-	-	-	-	-	-	3

Correlation Level: 3 - High 2 - Medium 1 - Low

DETAILED SYLLABUS:

UNIT I – FOUNDATIONS OF CRYPTOGRAPHY (09Periods)

FOUNDATIONS OF CRYPTOGRAPHY: Steganography, Substitution ciphers and Transposition Ciphers, One Time Pads.

Protocol Building Blocks: Introduction to protocols, communications using symmetric Cryptography, One-Way Hash Functions, Communications Using Public-Key Cryptography, Digital Signatures with Encryption.

UNIT II-CRYPTOGRAPHIC TECHNIQUES (09 Periods)

CRYPTOGRAPHIC TECHNIQUES: Key Management, Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mode, Counter Mode, Choosing a Cipher Mode, Interleaving, Block Ciphers versus Stream Ciphers.

UNIT III-MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS (11 Periods)

MATHEMATICS FOR CRYPTOGRAPHIC ALGORITHMS: Mathematical background: Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard (DES), DES decryption, Security of DES, Public Key Algorithms: RSA.

UNIT IV-HASH FUNCTIONS (08 Periods)

HASH FUNCTIONS: One Way Hash Functions, MD4, MD5, Secure Hash Algorithm (SHA), Security of SHA, Message Authentication Codes (MAC).

UNIT V-DIGITAL SIGNATURES (08 Periods)

DIGITAL SIGNATURES: Digital Signature Algorithm (DSA),Security of DSA, Discrete Logarithm Signature Schemes, Diffie-Hellman Key exchange.

Total Periods 45

EXPERENTIAL LEARNING:

1. Implement the following Poly-alphabetic Ciphers and analyze its attack resiliency.
   a. Hill cipher b. Vigenere
2. Implement the following block cipher modes and analyze the role of Initialization Vector(IV)
   a. counter mode b. Output Feedback mode
3. Implement a stream cipher algorithm with running key generator.

TEXTBOOKS:

1. Bruce Schneier, "*Applied Cryptography: Protocols, Algorithms and Source Code in C*", John Wiley and Sons, New York, 2009.

REFERENCE BOOKS:

1. Alfred J Menezes, Paul C van Oorschot and Scott A.Vanstone, "*Handbook of Applied Cryptography*", CRC Press, New York, 2010.

2. Wenbo Mao, "*Modern Cryptography Theory and Practice*", Pearson Education, 2004

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs03/preview
2. https://www.coursera.org/specializations/applied-crypto
3. https://www.udemy.com/course/du-cryptography/

WEB RESOURCES:

1. https://www.udacity.com/course/applied-cryptography--cs387
2. https://www.classcentral.com/course/udacity-applied-cryptography-326
3. https://www.classcentral.com/course/udacity-applied-cryptography-326
4. https://wiki.openssl.org/index.php/Command_Line_Utilities
5. https://www.sslshopper.com/article-most-common-openssl-commands.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101017	CYBER SECURITY	3	-	-	-	3

Pre-Requisite -- **Computer Networks**

Anti-Requisite --

Co-Requisite --

COURSEDESCRIPTION:

Cybercrime, Cyber offenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and organizational implications.

COURSEOUTCOMES:

After successfulcompletionofthiscourse,thestudentwillbeableto:

CO1. Analyze the methods of cybercrime, information security, cyber criminals.

CO2. Illustrate the Cyber offenses, Categories of cybercrime and how criminals plan the attacks.

CO3. Investigate tools used for cybercrime to protect computational assets

CO4. Illustrate the concepts ofCyberforensics, Digital Forensics Science, Digital Evidence, Collecting Electronic Evidence, Network Forensics.

CO5. Study the IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-	3

Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT:

Module 1–CYBERCRIME (09periods)

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Global perspective on cybercrimes

Module 2–CYBEROFFENSES AND ATTACKS (09periods)

Cyber offenses: Categories of cybercrime, How criminals plan the attacks, Social engineering,Cyberstalking, Cybercafe and cybercrimes, Botnets, Attack vector

Phishing and Identity Theft: Introduction**,** Phishing**,** Identity Theft (ID Theft)

Module 3–TOOLS AND METHODS USED IN CYBERCRIME (09periods)

Proxy servers and anonymizers, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

Module 4-Computer Forensics (09periods)

Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Digital Forensics Life Cycle - The Digital Forensics Process, The Phases in Computer Forensics/Digital Forensics, Precautions to be Taken when Collecting Electronic Evidence, Network Forensics.

Module 5- Organizational Implications (09periods)

Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations, Forensics best practices for organizations.

TotalPeriods:45

Experiential Learning:

1. Steps to attack a victim computer by using "ProRat" trojan tool
2. Perform the packet sniffing mechanism by download the “wireshark” tool and extract the packets
3. Perform the task of creating mail messages by using fake mail id by using the "fake mailer" website (https://emkei.cz)

RESOURCES

TEXTBOOKS:

1. Nina Godbole, SunitBelapure, Cyber Security: Understanding Cyber Crimes,

Computer Forensics and Legal Perspectives, Wiley.

REFERENCEBOOKS:

1. Nilakshi Jain, Ramesh Menon, Cyber Security and Cyber Laws, Wiley, 2020.

2. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short,

CybersecurityEssentials, 1st Edition, Sybex, 2018.

3. ErdalOzkaya, Cybersecurity: The Beginner's Guide, 1st Edition, Packt

Publishing,2019.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. https://www.coursera.org/learn/foundations-of-cybersecurity

WEB RESOURCES:

1. Yuri Diogenes, ErdalOzkaya, Cybersecurity: Attack and Defense Strategies, 2nd Edition, Packt Publishing, 2019.

2. http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf

3. Alessandro Parisi, Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing, 2019.

Course Code	Course Title	L	T	P	S	C
22CA101018	ETHICAL HACKING	3	-	-	-	3

Pre-Requisite -- **Computer Networks**

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION:

Ethical hacking, Network and computer attacks, Footprinting, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.

CO2. Select and apply footprinting and port scanning tools to discover vulnerabilities of the computer system.

CO3. Investigatehackingtechniquesandtoolstomaintaincomputersecurity.

CO4. Analyze cryptosystems and network protection systems for information securityand intrusion prevention.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	-	-	3	-	-	-	-	-	-	-	-	3	3
CO4	2	3	3	-	3	-	-	-	-	-	-	-	-	3	3
Course Correlation Mapping	3	3	3	-	3	-	-	-	3	-	3	-	-	3	3

COURSE CONTENT

UNIT-I: ETHICALHACKING,NETWORKANDCOMPUTERATTACKS (9Periods)

Introduction to Ethical Hacking: The role of security and penetration testers, Penetration-Testing methodologies, What you can and cannot do legally.

Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and

Worms,Protectionagainstmalwareattacks,Intruderattacksonnetworksandcomputers, Addressing physical security.

UNIT–II:TCP/IPCONCEPTSANDSOCIALENGINEERING (9Periods)

TCP/IP Concepts: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.

SocialEngineering: Whatissocialengineering,Whatarethecommon types ofattacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering countermeasures.

UNIT-III:FOOTPRINTINGANDPORTSCANNING (9Periods)

Footprinting: Usingwebtoolsforfootprinting,Conductingcompetitiveintelligence,Using domain name system zone transfers.

Port Scanning: Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting.

UNIT-IV:SYSTEMHACKING (9Periods)

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files, Steganographytechnologies,Howtocoveryourtracksandevidences;Sniffers-Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking - Spoofing vs.hijacking,Typesofsessionhijacking,Sequenceprediction,Stepsinperformingsession hijacking, Preventing session hijacking.

UNIT-V:CRYPTOGRAPHY,NETWORKPROTECTIONSYSTEMS (9Periods)

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.

NetworkProtectionSystems: Understanding routers, Firewalls, Honeypots.

Total Periods: 45

EXPERIENTIAL LEARNING :

1. Analyze Windows Server 2019 vulnerabilities as reported by CVE. Write a detailed report on Memory Corruption Vulnerability.
2. Conduct a vulnerability assessment on a simulated network. Identify and prioritize potential vulnerabilities. Develop a plan to remediate the vulnerabilities while considering their severity and impact.

TEXTBOOKS:

1. Michael T. Simpson, Kent Backman, James E. Corley, *Hands-On Ethical Hacking and Network Defense*, 3rdEdition, Cengage Learning, 2017.
2. KimberlyGraves,*CEH:OfficialCertifiedEthicalHackerReviewGuide*,Wiley,2007.

REFERENCEBOOK:

1. Michael Gregg, *Certified Ethical Hacker(CEH)Certguide*,3rdEdition,Pearson,20

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://www.youtube.com/watch?v=t8nwQ6At0CU&list=PL7AT7LU4byRKMBCEWpeZ4QOd2VWvdIHXU

WEB RESOURCES:

1. https://snyk.io/ethical-hacking-resources/
2. https://www.hackerone.com/ethical-hacker/useful-online-resources-new-hackers
3. https://hackernoon.com/top-resources-to-learn-ethical-hacking

Course Code	Course Title	L	T	P	S	C
22CA102019	**OBJECT ORIENTED SYSTEM DESIGN**	2	-	2	-	3

Pre-Requisite Software Engineering

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Introduction to object oriented concepts, methods, models, Conceptual Model of UML, Architecture , S/W Development Life Cycle, UML Diagrams, Analysis process, Design process.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the object-oriented concepts and modelling.
CO2. Design the architecture and defining class objects for the system.
CO3. Design the various diagrams for representation of system.
CO4. Analyzing the constructed system by using various SDLC approaches.
CO5. Designing various system process component models.
CO6. WorkindependentlyorinteamstosolveproblemswitheffectiveCommunication.

CO-PO-PSO Mapping Table

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO9**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	-	-	-	**-**	**-**	3
CO2	1	3	3	3	3	-	-	-	-	2
CO3	1	3	3	3	3	-	-	-	-	3
CO4	1	3	3	-	-	-	-	**-**	**-**	3
CO5	-	3	-	3	-	2	-	-	-	-
CO6	-	-	-	-	-	-	3			
Average	**2**	**3**	**3**	**3**	**3**	**-**	3	**-**	**-**	**2.6**
Levelof Correlation of thecourse	**2**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	-	**3**

3- High mapping **2-Medium Mapping** **1- Low Mapping**

Detailed Syllabus:

UNIT-I:Object Oriented Concepts and Modeling (6Periods)

What is Object Orientation? (Introduction to class, Object, inheritance, polymorphism)
Model : Importance of Modeling, Object Oriented Modeling
Object oriented system development: Function/data methods,Object oriented analysis, Object oriented construction, Object oriented testing
Identifying the elements of an object model: Identifying classes and objects ,Specifying the attributes, Defining operations ,Finalizing the object definition.

UNIT-II: Introduction to UML, Basic and Advanced Structural Modeling (6 Periods)

Introduction to UML: Overview of UML, Conceptual Model of UML, Architecture , S/W Development Life Cycle.
Basic and Advanced Structural Modeling: Classes Relationship, Common mechanism, Diagrams, Class diagram ,Advanced classes, Advanced Relationship, Interface, Types and Roles, Packages, Object Diagram

UNIT-III: Basic Behavioral Modeling and Architectural Modeling (6 periods)

Use cases, Use Case Diagram, Interaction Diagram,Sequence Diagram, Activity Diagram,State Chart Diagram,Collaboration Diagram,Components Diagram and Deployment Diagram

UNIT-IV: Object Oriented Analysis (6 Periods)

Iterative Development,Understanding requirements, Unified process and UP Phases: Inception,Elaboration,Construction,Transition, Agile UP

UNIT- V: Object Oriented Design (6 periods)

Generic Components of OO Design Model,System Design Process: Partitioning the Analysis Model,Concurrency and Subsystem Allocation,Task Management Component,Data Management Component,Resource Management Component,Inter Subsystem Communication,Object Design process.

Total Periods: 30

EXPERIENTIAL LEARNING:

1. Identify Use Cases and develop the Use Case model.
2. Identify the business activities and develop an UML Activity diagram.
3. Identity the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios find the interaction between objects and represent

them using UML Interaction diagrams.

5. Draw the State Chart diagram.

6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.

7. Implement the Technical services layer.

8. Implement the Domain objects layer.

9. Implement the User Interface layer.

10. Draw Component and Deployment diagrams.

11. Draw the System architecture and UML diagrams for any on the following cases

Suggested domains.

1. Library management system
2. Hospital management system
3. ATM system
4. Transport System
5. Book bank System
6. Exam Registration System
7. Stock maintenance system.
8. Online course reservation system
9. E-ticketing System
10. Credit card processing
11. e-book management system
12. Recruitment system
13. Foreign trading system
14. Conference Management System
15. BPO Management System

Resources

TEXT BOOKS:

1. Object-Oriented Systems Analysis and Design Using UML By Simon Bennett, Ray Farmer, Steve McRobb · 2010.

2. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd BrueggeandAllen H. Dutoit, 2nd Edition, Pearson Education Asia**.**

REFERENCEBOOK:

1. The Unified Modeling Language User Guide by Grady Booch, James Raumbaugh, Ivar Jacobson.

2. Object Oriented Software Engineering by Ivar Jacobson

3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/106/105/106105153/
2. https://onlinecourses.nptel.ac.in/noc19_cs48/preview
3. https://onlinecourses.nptel.ac.in/noc20_cs84/preview

WEB RESOURCES:

1. http://ndl.ethernet.edu.et/bitstream/123456789/90366/3/Revised%20OOSAD%20Module2020.pdf
2. https://online.stanford.edu/courses/cs108-object-oriented-systems-design
3. https://www.w3computing.com/systemsanalysis/object-oriented-systems-analysis-design/

Course Code	Course Title	L	T	P	S	C
22CA102020	**SOFTWARE TESTING AND AUTOMATION**	2	-	2	-	3

Pre-Requisite Software Engineering

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Black-Box Testing and White-Box Testing; Software Testing Life Cycle; Software Testing Principles; Test Cases; Bug Reporting, Advanced Testing concepts; Automated Software Testing; Automate Testing of Web Applications; Selenium;

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1: Understand the basic concepts of software testing and the need for software testing

CO2: DesignTestplanning anddifferent activitiesinvolvedintestplanning

CO3:Designeffectivetestcasesthatcanuncovercriticaldefectsintheapplication

CO4: Carryoutadvancedtypesoftesting

CO5: Automatethesoftware testing usingSelenium andTestNG

CO-PO-PSO Mapping Table

	PO 1	PO 2	PO3	PO 4	PO 5	PO 9	PO1 0	PO1 1	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	2	1	2	1	1	3	2	3	2	3
CO2	2	3	1	1	1	2	2	1	2	1	2	3
CO3	2	2	1	3	1	1	3	1	2	2	3	2
CO4	2	1	3	2	1	1	1	1	2	3	1	2
CO5	2	2	1	3	1	1	3	2	1	2	1	3
Average	2.2	2.2	1.6	2	1. 2	1. 2	2	1.6	1.8	2.2	1.8	2.6

Level of Correlation of thecourse	**2**	**3**	**2**	**2**	**2**		**-**	**-**		**-**	-	**3**

Detailed Syllabus:

UNIT-I: FOUNDATIONS OF SOFTWARE TESTING (6 Periods)

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: TESTPLANNING (6 Periods)

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: TESTDESIGNAND EXECUTION (6 Periods)

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 TESTINGCONCEPTS (6 Periods)

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: TESTAUTOMATIONAND TOOLS (6

Periods)

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.

Total Periods: 30

Experiential Learning:

1. Developthetest planfortesting ane-commerceweb/mobileapplication(www.amazon.in)
2. Designthetestcasesfortestingthee-commerce application
3. Testthee-commerceapplicationandreportthedefectsinit.
4. Developthetestplananddesignthetestcasesforaninventorycontrolsystem.
5. Executethetest cases againstaclientserverordesktopapplicationandidentifythedefects.
6. Testtheperformanceofthee-commerceapplication.
7. Automatethetestingof e-commerceapplicationsusing Selenium.
8. IntegrateTestNGwiththeabovetestautomation.
9. MiniProject:
    a. Buildadata-drivenframeworkusingSeleniumandTestNG
    b. BuildPageobjectModelusingSeleniumandTestNG
    c. BuildBDDframeworkwithSelenium,TestNGandCucumber

Resources

TEXTBOOKS

1. YogeshSingh,"SoftwareTesting",CambridgeUniversityPress,2012
2. UnmeshGundecha,SatyaAvasarala,"SeleniumWebDriver3PracticalGuide" Second Edition 2018

REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition,2012,JohnWiley& Sons,Inc.
2. RonPatton, Softwaretesting, 2ndEdition,2006,SamsPublishing
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor& FrancisGroup.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, PacktPublishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing,2009,Pearson Education,Inc.

6. SatyaAvasarala,SeleniumWebDriver PracticalGuide, 2014,PacktPublishing.
7. VarunMenon,TestNgBeginner'sGuide,2013,PacktPublishing.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs38/preview
3. https://www.coursera.org/specializations/software-testing-automation

WEB RESOURCES:

1. https://online.umn.edu/software-testing-and-automation
2. https://shiftasia.com/column/software-testing-automation-and-the-misconceptions/
3. https://link.springer.com/book/10.1007/978-3-031-22057-9

Course Code	Course Title	L	T	P	S	C
22CA102021	**.NET TECHNOLOGIES**	2	-	2	-	3

Pre-Requisite - Object Oriented Programming with C++

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: .NET Framework ,C# Programming; Object-oriented concepts with C#, Exception handling; Interfaces, Generics, Delegates and Events in C#; Database access with ADO.NET;ASP.NET MVC , ASP.NET Web API.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge on C# and .NET platform concepts.

CO2 Understand OOPS concepts and exception handling mechanisms.

CO3 Identify generic, event handling principles.

CO4 Apply ADO.NET concepts for data management

CO5 Design web applications with ASP.NET.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	2	-	3
CO2	3	-	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	3	3	-	3	-	-	-	-	-	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO C# AND .NET PLATFORM: ***(06 Periods)***

The Philosophy of .NET: Key Benefits of .NET platform, Building blocks of the .NET platform, Overview of .NET assemblies, Common type system, Common language specification.

Building C# Applications: Building C# applications on windows, Building .NET applications on a Non-windows OS, Anatomy of a Simple C# Program, System.Console class.

Module 2: OBJECT ORIENTED PROGRAMMING WITH C# AND EXCEPTION HANDLING: *(06 Periods)*

Object Oriented Programming with C#: C# class type, Constructors, The role of the this keyword, The static keyword, Pillars of OOP, C# access modifiers, C# encapsulation services, The basic mechanics of inheritance, The details of Inheritance.
Understanding Structured Exception Handling: The role of .NET exception handling, The simplest possible example, System-level exceptions, Application level exceptions

Module 3: INTERFACES, GENERICS AND EVENTS *(06 Periods)*

Interfaces: Understanding interface types, Defining custom interfaces, Implementing an interface.

Generics: Role of generic type parameters, Creating custom generic methods, Creating custom generic structures and classes.

Module 4: ADO.NET AND ORM ENTITY FRAMEWORK *(06 Periods)*

Definition of ADO.NET, ADO.NET data providers, ADO.NET namespaces, Connected layer of ADO.NET, Data readers,Working with Create, Update, and Delete Queries, Creating a Console-Based Client Application.

Module 5: INTRODUCING ASP.NET MVC AND INTRODUCING ASP.NET WEB API *(06 Periods)*

Introducing ASP.NET MVC: MVC Pattern, The ASP.NET MVC Application Template, Routing, Addingan application usingDAL, Controllers and Actions, The Razor View Engine, MVC Views, The Display Data Annotation, Razor Templates, Working with Forms.

Total Periods: 30

Experiential Learning:

1 Program to display the addition, subtraction, multiplication and division of two number using console application.

2 Program to display the first 10 natural numbers and their sum using console application.

3 Program to display the addition using the windows application.

4 Write a program to convert input string from lower to upper and upper to lower case.

5 Write a program to simple calculator using windows application.

6 Write a program working with Page using ASP.Net.

7 Write a program working with forms using ASP.NET.

8 Write a program to connectivity with Oracle database.

9 Write a program to access data source through ADO.NET.

10 Write a program to manage the session.

RESOURCES

TEXT BOOKS:

1. Andrew Troelsen and Philip Japikse, *Pro C# 7 With .NET and .NET Core*, Apress, 8th Edition, 2017

REFERENCE BOOKS:

1. Christian Nagel, Jay Glynn and Morgan Skinner**,** *Professional C# 5.0 and .NET 4.5.1*, WROX Publications, 1st Edition, 2014.
2. Mathew Mac Donald,The Complete Reference *ASP.NET, TATA McGraw Hill*, 1st Edition, 2010.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=kdPtNMb8tPw
2. https://www.youtube.com/watch?v=8ew1LgfWV6s

WEB RESOURCES:

1. https://www.tutorialspoint.com/dotnet_core/index.htm
2. https://www.javatpoint.com/net-framework
3. https://www.simplilearn.com/dot-net-programming-certification-training-course
4. https://www.coursera.org/courses?query=net

Program Elective

Course Code	Course Title	L	T	P	S	C
22CA102022	**WEB DESIGNING USING HTML, CSS, JAVASCRIPT**	2	-	2	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This Subject is useful for Making own Web page and how to host own web site on internet. Along with that Students will also learn about the protocols involve in internet technology.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand and apply the basic html markups in designing web pages.

CO2. Create the Dynamic web pages.

CO3. Understand and apply cascading style sheets to web pages

CO4. Identify the engineering structural design of XML and parse tree

CO5. Understand and apply the JavaScript concepts in designing web pages

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	-	-	-	-	3	-	-	3	3	-
CO2	3	3	3	3	3	-	-	-	-	3	3	3	3	3	-
CO3	3	3	2	3	3	-	-	-	-	3	-	-	3	3	-
CO4	3	3	3	3	3	-	-	-	-	3	3	3	3	3	-
CO5	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to HTML ***(06 Periods)***

Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox. HTML Common tags: List, Tables, images, forms, frames.

Module 2: Cascading Style Sheets (CSS) ***(06 Periods)***

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

Module 3: DHTML ***(06 Periods)***

Dynamic HTML, Document Object Model, Features of DHTML, CSSP (Cascading Style Sheet Positioning) and JSSS (JavaScript assisted Style Sheet), Layers of Netscape, The ID Attribute, DHTML Events.

Module 4: XML ***(06 Periods)***

XML: Introduction to XML, Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTML Parsing XML Data - DOM and SAX parsers in java

Module 5: Java Script ***(06 Periods)***

Objects, Methods, Events and Functions, Tags, Operators, Data Types, Literals and Type Casting in JavaScript, Programming Construct, Array and Dialog Boxes, Relating JavaScript to DHTML, Dynamically Changing Text, Style, Content.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Create HTML Pages contains
a) Basic text formatting Elements
b) Block and Inline Elements
2. Create Html pages Contains
a. Different Types of LISTs
b. Text Processing Tags
3. Create HTML Pages Contains links and Navigation
a. How to link between pages of your site
b. How to link to other sites
c. How to structure the folders on your website
d. How to link to specific parts of a page in your site
4. Create HTML Pages contains Table element.
5. Create HTML Pages with Form elements.
6. Apply Different types of CSS to the HTML pages.
a. Styling Text.
b. Styling LINKS.
c. Styling Backgrounds.

d. Styling Lists.
e. Styling Tables.
7. Simple XML Script with DTD.
8. Simple JavaScript Programs for the following
a. Functions.
b. Control Statements.
c. Loop Statements.
9. Handling JavaScript Events.
a. Window Events.
b. User Events (Actions performed on HTML FORM elements using Keyboard and Mouse)
10. .Sample Java Script Programs to work with BUILT-IN Objects.

RESOURCES

TEXT BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech.
2. Java Script, D.Flanagan, O'Reilly, SPD.

REFERENCE BOOKS:

1. Web Design with HTML, CSS, JavaScript and jQuery Set, Jon Duckett, Wiley Publications
2. Beginning Web Programming-Jon Duckett WROX
3. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.
4. JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley Publications

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106156
2. https://www.youtube.com/watch?v=8ew1LgfWV6s

WEB RESOURCES:

1. https://www.geeksforgeeks.org/web-technology/
2. https://www.javatpoint.com/html-tutorial
3. https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm
4. https://woz-u.com/blog/what-web-technologies-should-i-learn/

Course Code	Course Title	L	T	P	S	C
22CA102023	**WEB APPLICATIONS DEVELOPMENT USING PHP**	2	-	2	-	3

Pre-Requisite - Web Designing Using HTML, CSS, JavaScript

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand fundamentals and various paradigms of computing

CO2. Demonstrate cloud characteristics and models.

CO3. Identify the ways in which the cloud can be programmed and deployed.

CO4. Recognize the services and platform of cloud

CO5. Design different cloud services from different vendors.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	3	-	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	-	3	3	-	3	-	-	-	-	-	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: HTML: ***(06 Periods)***

Introduction: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Canvas, Forms, Frames and Multimedia.

HTML5: Introduction, HTML5 Document Structure, Creating Editable Content, Checking Spelling Mistakes, Exploring Custom Data Attributes, Client-Side Storage, Drag and Drop Feature, Offline Web Applications, Web Communications, Cross-Document Messaging and Desktop Notifications.

Module 2: CSS AND JAVASCRIPT: ***(06 Periods)***

CSS: Introduction, CSS Selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text Styles, Creating Boxes, Displaying, Positioning and Floating Elements, Features of CSS3, Media Queries.

Javascript: Overview of JavaScript, JavaScript Functions, Events, Image Maps and Animations, JavaScript Objects, Working with Browser and Document Objects, JQuery - Introduction, JQuery Selectors, Events.

Module 3: INTRODUCTION TO PHP: ***(06 Periods)***

Lexical structure, data types, variables, expressions and operators, flow control statements, embedding PHP in web pages.

Module 4: FUNCTIONS AND STRINGS: ***(06 Periods)***

FUNCTIONS: Calling a function, defining a function, variable scope, function parameters, return values.
STRINGS: quoting string constants, printing strings, cleaning strings, comparing strings, regular expressions.

Module 5: ARRAYS: ***(06 Periods)***

Indexed versus associative arrays, identifying elements in array, storing data in arrays, multi- dimentional arrays, extracting multiple values, converting between arrays and variables, traversing arrays .

Total Periods: 30

EXPERIENTIAL LEARNING:

1. Install and configure PHP, web server, MYSQL
   (a)Write a program to print "welcome to PHP".
(b)Write a simple PHP program using expressions and operators
2. Write a PHP program to demonstrate the use of decision making control structures using

(a) IF statement
(b) IF-else statement
(c) Switch statement

3. Write a PHP program to demonstrate the use of looping structures using:
   (a) While statement
   (b) Do-while statement
   (c) For statement
   (d) Foreach statement
4. Write a PHP program for creating and manipulating
   (a)Indexed array
   (b)Associative array
   (c)Multidimensional array
5. Write a PHP program to-
   a. Calculate length of string
   b. Count the number of words in string
   c. Write a simple PHP program to demonstrate use of various built-in string functions.
6. Design a web page using form controls: Text box, Radio button, Check box, Buttons
7. Design a web page using form controls: List box, Combo box, Hidden field box
8. Develop web page with data validation

RESOURCES

TEXT BOOKS:

1. Kevin tatroe&Peter Macintyre "Programming PHP", O'REILLY,4th Edition.

2. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, First Edition, 2011.Press, 2018

REFERENCE BOOKS:

1. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, First Edition, 2015. (e-book)
2. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010
3. Andrea Tarr, PHP and MySQL, Willy India, First Edition, 2012.
4. Chris Hay, Brian Prince, "Azure in Action" Manning Publications [ISBN: 9781935182481],2010.
5. Henry Li, "Introducing Windows Azure" Apress; 1 edition [ISBN: 978-14302-2469-3],2009.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=PGvrnas2_Pk
2. https://www.youtube.com/watch?v=hx38tnlYGlA

WEB RESOURCES:

1. https://www.javatpoint.com/php-tutorial
2. https://www.guru99.com/php-practical-example.html
3. https://www.geeksforgeeks.org/build-a-grocery-store-web-app-using-php-with-mysql/
4. https://www.cleart.com/php-web-application-development-php-web-development.html

Course Code	Course Title	L	T	P	S	C
22CA102024	**MULTIMEDIA SYSTEMS**	2	-	2	-	3

Pre-Requisite --Web Applications Development using PHP

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Multimedia and its applications, Global structure of Multimedia, Medium, Multimedia system and properties, Characteristics of a Multimedia system, Overview sound system, producing digital audio, Music and speech, Speech Generation, Speech Analysis, Uses of images and Graphics, Digital Video, Video signal representation, Need for Data Compression, Compression Basics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the knowledge of the basic fundamentals components of Multimedia.

CO2. To get familiar with Multimedia file formats and standards.

CO3. Understanding the video formats and types of animation.

CO4. Understand the basics of text, Image and Video compression.

CO5. Understand the various compression algorithms for multimedia content.

CO6. Work independently or in teams to solve problems with effective Communication.

CO-PO-PSO Mapping Table

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO9**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	3	3	1	3	2	3
CO2	3	3	3	3	3	3	2	3	2	3
CO3	1	3	3	3	3		-	-	-	3
CO4	3	2	2	1	1	-	-	2	2	2
CO5	3	2	2	1	2	-		2	2	2
CO6	-	-	-	-	-		2			
Average	3	3	3	2	2	3	2	2	2	2.6

Level of Correlation of the course	3	3	3	2	2	3	2	2	2	3

3- High mapping 2-Medium Mapping 1- Low Mapping

Detailed Syllabus:

MODULE 1 – INTRODUCTION TO MULTIMEDIA (6 Periods)

Multimedia and its applications, Global structure of Multimedia, Medium, Multimedia system and properties, Characteristics of a Multimedia system, Challenges for Multimedia Systems, Components of Multimedia System, Multimedia building blocks, Scope of Multimedia.

MODULE 2 – SOUND/AUDIO SYSTEM (6 Periods)

Overview sound system, Producing digital audio, Music and speech, Speech Generation, Speech Analysis, Speech Transmission, Representation of audio files, Computer Music - MIDI,MIDI versus Digital Audio.

MODULE 3 – IMAGES AND GRAPHICS (6 periods)

Uses of images and Graphics, Digital Image Representation, Image and graphics Format, Working with image and graphics, Image Synthesis, analysis and Transmission.

MODULE 4 – VIDEO AND ANIMATION (6 Periods)

Digital Video, Video signal representation, Computer Video Format, Computer- Based animation, Animation Language, Timeline and frame-based animation, Timeline and Tween-Based animation, Methods of controlling Animation, Display of Animation, Transmission of Animation

MODULE 5 – DATA COMPRESSIONS (6 periods)

Need for Data Compression, Compression Basics, Storage Space, Coding Requirements, Lossless and Lossy Compression techniques, Source, Entropy and Hybrid Coding, Lossy Sequential OCT- based Mode, Expanded Lossy OCT-based Mode, JPEG and MPEG Compression.

Total Periods: 30

EXPERIENTIAL LEARNING:

1) Create a simple painting program using Flash or equivalent.

2) Create a simple animated banner using Flash or equivalent.

3) Design an object dragging program.

4) Prepare a photo album using Flash or equivalent.

5) Create animated buttons which is used for web design using Adobe Photoshop or equivalent.

6) Design image mapping using Flash or equivalent.

7) Create image morphing using adobe Photoshop or equivalent.

8) Make animations using macromedia Flash or equivalent.

9) Create animated Gifs for use as banners, titles and buttons.

10) Create short film in Flash or equivalent using any theme.

11) To perform animation using any animation software.

12) To perform image editing using basic tool, masking effect and rendering effects using Photoshop or equivalent.

Resources

TEXT BOOKS:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications and Applications, Pearson Education Asia
2. Multimedia: Making It Work, Tay Vaughan, 7th Edition, Tata Mc-Graw Hill., 2008.
3. John F. Koegel Buford, Multimedia Systems, Pearson Education Asia.

REFERENCE BOOKS:

1. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems", Excel Publication, New Delhi, 2007.
2. Li & Drew, " Fundamentals of Multimedia" , Pearson Education, 2009.
3. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007
4. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.

VIDEO LECTURES:

1. https://www.coursera.org/lecture/internet-of-things-multimedia/multimedia-technologies-YQGDv
2. https://www.udemy.com/course/graphic-designing-course-for-special-needs-people/

WEB RESOURCES:

1. https://nptel.ac.in/courses/117105083
2. https://archive.nptel.ac.in/content/storage2/courses/117105083/pdf/ssg_m1l1.pdf

Course Code	Course Title	L	T	P	S	C
22CA102025	**GAME DESIGN AND DEVELOPMENT**	2	-	2	-	3

Pre-Requisite --Python Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components, Character Development, Storyboard Development for Gaming – Script Design, Rendering Concept, Pygame Game development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Explaining the concepts of 2D and 3d Graphics.

CO2. Design game design documents.

CO3. Implementation of gaming engines.

CO4. Survey gaming environments and frameworks.

CO5. Implement a simple game in Pygame.

CO6. Work independently or in teams to solve problems with effective Communication.

CO-PO-PSO Mapping Table

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO11**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	-	2	2	2
CO2	1	2	2	1	2	-	2	2	1
CO3	1	1	1	2	1	-	2	2	2
CO4	3	3	1	3	3	-	2	2	3
CO5	3	3	2	1	3	2	2	2	3
CO6	-	-	-	-	-	2			
Average	2.2	2.2	1.6	1.6	2.2	**2**	2	2	2.2
Level of Correlation of the course	**2**	**2**	**2**	**2**	**3**	**2**	**2**	2	**3**

3- High mapping **2-Medium Mapping** **1- Low Mapping**

Detailed Syllabus:

MODULE 1 – 3D GRAPHICS FOR GAME DESIGN (6 Periods)

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.

MODULE 2 – GAME DESIGN PRINCIPLES (6 Periods)

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.

MODULE 3 – GAME ENGINE DESIGN (6 periods)

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms –Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

MODULE 4 – OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS (6 Periods)

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, UnitySingle player and Multi-Player games

MODULE 5 – GAME DEVELOPMENT USING PYGAME (6 periods)

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 Periods: 30

EXPERIENTIAL LEARNING:

1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI.
2. Conceptualize the theme for a 2D game.
3. Character design, sprites, movement and character control
4. Level design: design of the world in the form of tiles along with interactive and collectible objects.
5. Design of interaction between the player and the world, optionally using the physics engine.
6. Developing a 2D interactive using Pygame
7. Developing a Puzzle game
8. Design of menus and user interaction in mobile platforms.
9. Developing a 3D Game using Unreal
10. Developing a Multiplayer game using unity

Resources

TEXT BOOKS:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.

REFERENCE BOOKS:

1. Paul Craven, "Python Arcade games", Apress Publishers,2016.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.
3. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC,

2011.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs77/preview
2. https://onlinecourses.nptel.ac.in/noc19_ge32/preview
3. https://archive.nptel.ac.in/courses/106/101/106101237/

WEB RESOURCES:

1. https://guides.library.unt.edu/game-design/resources
2. https://alexiamandeville.medium.com/the-game-design-resource-guide-e19bb237877

Course Code	COURSE TITLE	L	T	P	S	C
22CA102026	MACHINE LEARNING AND AI USING PYTHON	2	-	2	-	3

Pre-Requisite --Python Programming

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course helps to understand the basics of Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, machine learning in data science and various machine learning algorithms. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to work on real time problems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Architect intelligent agents using artificial intelligence techniques and principles.

CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3. Build Linear Regression models for given dataset

CO4. Implementation of clustering algorithms on data models and build recommendation System

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE ***(06 Periods)***

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2: PROBLEM SOLVING BY SEARCHING ***(06 Periods)***

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions

Module 3: LINEAR REGRESSION ***(06 Periods)***

Basic facts of linear regression, Model representation for a single variable, Cost Function, Gradient Descent for Linear Regression, Multivariate Linear Regression, Implementation of linear regression, Case studies of linear regression using data set.

Module 4: LOGISTIC REGRESSION ***(06 Periods)***

Basic facts and implementation of logistic regression, Classification, Hypothesis Representation, Decision Boundary, Cost function, Multi-classification, solve a case study to predict output using existing data set.

Module 5: DECISION TREE ***(06 Periods)***

Introduction - Constructing Decision Trees - Regression Tree and Classification Tree - Attribute Selection Measures, Entropy, Information Gain, Gini Index.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Design and implement agent programs for Table-driven agents using the agent function of vacuum-cleaner world. The agent cleans the current square if it is dirty, otherwise it moves to the other square
2. Implement agent programs for Simple reflex agents and Model-based reflex agents using the agent function of vacuum-cleaner world.
3. Solve the travelling sales man problem using Hill Climbing search algorithm.
4. Design and implement solution for 8-puzzle problem using Greedy Best First Search. 5. Find the shortest path between a starting location and destination location in a graph using A* search algorithm
5. Use python to predict employee attrition in a firm and help plan their manpower (take dataset from Kaggle)
6. Create customer clusters using different market strategies on a dataset
7. Make a movie recommendation system

RESOURCES

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4 th Edition, 2020.
2. Pradhan, Manaranjan, and U. Dinesh Kumar. Machine Learning Using Python. Wiley, 2020.
3. Jose, Jeeva. Introduction to Machine Learning. Khanna Book Publishing Co., 2020

REFERENCE BOOKS:

1. Stephen Lucci , Danny Kopec, Artificial Intelligence in the 21st Century, Mercury Learning and Information, 3rd Edition,2018.
2. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.
3. Mukhopadhyay, Sayan. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning and NLP Examples. 1st ed. edition. Apress, 2018
4. Monte F. Hancock, Jr. Practical Data Mining. 1st edition. Auerbach Publications, 2011.

SOFTWARE/TOOLS:

1. Google CoLab

2. Programming Language : Python 3.8

3. Machine Learning Library : Tensor Flow 2.1 and Keras

VIDEO LECTURES:

1. https://youtu.be/SfigNnlRyIM
2. https://youtu.be/nmWGhb9E4es
3. https://youtu.be/YwlBCZVdpmI
4. https://youtu.be/wefc_36d5mU
5. https://youtu.be/VImxF-9jk1E

WEB RESOURCES:

1. https://searchenterpriseai.techtarget.com/definition/AI
2. https://www.w3schools.com/python/python_ml_getting_started.asp
3. https://realpython.com/python-ai-neural-network/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101019	**ARTIFICIAL INTELLIGENCE**	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Architect intelligent agents using artificial intelligence techniques and principles.

CO2. Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

CO3. Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.

CO4. Investigate robot hardware and frameworks for intelligent robotic perception.

CO5. Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	1	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	1	-	2	-	-	-	-	-	-	3

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

UNIT–I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 Periods)

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

UNIT–II: PROBLEM SOLVING BY SEARCHING (09 Periods)

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

UNIT–III: SEARCH IN COMPLEX ENVIRONMENTS (09 Periods)

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

UNIT–IV: PROBABILISTIC REASONING (9 Periods)

Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

UNIT–V: ROBOTICS, ETHICS AND SAFETY IN AI (8 Periods)

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

Total Periods: 45

Experiential Learning:

1. Solve the travelling sales man problem using Hill Climbing search algorithm.
2. Design and implement solution for 8-puzzle problem using Greedy Best First Search.

RESOURCES

TEXT BOOK(S):

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4th Edition, 2020.

REFERENCE BOOKS:

1. Stephen Lucci , Danny Kopec, Artificial Intelligence in the 21st Century, Mercury Learning and Information, 3rd Edition,2018.
2. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.
3. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education, 2017.
4. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2. https://nptel.ac.in/courses/106105077

3. https://www.coursera.org/learn/introduction-to-ai

WEB RESOURCES:

1. https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence
2. http://aima.cs.berkeley.edu/
3. https://ai.google/education/
4. https://www.coursera.org/courses?query=artificial%20intelligence
5. https://www.edureka.co/blog/artificial-intelligence-with-python/

Specialization Electives

Course Code	Course Title	L	T	P	S	C
22CA101023	Introduction to Virtual Reality	3	-	-	-	3

Pre-Requisite Computer Graphics

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a discussion on Introduction to Virtual Reality, 3D Graphic Basics, Computing Architectures for VR, modelling, Huma Factors in VR.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of Virtual Reality platforms and Applications.

CO2. Analyze the 3D graphics coordinate systems, transforms and matrices.

CO3. Design the Computing Architectures for virtual Reality using Graphics Benchmarks.

CO4. Applying the Geometric Modelling, Kinematics modelling, Physcialmodelling and Behaviourmoedling.

CO5. Implement the concepts of human factors for developing the Virtual Reality applications.

CO-PO- PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	3	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Virtual Reality ***(10 Periods)***

Stereoscopic Displays - Motion Tracking Hardware - Input Devices - Computing Platforms - Virtual Reality Applications.

Module 2: 3D Graphics Basics ***(09 Periods)***

3D Coordinate Systems - Meshes, Polygons, and Vertices - Materials, Textures, and Lights - Transforms and Matrices - Cameras, Perspective, Viewports, and Projections - Stereoscopic Rendering.

Module 3: Computing Architectures For VR ***(10 Periods)***

The Rendering Pipeline - The Graphics Rendering Pipeline - The Haptics Rendering Pipeline - PC Graphics Architecture - PC Graphics Accelerators - Graphics Benchmarks

Module 4: Modeling ***(08 Periods)***

Geometric Modeling - Virtual Object Shape - Object Visual Appearance - Kinematics Modeling - Physical Modeling - BehaviorModeling

Module 5: Human Factors in VR ***(08 Periods)***

Usability Engineering Methodology - VR Health and Safety Issues - Direct Effects of VR Simulations on Users - Cybersickness - Traditional VR Applications - Emerging Applications of VR

Total Periods: 45

Experiential Learning:

1) A virtual Study Use Case- NICE, An Educational Experience

2) Study the use of Virtual Reality at NASA

3) Sweeping coverage of eye movements

RESOURCES

TEXT BOOKS:

1. Tony Parisi – Learning Virtual Reality, O'Reilly Media, Inc., 2015, ISBN- 9781491922835

REFERENCE BOOKS:

1. Grigore C. Burdea, Philippe Coiffet - Virtual Reality Technology, 2nd Edition Wiley-IEEE Press, ISBN: 978-0-471-36089-6 July 2003

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/nou23_ge34/preview
2. https://archive.nptel.ac.in/courses/121/106/121106013/
3. https://www.udemy.com/course/virtual-reality-a-quick-introduction/

WEB RESOURCES:

1. https://www.geeksforgeeks.org/virtual-reality-introduction/
2. https://msl.cs.uiuc.edu/vr/vrch1.pdf

Course Code	Course Title	L	T	P	S	C
22CA102036	**INTRODUCTION TO GRAPHICS AND ANIMATION TOOLS USING OPENSOURCE SOFTWARE**	3	-	2	-	4

Pre-Requisite Introduction to 3D Computer Animation

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: The objective of this course is the students would be able to create an advertisement to promote the products online also get aware to create websites with animated graphics, Intensive interfaces.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand computer operations using Fedora Linux Operating System
CO2. Understand the computer operations using application packages for Office Automation
CO3. design Brochure using multimedia Software Flash Package and its tool to
CO4. Design Animated Document, Movie, Video clips etc

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: OPEN SOURCE SOFTWARE ***(08 Periods)***

Introduction to Concept Of Open Source, Introducing Linux, Exploring Features Of Linux, Overview of Linux Distributions: Ubuntu, Debian, Gentoo, Knoppix, Suse And Opensuse, Yellow Dog Linux, Slackware, Mandrive, Freespire And Xandros, Fedora, Introducing The Fedora Desktop, K Desktop Environment, Gnome Desktop Environment, Working With Files And Directories: Introduction To Linux File And Directory Structure, Basic Linux Commands, Creating, Copying, Removing Files,

Linux File Permission, Creating, Removing Directory, Applying Permission On Directories, Working With Storage Media.

Module 2: OPEN OFFIC SUITE ***(08 Periods)***

Overview of Internet and Linux – based Mozilla Firefox, Features of Mozilla Firefox, Interface of Mozilla Firefox, Browsing the Internet with Mozilla Firefox, Setting Preferences in Mozilla Firefox, Viewing the History of visited Websites, use of Search Engine, Creating Blog, Introducing and working with E-Mail and Chat, Quitting Mozilla Firefox, Introduction to Open Office Suite, Exploring an Interface of OpenOffice.org Writer, Working with Document: Saving, Closing, Editing Documents in Writer: Find and replace feature, Auto Correct, Word Completion features, Spelling and Grammar Checker, Hyperlinks, Merging Documents, Saving Changes to a document.

Module 3: Introduction to FLASH ***(10 Periods)***

Overview of FLASH, FLASH environment, Creating new FLASH document, User interface of FLASH, FLASH workspace, Menu bar, Time line, Property Panel, Motion Editor Panel, Saving files: As uncompressed XML – based format, As Template, Drawing Modes in FLASH, Drawing tools: Stage and Pasteboard, Oval, Rectangle and Polystar, Line tool and it's Properties, Pencil tool and it's Properties, Pen Tool, Brush tool, Lock skill, Align tool, Eraser tool, Adding Color, Stroke, Fill, Bucket tool, Dropper tool, Gap Controls, Transform, Magnifier tool, Hand Tool, Zoom Control, Selection tools: Lasso tool, Magic wand, Arrow tool, Original Fill, Snap, Straighten, Rotate.

Module 4: Text, Gradients, Symbols **(10 Periods)**

Text Tools : Expanding Textbox, Font, Font size, Font Color, Effect, Alignment, Paragraph, Text field, Modifying Text, Gradients: Custom, Linear, Radial, Creating a Static Symbol, Tint, Alpha, Brightness, Editing Symbols

Module 5: Animation, Tweening, Buttons ***(09 Periods)***

Animation Techniques : Basics of Animation, Introduction to key Frames and Tweens, Types of Frames, Motion, Layer, Skinning, Controller, Shadow, Motion Tweening, Tween Scaling, Rotate, Easing, Creating Shape, Multiple Layers, Buttons : Button Timeline, Up State, Over State, Down State, Introduction to Movie Clip, Actions

Total Periods: 45

EXPERIENTIAL LEARNING

1) Convert an image object into a symbol and adding basic movement using motion tweening.
2) Convert one object into another object using create motion tween and then shape.
3) Convert one text into another text using create motion tween and then shape.
4) Create a path for object to move one place to another place with the help of Motion Guide.
5) Create a text animation with the help of color, shapes.
6) Create a ripple masking effect of any one object with the help of create motion tween and Mask
7) Create a line dance effect with the help of line tool, shape and Hint option.
8) Create a masking effect with the help of one object, create motion tween and Mask.

9) Create one movie clip with the help of Library, Create Motion Tween and one object.

10) Create a CW/CCW effect of any object with the help of Gradient, Shape, Create Tween Motion.

RESOURCES

TEXT BOOKS:

1. Linux and OpenOffice Course Kit, Vikas Gupta, Dreamtech Press
2. Flash – 3rd Edition, Michael Lennox, Techmedia

REFERENCE BOOKS:

1. Flash web design-the art of motion graphics, BPB Publication
2. Web Designing, Computer Jagat Publications

Software / Tool: FEDORA LINUX, FLASH 8

VIDEO LECTURES:

1. https://nptel.ac.in/courses/117105083
2. https://onlinecourses.swayam2.ac.in/ntr20_ed15/preview

WEB RESOURCES:

1. https://onlinecourses.swayam2.ac.in/cec20_cs08/preview
2. https://www.classcentral.com/course/swayam-graphics-and-animation-development-january-2022-23776

Specialization Electives

Course Code	Course Title	L	T	P	S	C
22CA102037	USER INTERFACE DESIGN	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides fundamental user interface design principles and methodologies such as layout, controls and navigation. Students will learn the tools and techniques of Photoshop and Illustrator in order to create user interface animations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Gain insight into the basic theories and current research topics in user-centred interaction design

CO2. Be able to create user interface animations with the aid of Photoshop and Illustrator

CO3. Develop an interactive mockup website and mobile with the design ideas in a constructive manner

CO4. Develop the ability to construct Navigation that enables users to easily accomplish user interface design tasks

CO-PO- PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Photoshop ***(9 Periods)***

Introduction to Photoshop - Raster graphics - Performance Optimization - Color Calibration Workspace overview - Photoshop controls - Interface - Layers and Panels - Navigation Pan - Rotate View tool - Navigator panel - Zoom in or out - Fit an image to the screen- Photoshop Tools - Usability features - Masks in UI Design - Lights and Shadows - Emphasis and Blending

Module 2: Color Scheme ***(10 Periods)***

Color Scheme - Primary Color - Secondary colors - Neutral colors - Brainstorm - Typography - Web Safe Fonts - Font Themes - Size - Color and Contrast - Tracking - Leading - Soft Buttons - 3D Buttons - Realistic Buttons - Web Template Design - Components of a Web Page

Module 3: Logo Design Principles ***(10 Periods)***

Logo Design Principles - Purpose - Target audience - Planning essentials - Web Layout Design - Rule of third - Rule of odds - Poster Design Principles - F shaped pattern - Visual Hierarchy - User friendly - Photoshop Etiquette - Stretching text and images - Proofread - Make easy to find

Module 4: UI Illustrations ***(08 Periods)***

UI Illustrations - Creating visual triggers - Creative storytelling - Emotional appeal - Aesthitic satisfaction - Mobile GUI Design - Mobile GUI Guidelines - Android UI Design - Screen Components - IOS UI Design - Animations - UI Animations in Photoshop - UI Animation in Illustrator.

Module 5: Web Design ***(08 Periods)***

Mockup Design - Responsive Web Design - Setting the stage - Basic mechanics - Typography and Layout - Navigation patterns - Advanced Enhancement -Performance - Page Designs - Metro UI Design - Mascot Design - Characters Purpose - Unique features - Exporting for Web, Mobile, Print - Design Optimization

Total Periods: 45

EXPERIENTIAL LEARNING

1) Design a UI for a Game website
2) Design a UI for a female centric website
3) Design a UI suitable for both mobile and PC
4) Design a UI for a horror themed website
5) Design a one pager UI for a website
6) Design a one pager UI for a mobile

7) Design a mascot for an imaginary brand

8) Design a UI compatible for IOS

9) Design a mock-up website for a service sector company

10) Design a mobile (Android and IOS) mock-up website for an online store

RESOURCES

TEXT BOOKS:

1. Diana MacDonald, "Practical UI Patterns for Design Systems: FastTrack Interaction Design for a Seamless User Experience", Apress, 2019.
2. Jenifer Tidwell, "Designing Interfaces: Patterns for Effective Interaction Design" Second Edition, O'Reilly Media, Inc., 2010.

REFERENCE BOOKS:

1. R. Moore "UI design with Adobe Illustrator", Berkely, California: Adobe Press, 2013.
2. Lesa Snider, "Photoshop CS6: The Missing Manual", 2nd Edition, O'Reilly Media Publisher, 2012

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. https://www.coursera.org/specializations/user-interface-design

WEB RESOURCES:

1. https://www.usability.gov/what-and-why/user-interface-design.html
2. https://www.coursera.org/in/articles/what-is-a-user-interface-ui-designer-guide

Specialization Electives

Course Code	Course Title	L	T	P	S	C
22CA101024	Introduction to Augmented Reality	3	-	-	-	3

Pre-Requisite Computer Graphics

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a discussion on Introduction to Virtual Reality, 3D Graphic Basics, Computing Architectures for VR, modelling, Huma Factors in VR.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Gain Knowledge on the basic and advanced concepts of Augmented reality platforms and Applications.

CO2. Analyze the concepts of tracking.

CO3. Implement the concepts of computer vision for augmented reality which mapping

CO4. Apply the calibration and registration for augmented reality and visual coherence

CO-PO- PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Augmented Reality ***(9 Periods)***

History – Multimodal Displays - Visual Perception - Requirements and Characteristics -

Spatial Display Model - Visual Displays

Module 2: Tracking ***(10 Periods)***

Tracking, Calibration, and Registration - Coordinate Systems - Characteristics of Tracking Technology - Stationary Tracking Systems - Mobile Sensors - Optical Tracking

Module 3: Computer Vision for Augmented Reality ***(10 Periods)***

Marker Tracking - Multiple-Camera Infrared Tracking - Natural Feature Tracking by Detection - Incremental Tracking - Simultaneous Localization and Mapping.

Module 4: Calibration and Registration ***(08 Periods)***

Camera Calibration - Internal Camera Parameters - Correcting Lens Distortion - Display Calibration - Single Point Active Alignment Method - Head-Mounted Display Calibration Using a Pointing Device - Hand–Eye Calibration - Registration - Geometric Measurement Distortions - Error Propagation - Latency - Filtering and Prediction.

Module 5: Visual Coherence ***(08 Periods)***

Registration - Occlusion - Occlusion Refinement - Probabilistic Occlusion - Model-Free Occlusion - Photometric Registration - Image-Based Lighting - Light Probes - Offline Light Capturing

Total Periods: 45

EXPERIENTIAL LEARNING

1) Investigate the historical evolution of augmented reality. How has it evolved over time, and what were the key milestones in its development?

2) Explore the spectrum between real and virtual worlds. Provide examples of technologies that fall within this spectrum and discuss their relationship with augmented reality.

3) Identify and discuss real-world applications of augmented reality. How is AR being used across various industries, and what impact does it have on user experiences?

4) Examine the various sensory displays in augmented reality hardware. How do audio displays, haptic displays, and visual displays contribute to enhancing the user's AR experience?

5) Delve into the role and architecture of processors in augmented reality hardware. How do processors contribute to the overall functionality of AR devices?

6) Explore the characteristics of tracking technology in augmented reality. How does tracking,

calibration, and registration enhance the precision and accuracy of AR devices?

7) Conduct an experiment using marker tracking in augmented reality. Discuss the advantages and limitations of marker-based tracking in various scenarios.

8) Analyze the major components of augmented reality software systems. How do these components work together to create a seamless AR experience?

9) Implement a markerless tracking approach in a real-world scenario. Discuss the challenges and benefits of markerless tracking, providing examples of successful implementations.

10) Investigate different types of markers used in augmented reality, such as template markers and 2D barcode markers. Compare their advantages and disadvantages in specific contexts.

RESOURCES

TEXT BOOKS:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016), ISBN-10: 9332578494
2. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178

REFERENCE BOOKS:

1. SanniSiltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

VIDEO LECTURES:

1. https://www.coursera.org/learn/ar
2. https://www.coursera.org/courses?query=augmented%20reality
3. https://www.udemy.com/course/develop-augmented-reality-book-ar-business-card-with-unity/?gad_source=1&gclid=EAIaIQobChMIv4yp-rv4ggMVy0QrCh37ZgtREAMYASAAEgJ2j_D_BwE&matchtype=b&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=adwords&utm_term=_._ag_84769212688_._ad_670113543834_._kw_augmented+reality+training_._de_c_._dm__._pl__._ti_kwd-330491438159_._li_9152562_._pd__._

WEB RESOURCES:

1. http://pire.fiu.edu/publications/Augmented.pdf
2. https://b-u.ac.in/sites/b-u.ac.in/files/latest-attachments/2.pdf

Course Code	COURSE TITLE	L	T	P	S	C
22CA101025	Graph Theory and Combinatorics	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course introduces design thinking in product innovation. This course is intended to familiarize Introduction to Graph Theory, Graphy Theory, Trees, Directed Graph, Combinatorics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

C The objective of the course is to explain basic concepts in combinatorial graph theory.

CO2. Define how graphs serve as models for many standard problems.

CO3. Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.

CO4. See the applications of graphs in science, business and industry.
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CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Graph Theory ***(08 Periods)***

Basic Terminology, Walks, Paths, Circuits, Connectedness, Handshaking Lemma, Isomorphism, Sub Graphs, Reach Ability, Union and Interaction of Graphs.

Module 2: Graph Theory ***(09Periods)***

Euler Graph, Shortest Path Problem, Hamiltonian Graph, Traveling Salesman Problem, Bipartite Graphs

Module 3 Trees ***(09 Periods)***

Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees, Fundamental Circuits, Spanning Trees of a Weighted Graph, Cut Sets and Cut Vertices, Fundamental Cut Set, Minimum Spanning Tree

Module 4 Directed Graph ***(10 Periods)***

Directed Graphs and Connectedness, Directed Trees, Network Flows, Max Flow-Mincut Theorem, Matrix Representation of a Graph, Planar Graphs: Combinational and Geometric Duals, Kuratowski's Graphs, Detection of Planarity, Thickness and Crossing.

Module 5 Combinatorics ***(09 Periods)***

Partitions, Counting Functions, Number of Partitions into Odd or Unequal Parts. Necklaces, Euler's Function, Set of Symmetries, Enumeration in the Odd and Even Cases.

Total Periods: 45

EXPERIENTIAL LEARNING

1 Program to find the number of vertices, even vertices, odd vertices and number of edges in a Graph.
2 Program to Find Union, Intersection and ring-sum of 2 graphs.
3 Program to Find Minimum Spanning tree Using Prim's Algorithm
4 Program to Find Minimum Spanning tree Using Kruskal's Algorithm
5 Program to find Shortest Path between 2 Vertices using Dijkstra Algorithm

RESOURCES

TEXT BOOKS:

1. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 2nd Edition, 2000.
2. N. Deo**,** Graph Theory with Applications to Engineering and Computer Science, PHI publication, 3rd edition, 2009

REFERENCE BOOKS:

1. Harikishan, Shivraj Pundir and Sandeep Kumar, Discrete Mathematics, Pragati Publication, 7th Edition, 2010.

2. Colmun, Busby and Ross, Discrete Mathematical Structure, PHI Publication, 6th Edition, 2009

VIDEO LECTURES:

3. https://ocw.mit.edu/courses/18-217-graph-theory-and-additive-combinatorics-fall-2019/video_galleries/video-lectures/
4. https://www.math.uvic.ca/~noelj/combinatoricsLectures.html

WEB RESOURCES

4. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf
5. http://www.cectl.ac.in/images/pdf_docs/studymaterial/cse/s5/gtc1.pdf
6. https://iuuk.mff.cuni.cz/~ipenev/KGLectureNotes.pdf

Specialization Electives

Course Code	Course Title	L	T	P	S	C
22CA102038	ANIMATION DESIGN	3	-	2	-	4

Pre-Requisite Computer Graphics

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a discussion on fundamental principles and tools of animation and media. Skills in 2D production, motion graphics, stop motion and basic traditional animation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the fundamental principles and tools of animation and media

CO2. Develop the skills in 2D production, motion graphics, stop motion and basic traditional animation

CO3. Create animated sequences from the development of the original concept through design to final film or video production

CO4. Coordinate and manage the production of a student film, including the aspects of cinematography, art direction and editing.

CO-PO- PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	2	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to 2D Animation ***(9 Periods)***

Introduction to 2D Animation - Basic concepts of 2D techniques - Principles of motion study - 2D Workflow Script - Storyboard - Concept art - Animation-Introduction to workspace - Understanding document types - Setting up projects and changing project types - Introduction to panels - Working with timeline

Module 2: Creating Structures ***(10 Periods)***

Strokes and fills - Creating lines and Shapes - Object drawing mode - Pen tool drawing states - Adjusting segments - Arranging objects - Exporting art

Module 3: Working with Filters ***(10 Periods)***

Working with timeline - Working with libraries - Symbols - Instances - Editing properties - Graphic filters - Filters overview - Animated filters - Working with filters

Module 4: 2D Animation and frames ***(08 Periods)***

Basic 2D Animation - Animating transformation - Motion path - Nested Animations - Adding frames - Moving keyframes - Motion tween animations - Tween span - Property keyframe - Tweenable objects and properties

Module 5: Frame Animation ***(08 Periods)***

Frame by Frame animation - Converting classic motion tweens - Using onion skinning - Shape tweens - Mask layer - Unlink layers - Motion Editor - Property curves - Applying presets and custom eases - Resultant curve - Exporting the final output - Different file formats

Total Periods: 45

EXPERIENTIAL LEARNING

Implement the following in 2D Animation:

1) Ball bouncing across the screen
2) Character jumping
3) Walk cycle
4) Run cycle
5) Flour sack jumping
6) Kicking a ball
7) Character thinking
8) Variations for face expressions
9) Change a character emotion (Happy to sad, sad to angry etc.,)
10) Object falling into a body of water

RESOURCES

TEXT BOOKS:

1. Williams, Richard , "The Animator's Survival Kit: A Manual of Methods, Principles and Formulas for Classical, Computer, Games, Stop Motion and Internet Animators", 4th Edition, Macmillan , 2009
2. Jean Ann Wright, "Animation Writing and Development: From Script Development to Pitch (Focal Press Visual Effects and Animation)" 1st Edition, Taylor & Francis, 2013.

REFERENCE BOOKS:

1. Preston J. Blair, "Animation 1: Learn to Animate Cartoons Step by Step", 2003
2. Russell Chun, "Adobe Animate CC Classroom in a Book (2018 release), 1st Edition, Adobe Press, 2018

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/cec20_cs08/preview
2. https://nptel.ac.in/courses/106102065

WEB RESOURCES:

1. https://www.dgp.toronto.edu/~patrick/csc418/notes/tutorial11.pdf
2. https://web.stanford.edu/class/cs248/pdf/class_03_animation.pdf

Course Code	Course Title	L	T	P	S	C
22CA102039	**INTRODUCTION TO 3D COMPUTER ANIMATION**	3	-	2	-	4

Pre-Requisite Computer Graphics

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: The objective of this course is to develop the skill & knowledge in 3D Computer Animation.Students will understand the function either as an entrepreneur or can take up jobs in the multimedia and animation industry, video studios, edit set-up and other sp.effects sectors.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Describe Computer-based Animation&Getting Started with Max.
CO2. Understand 3D Modeling concepts.
CO3. Use Simulation & Effects concepts for Animation
CO4. Analyze and understand the Lighting & Camera
CO5. Acquire knowledge of Texturing with Max

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	3	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Computer-based Animation&Getting Started with Max *(08 Periods)*
Definition of Computer-based Animation,Basic Types of Animation: Real Time ,Non-real-time, Definition of Modelling, Creation of 3D objects. Exploring the Max Interface, Controlling & Configuring the Viewports, Customizing the Max Interface & Setting Preferences, Working with

Files, Importing & Exporting, Selecting Objects & Setting Object Properties, Duplicating Objects, Creating & Editing Standard Primitive & extended Primitives objects, Transforming objects, Pivoting, aligning.

Module 2: 3DModelling ***(08 Periods)***

Modeling with Polygons, using the graphite, working with XRefs, Building simple scenes, Building complex scenes with XRefs, using assets tracking, deforming surfaces & using the mesh modifiers, modeling with patches & NURBS

Module 3: Simulation & Effects ***(10 Periods)***

Bind to Space Warp object, Gravity, wind, displace force object, deflectors, FFD space warp, wave, ripple, bomb, Creating particle system through parray, understanding particle flow user interface, how to particle flow works, hair & fur modifier, cloth & garment maker modifiers.

Module 4: Lighting& Camera **(10 Periods)**

Configuring & Aiming Cameras, camera motion blur, camera depth of field, camera tracking, using basic lights & lighting Techniques, working with advanced lighting, Light Tracing, Radiosity, video post, mental ray lighting etc.

Module 5: Texturing with Max ***(09 Periods)***

Using the material editor & the material explorer, creating & applying standard materials, adding material details with maps, creating compound materials & material modifiers, unwrapping UVs & mapping texture, using atmospheric & render effects etc.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Introduction to 3D Studio Max.
   - A. Exploring the Max Interface
   - B. Creating & Editing Standard Primitive Objects
   - C. Creating & Editing Extended Primitive Objects
   - D. Working with Files, Importing & Exporting
2. 2D Splines, Shapes & Compound Objects.
   - A. Understanding 2D Splines & Shape
   - B. Convert 2D to 3D object using extrude, bevel, loft, terrain etc.
   - C. Using Morph, Scatter, conform, connect compound objects.
   - D. Using Boolean, Proboolean&Procutter
3. 3D Modeling
   - A. Modeling with polygon objects
   - B. Building Simple & Complex Scene
   - C. Using Mesh Modifier
   - D. Modeling with patches & NURBS
4. Simulation & Effects
   - A. Bind to space warp objects
   - B. Using Gravity & Wind
   - C. Using FFD, wave, ripple, bomb
   - D. Using Particle System
   - E. Using Particle Flow

F. Using Hair & Fur Modifier
G. Cloth & Garment Maker

5. Lighting & Camera
   A. Configuring & Aiming Cameras
   B. Using Camera Motion Blur & Depth of Field
   C. Using Basic lights 6.4 Using Light tracing, radiosity
   D. Video Post
   E. Mental Ray Lighting
6. Texturing with Max
   A. Using Material Editor
   B. Create &Aplly standard material
   C. Material Modifier
   D. unwrapping UVs
   E. Mapping texture
   F. Using atmospheric & render effects

RESOURCES

TEXT BOOKS:

1. TedBoardman, 3d'sMax5Fundamentals, Techmedia Publishers
2. Michelebousquet, Modelrig,Animatewith3d'smax6, Manyworldproduction

REFERENCE BOOKS:

1. Michael E. Mortenson, 3D Modelling, Animation, and Rendering, Createspace
2. Boris Kulagin, 3ds Max 8 from Modelling to Animation, Bpb Publication

VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/cec20_cs08/preview
2. https://www.coursera.org/learn/introduction-to-3d-modeling

WEB RESOURCES:

1. https://www.upwork.com/resources/what-is-3d-animation
2. http://ilearntoanimate.com/animation-resources/

Course Code	Course Title	L	T	P	S	C
22CA102040	**DIGITAL IMAGE PROCESSING**	3	1	2	-	5

Pre-Requisite Introduction to 3D Computer Animation

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: Image Fundamentals, Image Transforms, Image enhancement in spatial and frequency domains, Restoration of images corrupted by noise, Image Compression models with coding, Segmenting images based on properties and Color image processing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply various transformations on images by analyzing basic operations on images.

CO2. Apply various image enhancement techniques in spatial and frequency domains.

CO3. Apply restoration techniques based on noise models and degradation function to restore the images, pertaining to health and societal applications.

CO4. Analyze various coding techniques for compression to reduce redundancies in images.

CO5. Analyze various segmentation techniques on images for societal applications.

CO6. Analyze various color models for different types of images.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO5	3	3	2	2	2	2	2						1		
CO6	3	3			2									3	
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Digital Image Fundamentals ***(08 Periods)***

Fundamental steps in Image Processing, Image sampling & quantization, some basic relationships between pixels, Arithmetic operations, Logical operations, Spatial operations.

Image Transforms: 2D-DFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar-Transform, Slant Transform and KL Transform, properties of image transforms.

Module 2: IMAGE ENHANCEMENT ***(08 Periods)***

Basic Intensity transformation functions, Histogram processing, Fundamentals of Spatial Filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial Enhancement methods.

Basics of filtering in frequency domain, Correspondence between filtering in the spatial and frequency domains, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters, Homomorphic filtering

Module 3: Image Restoration ***(10 Periods)***

Image degradation/Restoration model, Noise models, Restoration in the presence of Noise only-spatial filtering - mean, order- statistic and adaptive filters. Estimating the degradation function, Inverse filtering, Weiner filtering, Constrained least squares filtering.

Module 4: IMAGE COMPRESSION **(10 Periods)**

Classification of redundancy in Images, Image Compression models, Run length coding, Arithmetic coding, Dictionary based compression, bit-plane coding, Transform based coding, Fidelity Criteria, JPEG 2000.

Module 5: IMAGE SEGMENTATION AND COLOR IMAGE PROCESSING ***(09 Periods)***

Detection of discontinuities- Point, line and edge Detection. Thresholding- global thresholding, adaptive thresholding. Region based Segmentation. Color image fundamentals - RGB, HSI models, conversions, Pseudo Color Image Processing, Color transformations.

Total Periods: 45

EXPERIENTIAL LEARNING

1) Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2) Implementation of Relationships between Pixels
3) Implementation of Transformations of an Image
4) Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5) Display of bit planes of an Image
6) Display of FFT(1-D & 2-D) of an image
7) Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8) Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)

9) Implementation of image sharpening filters and Edge Detection using Gradient Filters

10) Image Compression by DCT,DPCM, HUFFMAN coding

RESOURCES

TEXT BOOKS:

1 Rafael C. Gonzalez & Richard E. Woods, *Digital Image Processing*, Pearson Education,4th Edition, 2018.

2 Anil K. Jain, *Fundamentals of Digital Image processing*, Prentice Hall, 2007

REFERENCE BOOKS:

1. S Jayaraman, S Esakkirajan, T Veerakumar, *Digital Image Processing*, Tata McGraw Hill Education, Second Edition, 2020.
2. Vipula Singh, *Digital Image Processing with MATLAB &LabVIEW*, Elsevier, 2019.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee75/

WEB RESOURCES:

1. https://www.coursera.org/learn/digital
2. https://www.imageprocessingplace.com/root_files_V3/students/students.htm
3. https://archive.nptel.ac.in/courses/106/105/106105032/

Course Code	Course Title	L	T	P	S	C
22CA104003	**ADVANCED COMPUTER GRAPHICS**	2	-	2	4	4

Pre-Requisite Introduction to 3D Computer Animation

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: To Introduce various Graphics Applications in real world scenario, familiar with image fundamentals and animations and learn more about 2D, 3D and Curve applications

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Compare various graphics algorithm used in 2D and 3D

CO2. Understand fundamentals of graphics used in various real life applications.

CO3. Understand and identify the performance characteristics of graphics algorithms.

CO4. Design basic graphics application programs, including animation

CO5. Acquire familiarity with the relevant mathematics of computer graphics

CO6. Design applications that display graphic images to given specifications

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
CO3	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO4	2	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO5	3	3	2	2	2	2	2						1		
CO6	3	3			2									3	
Course Correlation Mapping	**2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Review of 2D and 3D graphics ***(06 Periods)***

Transformations, Windowing, Clipping, 3D geometry, primitives and transformations, Rotation about an arbitrary axis, Parallel and perspective projection, Viewing parameters, 3D clipping and viewing transformation.

Module 2: Curves and Fractals ***(06 Periods)***

Polygon Meshes, Parametric Cubic curves: B-spline, Bezier, Hermite. Parametric Bicubic Surfaces, Quadric surfaces, Fractals: fractal lines and surfaces Applications.

Module 3: Achromatic and Colored Light ***(06 Periods)***

Achromatic light, Gamma correction, Halftone, approximation, Chromatic Color,CIE chromaticity diagram, Color models for Raster Graphics. Using Color in Computer Graphics.

Module 4: Illumination and Shading **(06 Periods)**

Surface detail, shadows and Transparency, Inter object Reflections, Illumination Models, Extended Light Sources, Recursive Ray Tracing.

Module 5: Animation and Graphics Hardware ***(06 Periods)***

Introduction,morphing, character animation and facial animation, Special-purpose computer graphics processors and accelerators.

Total Periods: 30

EXPERIENTIAL LEARNING

1) To perform open GL program for Bezier Curve.
2) To perform Bezier curve with c0 and c1 continuity.
3) To Draw cube with or without back face culling.
4) To perform Hermite Curve.
5) To perform program for diffuse illumination
6) To perform program for sphere with Back face culling.
7) To perform program for Ambient and diffuse light source.
8) To perform program for ambient & specular & diffuse light source.
9) To perform program for Diffuse only light source.
10) To perform Z buffer visible surface Algorithm

PROJECT BASED LEARNING

The students have to select the problems and solve using the concept of computer Graphics.

1. Ambient light simulation in 3D Object
2. Visualization of the digits of PI
3. Client Server Architecture Simulation
4. Superellipse visualization
5. Mandelbrot set visualization
6. Visualization of A* Shortest Pathfinding Algorithm
7. Fibonacci Spiral (Golden Ratio) Visualisation

RESOURCES

TEXT BOOKS:

1 Computer Graphics: principals and practice Foley, vanDam, Feiner Hughes Addision Wesley

2 Mathematical Elements of Graphics Roges Tata McGrow Hill

REFERENCE BOOKS:

1. Computer Graphics Donald Hearn and M.Pauline Baker Prentice Hall India
2. Procedural Elements-Computer Graphics, David Rogers, TMH
3. Principals of Computer graphics, Shalini Govil-pal, springer

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc20_cs90/preview
2. https://nptel.ac.in/courses/106106090

WEB RESOURCES:

1. https://www.coursera.org/learn/interactive-computer-graphics
2. https://www.coursera.org/learn/interactive-computer-graphics

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101026	TEXT ANALYTICS	3	-	-	-	3

Pre-Requisite Machine Learning
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This Course provides a detailed discussion on Text tokenization, Text normalization, Text syntax and structure, Text classification, Feature extraction, Classification algorithms, Text summarization, Keyphrase extraction, Topic modeling, Text similarity and clustering, Document clustering, Automated document summarization, Semantic analysis, Sentiment analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on preprocessing techniques for text data.

CO2. Apply various computational, language processing, machine learning techniques to classify and cluster text.

CO3. Build manual and automated text summarizers for getting more insights from the given text data.

CO4. Apply various distance or similarity measures to estimate the degree of similarity between two text documents.

CO5. Design machine learning models using supervised learning approaches and perform sentiment analysis.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	3	3	-	-		-	-	-	3	3	3
Course Correlation Mapping	**3**	**3**	**3**	**2**	**3**	**3**	-	-	-	**-**	**-**	-	**3**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: TEXT PROCESSING ***(09 Periods)***

Text tokenization– Sentence tokenization, Word tokenization; Text normalization, Cleaning, Tokenizing, Removing special characters, Expanding contractions, Case conversions, Removing stop words, Correcting words, Stemming, Lemmatization; Text syntax and

structure–Parts of Speech tagging, Text parsing.

Module 2: TEXT CLASSIFICATION ***(09 Periods)***

Text classification, Automated text classification, Blueprint of text classification, Feature extraction – Bag of Words model, TF-IDF model, Averaged word vectors, TF-IDF weighted averaged word vectors; Classification algorithms – Naïve Bayes, Support vector machines Evaluating classification models, Building a multi-class classification system.

Module 3: TEXT SUMMARIZATION ***(08 Periods)***

Text summarization and information extraction, Singular value decomposition, Key phrase extraction – Weighted tag–based phrase extraction; Topic modeling – Latent semantic indexing, Latent Dirichlet allocation, Non-negative matrix factorization, Extracting Topics from Product Reviews, Automated Document Summarization.

Module 4: TEXT SIMILARITY AND CLUSTERING ***(09 Periods)***

Information Retrieval (IR), Feature Engineering, Similarity Measures, Unsupervised Machine Learning Algorithms, Text Normalization, Feature Extraction, Text Similarity, Analyzing Term Similarity, Analyzing Document Similarity, Document Clustering, Clustering Greatest Movies of All Time.

Module 5: SEMANTIC AND SENTIMENT ANALYSIS ***(10 Periods)***

Semantic Analysis, Exploring WordNet, Word Sense Disambiguation, Named Entity Recognition, Analyzing Semantic Representations, Sentiment Analysis, Sentiment Analysis of IMDb Movie Reviews.

Total Periods: 45

EXPERIENTIAL LEARNING

List of Exercises

1. Perform clustering of popular movies based on their IMDb synopses as raw data using K-Means clustering. Find out similarities within groups of people in order to build a movie recommending system for users and they are going to analyze a dataset from Netflix database to explore the characteristics that people share in movies' taste, based on how they rate them.
2. Classify the given texts using Naïve Bayes algorithm and evaluate the classifier performance. Implement the Naïve Bayes Classifier in R/Python.
3. Keep Track of Marketing Trends: Trend analysis is an important aspect of marketing the product or service. Use Google Trends and other tools to look for trending terms. Discover hidden patterns, such as specialized niche keywords, by doing a keyword analysis on feedback from the target audience across various social media platforms and review sites. Use text summarize key phrases extraction approach to analyse trending marketing.

RESOURCES

TEXT BOOKS:

1. Dipanjan Sarkar, Text Analytics with Python, APRESS,2016.

REFERENCE BOOKS:

1. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O'Reilly, 2018.
2. Charu C. Aggarwal, Machine Learning for Text, Springer, 2018.
3. Benjamin Bengfort, Rebecca Bilbro,Tony Ojeda, Applied Text Analysis with Python,
   O'Reilly, 2018.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/110107129
2. https://freevideolectures.com/course/4135/nptel-business-analytics-text-mining-modeling-using-python/38
3. https://freevideolectures.com/course/4135/nptel-business-analytics-text-mining-modeling-using-python/39
4. https://freevideolectures.com/course/4135/nptel-business-analytics-text-mining-modeling-using-python/40
5. https://www.youtube.com/watch?v=FtGBzBi51mQ

WEB RESOURCES:

1. https://www.lexalytics.com/technology/text-analytics
2. https://download.e-bookshelf.de/download/0008/3870/64/L-G-0008387064-0017200370.
3. https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing.
4. https://www.coursera.org/learn/text-mining
5. https://onlinecourses.nptel.ac.in/noc19_mg47/preview

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101027	**WEB ANALYTICS**	3	-	-	-	3

Pre-Requisite - Web Technologies
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Web Data Collection procedures, qualitative analysis and web analytic fundamentals, Web Metrics, Web Analytics 2.0, Google Analytics and Relevant Technologies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understanding the basic concepts of Web Analytics and Search Engine.
CO2. Demonstrate knowledge on Qualitative Analysis and Web Analytic fundamentals.
CO3. Understand the concepts Web Analytical Metrics.
CO4. Perform Website traffic analysis using Web Analytics 2.0
CO5. Apply Google Analytics for web traffic analysis.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-						3	2	3
CO2	2	3		2									3	2	3
CO3	2	2	3	1									3	2	3
CO4	3	2	3	1	3								3	2	3
CO5	2	2	3	1	3								3	2	3
Average	**3**	**2**	**3**	**1**	**3**								**3**	**2**	**3**
Level of correlation of the course	**3**	**2**	**3**	**1**	**3**								**3**	**2**	**3**

Correlation Levels: 3: High 2: Medium 1: Low

COURSE CONTENT:

Module 1 - INTRODUCTION AND DATA COLLECTION (9 periods)

Introduction: Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.

Data Collection: Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support;

Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

Module 2 – QUALITATIVE ANALYSIS AND WEB ANALYTIC FUNDAMENTALS

(9 periods)

Qualitative Analysis: Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, post-visit surveys, creating and running a survey, Benefits of surveys.

Web Analytic fundamentals: Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.

Module 3 – WEB METRICS (9 periods)

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization e-Commerce, non e-commerce sites: Improving bounce rates, Optimizing AdWords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.

Module 4–WEB ANALYTICS 2.0 (9 periods)

Web Analytics 2.0: Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis: CI data sources, Toolbar data, Panel data, ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

Module 5– GOOGLE ANALYTICS AND RELEVANT TECHNOLOGIES (9 periods)

Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext TransferProtocol), Server Log Files & Cookies, Web Bugs.

Total periods: 45

Experiential Learning:

1. Demonstrate how User Behaviour Analysis is performed.
2. Develop a case study on Web Analytics for e-commerce application.
3. Demonstrate Content Performance Analysis with Web Analytics

RESOURCES

TEXT BOOKS:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed.

REFERENCE BOOKS:

1. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of CustomerCentricity, Wiley Publishing, Inc. 1st ed.
2. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons

VIDEO LECTURES:

1. https://www.udemy.com/topic/web-analytics/
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/web-analytics-for-beginners

WEB RESOURCES:

1. https://iide.co/blog/web-analytics
2. https://growthnatives.com/blogs/web-analytics/web-analytics-tools-techniques-and-best-practices/

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101028	IMAGE AND VIDEO ANALYTICS	3	-	-	-	3

Pre-Requisite - **Digital Image Processing**

Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
This course provides a detailed discussion on the basic principles and concepts in digital image and video processing. To explore and demonstrate real time image and video analytics in solving practical problems of commercial and scientific interests.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the Image Segmentation, Compression and Colour Image Processing concepts

CO2 Demonstrate knowledge on digital image processing techniques in developing societal applications

CO3 Apply feature extraction and texture analysis techniques in object recognition and image retrieval.

CO4 Understand the fundamentals of digital video processing.

CO5 Apply video segmentation and tracking techniques for motion detection and tracing applications.

CO6 Apply video analytics techniques for action detection in real-time applications.

CO-PO and PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO2	2	3	2	2		-	-	-	-	-	-	-	3	3	3
CO3	2	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO4	2	3	2	2		-	-	-	-	-	-	-	3	3	3
CO5	2	3	2	2		-	-	-	-	-	-	-	3	3	3
CO6	2	3	2	2	2	-	-	-	-	-	-	-	3	3	3
Average	2	3	2	2	2	-	-	-	-	-	-	-	3	3	3
Level of correlation of the course	2	3	2	3	2	-	-	-	-	-	-	-	3	3	3

Level of Correlation: 3 - High 2 - Medium 1 - Low

COURSE CONTENT

Module 1: INTRODUCTION (09 Periods)

Basic steps of Image processing system – Pixel relationship- Image Transforms-. Image Enhancement- Histogram Processing, Spatial filtering, Frequency Domain filtering

Image Segmentation, Compression and Colour Image Processing

Image Segmentation –Detection of Discontinuities. - Edge Linking and Boundary Detection. - Thresholding. - Region-Based Segmentation. Image Compression – Encoder-Decoder model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, JPEG, JPEG 2000. Colour Image Processing – Colour Models, Color Transformations Color Image Smoothing and Sharpening, Color Noise Reduction, Color-Based Image Segmentation.

(09 Periods)

Module 2: FEATURE EXTRACTION AND TEXTURE ANALYSIS

Feature Extraction - Binary object feature, Histogram-based (Statistical) Features, Intensity features, Shape feature extraction, PCA - SIFT – SURF. Texture Analysis - Concepts and classification, statistical, structural and spectral analysis.

Object recognition and Image Retrieval

Object Recognition -Patterns and pattern class, Bayes' Parametric classification, Feature Selection and Boosting, Template- Matching. Content Based Image Retrieval - Feature based image retrieval, Object Based Retrieval

(08 Periods)

Module 3 DIGITAL VIDEO PROCESSING

Digital Video, Sampling of video signal, Video Enhancement and Noise Reduction- Rate control and buffering, MPEG, H.264, Inter frame Filtering Techniques, Fundamentals of Motion Estimation and Motion Compensation

(11 Periods)

Module 4 VIDEO SEGMENTATION AND TRACKING

Change Detection, Background modelling, Motion Segmentation, Simultaneous Motion Estimation and Segmentation, Motion Tracking, Multi-target/Multi-camera tracking

(08 Periods)

Module 5 VIDEO ANALYSIS ACTION RECOGNITION

Video Analysis Action Recognition, Video based rendering, Context and scene understanding. Case Study: Surveillance - Advanced Driver Assistance System

Total Periods: *45*

Topics for self-study are provided in the lesson plan.

EXPERIENTIAL LEARNING

1. Understand and know how to apply state-of-the-art machine learning techniques (convolution neural networks) to solving problems in image and video analysis
2. Understand and describe the fundamental principles of image and video analysis and have an idea of their application.
3. Image and video segmentation and texture models
4. Fundamentals of digital image processing, image and video analysis, computer vision including camera calibration, feature matching and object detection and recognition
5. Image and video analysis, processing, machine learning for image analysis.

RESOURCES

TEXT BOOK:

1. *Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Ed., Prentice-Hall, 2008*

2. *A Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.*

REFERENCE BOOKS:

1. *Oge Marques, "Practical Image and Video Processing Using MATLAB", Wiley-IEEE Press,2011*
2. *Yu Jin Zhang, "Image Engineering: Processing, Analysis and Understanding", Tsinghua University Press, 2009.*
3. *Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012*
4. *Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010*
5. *Boguslaw Cyganek,"Object Detection and Recognition in Digital Images: Theory and Practice", Wiley, 2013*

WEB REFERENCES:

1. *http://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm*
2. *https://www.cs.cmu.edu/~cil/v-images.html*
3. *http://www.imageprocessingplace.com/root_files_V3/image_databases.htm*

VIDEO LECTURES:

1. https://gengo.ai/datasets/20-best-image-datasets-for-computer-vision
2. https://nptel.ac.in/courses

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101029	**COMPUTER VISION**	3	-	-	-	3

Pre-Requisite

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Concepts of low-level vision, Image filtering operations, Masking, Thresholding techniques, Edge Detection, Dilation and erosion, Background subtraction, Shot boundary detection, Interactive segmentation, Clustering based segmentation, Texture, Classification, Overfitting, Receiver Operator curves, Object detection and recognition and Information Retrieval methods.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze computer vision techniques for image enhancement, synthesis and segmentation.

CO2. Apply threshold techniques, morphological process and region growing methods for edge detection in images.

CO3. Develop clustering-based segmentation solutions for image synthesis.

CO4. Synthesize and Evaluate classification procedures for texture and feature analysis.

CO5. Select and Apply appropriate techniques for object recognition and detection in computer vision-based applications.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	2	-	-	1	1	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**3**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	3

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 INTRODUCTION AND IMAGE ENHANCEMENT ***(08 Periods)***

The nature of the vision, Low-level vision – Gray scale versus color, Image processing operations; Basic image filtering operations – Gaussian smoothing, Median filters, Mode Filters, Rank Order Filters, Sharp and Unsharp masking.

Module 2 THRESHOLDING AND EDGE DETECTION ***(10 Periods)***

Region-growing methods, Thresholding, Adaptive thresholding, Threshold selection – Variance-based thresholding, Entropy-based thresholding, Maximum likelihood thresholding; Global valley approach to thresholding; Edge Detection – Template Matching Approach, 3×3 Template Operators, Canny Operator, Laplacian Operator; Dilation and erosion in binary images – Properties of dilation and erosion operators, Closing and opening.

Module 3 SEGMENTATION BY CLUSTERING ***(09 Periods)***

Grouping and gestalt, Important applications – Background subtraction, Shot boundary detection, Interactive segmentation, Forming imaging regions; Image segmentation by clustering pixels, Segmentation, clustering and graphs – Terminology and facts for graphs, Agglomerative clustering with a graph, Divisive clustering with a graph, Normalized cuts.

Module 4 CLASSIFICATION AND DETECTION OF OBJECTS ***(11 Periods)***

Texture – Spots and bars, Representation, Synthesizing textures and filling holes in images, Shape from texture; Learning to classify – Using loss to determine decisions, Training error, test error and overfitting, Regularization, Error rate and Cross-validation, Receiver operating curves; Classifying images – Classifying images of single objects; Detecting objects in images – The sliding window method.

Module 5 OBJECT RECOGNITION, APPLICATIONS ***(07 Periods)***

Object Recognition – Categorization, Selection, Feature questions, Geometric questions, Semantic questions; Applications – Classifying materials, Classifying scenes, Tracking people.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement Image sharpening using 2-D Laplacian high pass filter in spatial domain.
2. Implement Edge detection in a segmented binary image using Canny edge detector.

(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. David A. Forsyth, Jean Ponce, Computer Vision: A Modern Approach, Pearson, 2nd Edition, 2012.
2. E. R. Davies, Computer and Machine Vision: Theory, Algorithms, Practicalities, Elsevier, 5th Edition, 2017.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, 4th Edition, 2018.
2. William K. Pratt, Digital Image Processing, Wiley, 4th Edition, 2006.
3. Will Ballard, Hands-on Deep Learning for Images with Tensorflow: Build Intelligent Computer Vision Applications using Tensorflow and Keras, Packt Publishing, 2018.
4. Ahmed Fawzy Mohamed Gad, Practical Computer Vision Applications using Deep Learning with CNNs: With Detailed Examples in Python using Tensorflow and Kivy, Apress, 2018.
5. Abhinav Dadhich, Practial Computer Vision: Extract Insightful Information from Images using Tensorflow, Keras, OpenCV, Packt, 2018.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/108103174
2. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
3. https://onlinecourses.nptel.ac.in/noc23_ee78/preview
4. https://onlinecourses.nptel.ac.in/noc21_ee23/preview
5. https://archive.nptel.ac.in/courses/106/105/106105216/
6. https://www.coursera.org/learn/ml-computer-vision
7. https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

WEB RESOURCES:

1. https://slideplayer.com/slide/5158896/
2. www.scs.carleton.ca/~c_shu/Courses/comp4900d/notes/PPT/lect1_intro.ppt
3. http://coeosmanabad.com/etc/manual/BE%20DIP%20Lab%20Manual.pdf
4. https://jnec.org/Lab-manuals/CSE/CSE1/TE-Part-1/DIP.pdf
5. http://gn.dronacharya.info/CSEDept/Downloads/Labmanuals/DIP-Lab-Manual.pdf
6. http://titagartala.ac.in/wp-content/uploads/2018/12/Digital-Lab-Processing-Lab-Manual.pdf

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA102027	**DATA VISUALIZATION**	3	-	2	-	4

Pre-Requisite - Python Programming
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Data Visualization elements, tools, visualization of maps, Dashboard design using Power BI and Tableau.

Course Objectives:

- To impart knowledge on Data Visualization concepts.
- To develop skills in data visualization tools.
- To design and develop dash boards as per business requirements

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Data Visualization concepts.

CO2. Apply data visualization tools to perform ETL process and create charts.

CO3. Develop customized Map visualizations

CO4. Demonstrate skills in developing Dashboards as per business requirements.

CO5. Perform Data Analysis using Power BI.

CO6. Work independently and in teams to solve Data Visualization problems with effective communications

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		3
CO2	3	3	3		3	2							3		3
CO3	3	3	3	3	3								3		3
CO4	2	3	2	3	2	2							3		3
CO5	3	3	3	3	3	3							3		3
CO6				2					3	3					
Average	**3**	**3**	**3**	**3**	**3**	**3**			**3**	**3**			**3**		**3**
Level of correlation of the course	**3**	**3**	**3**	**3**	**3**	**3**			**3**	**3**			**3**		**3**

Correlation Levels: 3: High 2: Medium 1: Low

COURSE CONTENT:

Module 1: INTRODUCTION (9 periods)

Definition of Data Visualization, The data visualization process, Data visualization importance in reports and statements; Data types, relationships, and visualization formats, Basic principles for data visualization, Layout and design: communicative elements, Prioritize patterns in visualizations: Gestalt, Storytelling for social and market communication, Trends in market research and data visualization dashboards

Module 2: DATA VISUALIZATION TOOLS (9 periods)

Data Visualization and Benefits Data Visualization Tools, Data Visualization Tools- Google Data Studio, Tableau, Qlikview, Power BI; Features, Data Access from Data Sources, Data transformation-Extraction, Transformation and Load (ETL), Messy data, Data formats and schemas, Data blending or fusion, Methods for data cleansing, Data profiling, Open source data-cleansing tools; Bar Chart, Pie Chart, Data Tables, Scatter Chart, Time Series Chart, Scorecards, Bullet Charts, and Area Chart.

Module 3: MAPS (9 periods)

Heat Map-Introduction, Uses of Heat map, Procedure to Create Heat Map in Tableau; Geo Map- Introduction -Need of map visualization, Uses of Geo map, Types of maps, Procedure to create Geo map / Symbol map in Tableau; Symbol Map- Introduction, Procedure to create Symbol Map; Filled Map; Editing Location in Map- Add more fields to view, Edit locations in the Special Values menu, Edit ambiguous locationsv, Edit unknown locations.

Module 4: DASH BOARDS (9 periods)

Introduction- Definition, Key Metrics for Dashboard, Benefits of Dashboard, Types of Dashboard, Customized Dashboard; Creating a Dashboard- Creating a Dashboard using Google Data Studio, Creating a dashboard in Tableau; Formatting a Dashboard- Dashboard Size, Steps to set overall dashboard size, Group items using layout containers, Tile or float dashboard items; Actions In Dashboard- Highlight Action, Dashboard Filters, URL Action; Sharing Reports- Share with specific users and groups, Sharing the link of report, Embedding report, Download the report

Module 5: POWER BI (9 periods)

Understanding Power BI, Key Features of Power BI, Advanced features of Power BI, Variants of Power BI, Data sources and modeling, Data transformation and relationships, chart types for visualization, format options of charts, Data Analysis Expressions functions include aggregate, counting, logical and date functions for creating calculated columns and measures.

Total Periods: 45

EXPERIENTIAL LEARNING:

List of Exercises:

1. Connect data sources to Tableau.
   i). Text files, Excel files, Access Databases, SQL Server

ii). Dimensions and measures of data, Perform changing data types, Apply filters, Merge multiple data sources.

2. Create Univariate charts
   i) Create Tables
   ii) Create common visualizations (bar charts, line charts etc.) and sort the graphs
   iii) Show aggregate measures and top 10 items
3. Create Maps and Perform customization of maps
4. Calculate user-defined fields using functions
5. Assemble a dashboard layout and apply filters.
6. Perform interactions with text, visual tooltips and actions.
7. Drill down between dash boards.
8. Perform advanced visualization using Tableau.
9. Create a data story in Tableau.
10. Create a graph for telecom billing data:
    i). Bar chart for customer segment vs average bill

    ii). Sort them based on average current charges

    iii). Create a set based on last five groups

    iv). What is the count of accounts and average bill for the subset.

11. Design a dashboard to show units in stock by product and a total sale by year. (*Demonstration on List of Power BI chart types for visualization*).

12. Design a dashboard to check the total amount of sales made in each month and find out which month had the highest and lowest sales. Use a simple clustered column chart. Drag the date column on the axis and the sales on to the values then change the color of the bars by going to the format option and selecting data colors. (*Demonstration on format options of charts*).

RESOURCES

TEXT BOOKS:

1. Visualize It! A Comprehensive Guide to Visualization
2. Dr. S. Karpagavalli, Introduction To Data Visualization Tools, Blue Hill Publishers, 1st Edition,2020.

REFERENCE BOOKS:

1. Teo Lachev, "*Applied Microsoft Power BI*," Prologika, Seventh Edition, 2022.
2. Alberto Ferrari and Marco Russo, "*Introducing Microsoft Power BI*," Microsoft Press, 2016.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=TPMlZxRRaBQ
2. https://www.youtube.com/watch?v=yjDPgvQX-9I

Web Resources:

1. https://docs.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview.
2. https://www.edureka.co/blog/power-bi-tutorial/
3. https://mindmajix.com/power-bi-visualization-types
4. https://intellipaat.com/blog/tutorial/power-bi-tutorial/
5. https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/sharepoint-scenario-build-report.
6. https://www.projectpro.io/article/power-bi-microsoft-projects-examples-and-ideas-for-practice/533.

Software/ Tools Used:

1. https://www.tableau.com/products/techspecs
2. https://www.tableau.com/tft/activation

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA102028	**DATA ENGINEERING ON CLOUD**	3	-	2	-	4

Pre-Requisite - Cloud Computing
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Data Engineering, Data Management Architectures; Architecting and Implementing Data Lakes And Lake Houses-I; Identifying and Enabling Data Consumers; Queries And Data Visualization; AI And Ml In Data Engineering

COURSE OBJECTIVES:

- To impart knowledge on Big Data enablers, storage, processing, querying and reporting
- To develop skills to analyze data engineering applications and use the software development best practices to improve performance of the application
- To inculcate attitude among students to solve societal problems using Data Engineering models

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on Data Engineering architectures, storage, processing, querying and reporting.

CO2. Analyze data ingestion issues and solve using data lake tools and techniques.

CO3. Design data pipelines using AWS tools for data processing as per user requirements.

CO4. Solve large data lake analysis problems using Amazon Quicksight.

CO5. Apply Artificial Intelligence and Machine Learning techniques for reviewing real world

CO6. Work independently and in teams to solve Data Engineering problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2										3	2	2
CO2	2	2	3		2	2							3	2	2
CO3	2	2	2	3	2								3	2	2
CO4	2	3	2	3	2	2							3	2	2

CO5	2	2	3	3	3	3							3	2	2
CO6				2					3	3					
Average	**2**	**2**	**2**	**3**	**2**	**2**							**3**	**2**	**2**
Level of correlation of the course	**2**	**2**	**2**	**3**	**2**	**2**			**3**	**3**			**3**	**2**	**2**

Correlation Levels: 3: High 2: Medium 1: Low

COURSE CONTENT:

Module 1: Introduction to Data Engineering ***(9 Periods)***

Introduction to Data Engineering: Introduction –The rise of Big Data as corporate asset–Challenge of ever growing dataset–Big data Enablers-benefits of cloud in building big data analytics.

Data Management Architectures: Introduction - Evolution- Data Warehouses and Datamarts– Datalakes and lake house Architecture-S3 bucket.

Data Engineer's Tool Kit: AWS Technical Requirements–Services for Ingesting Data–Services for Transforming Data–Services for orchestration of Big data Pipelines–Services for Consuming Data–Lambda Function

Data Security: Introduction- AWS Glue/Lake formation data catalog-Services for Data Encryption and Security Monitoring-Services for Managing Identity and Permissions-Configuring lake formation permissions.

(9 Periods)

Module 2: ARCHITECTING AND IMPLEMENTING DATA LAKES AND LAKE HOUSES-I

***Architecting Data Engineering Pipeline*:** Introduction – Approaching the data pipeline architecture–Identifying data consumers and understanding their requirements–Identifying Data Sources and Ingesting data–Identifying Data Transformations and Optimizations – Loading data into Datamarts-Architecting a sample pipeline.

Ingesting Batch and Streaming Data: Introduction-Understanding Data Sources-

Ingesting Data from Relational Database-Ingesting Streaming data- Ingesting data with AWS DMS.

Transforming Data for optimize for Analytics: Transformations-Types of Data Transformation Tools-Data Preparation Transformations-Business Use case transformation-Working with Change Data Capture(CDC) data-Joining Datasets with AWS Glue Studio.

Module 3: ARCHITECTING AND IMPLEMENTING DATA LAKES AND LAKE HOUSES-II ***(11 Periods)***

Identifying and Enabling Data Consumers: Understanding the impact of data democratization-Meeting the needs of business users with Data Visualization- Meeting the needs of Data Analysts with Structured Reporting-Meeting with needs of Data Scientists and Machine Learning Models- Creating Data Transformations with AWS Glue dataBrew.

Loading data into a Data Mart: Introduction-Extending Analytics with Data warehouses /Data marts-Anti Patterns for a Data Warehouse-Redshift architecture review and storage deep drive-designing a high performance data warehouse-Moving Data between a data Lake and Redshift-Loading data into an Amazon Redshift Cluster and running queries.

Orchestrating the Data Pipeline: Introduction- Understanding the core concepts for pipeline orchestration- Examining the Options for Orchestration Pipelines in AWS-Orchestrating a data pipeline with Step Function.

Module 4: QUERIES AND DATA VISUALIZATION ***(8 Periods)***

Ad-hoc queries with Amazon Athena: Introduction –Amazon Athena-in-place SQL Analytics for the data lake- Tips and Tricks to Optimize Amazon Athena Queries-Federating the queries of external data sources with Amazon Athena Query Federation-Managing Governance and costs with Amazon Athena Workgroups-Creating Athena Workgroups and Athena Settings-Switching workgroups and Running Queries.

Visualizing Data with Amazon QuickSight: Introduction-Representing Data Visually for maximum impact-Understanding Amazon QuickSight's core concepts- Ingesting and Preparing Data from variety of Sources-Creating and Sharing Visuals with QuickSight Analyses and dashboards-QuickSight's advanced features: ML insights and embedded

dashboards-Creating a Quicksight Visualization.

Module 5: AI AND ML IN DATA ENGINEERING ***(08 Periods)***

Enabling Artificial Intelligence and Machine Learning: Understanding the value of AI and ML for Organizations-Exploring AWS Services for ML- Exploring AWS Services for AI-Reviewing Reviews with Amazon Comprehend- Looking the Data Analytics in Big Picture-Examining examples of real-world data pipelines-Emerging Trends.

Total Periods: 45

LIST OF EXPERIMENTS: (Minimum 10 experiments shall be conducted)

1 a. Create a static website using AWS S3 Bucket

b. Implement the following AWS CLI Commands for creation and manipulation of S3 buckets

i.mb ii.ls iii.mv iv.mv v.presign vi.rb vii.rm viii.sync xi.website

2. Implement the following task related to AWS lambda function

i. Create serverless web application using AWS lambda

ii.Create a cronjob on AWS lambda to schedule the tasks at specific time'

iii.Publish Amazon CloudWatch metrics to a CSV file using AWS Lambda

iv.Create a Lambda function to process files in the S3 bucket that contain new Slack messages

3. Create ,manage and secure data lakes using AWS lake formation
4. Create a data pipeline using console templates and perform activites like viewing,editing,cloning,tagging,deactivating and deleting the pipeline
5. Perform streaming data Ingestion with AWS Kinesis
6. Build a Spark Pipeline to analyze streaming data using AWS Glue and S3
7. Create Glue DataBrew Job for cleaning and normalizing the dataset
8. Create a sample database on Amazon Redshift Cluster and perform complex queries on existing data
9. Build a serverless Workflow with AWS Step Functions.
10. Create Athena Workgroups and query S3 with SQL using AWS Athena
11. Create a dynamic dashboard using AWS Quicksight for data visualization
12. Perform sentimental analysis on any data set using Amazon Comprehend

EXPERIENTIAL LEARNING:

RESOURCES

TEXTBOOKS:

1. Gareth Eager, Data Engineering with AWS, packt Publishers, 1st Edition,2021

REFERENCE BOOKS:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc. ,1st Edition, 2022
2. **James Densemore, Data Pipelines Pocket Reference,O'Reilly Media, Inc., 1st Edition, 2022**

VIDEO LECTURES:

3. https://www.coursera.org/learn/cloud-data-engineering-duke
4. https://www.udemy.com/course/data-engineering-using-aws-analytics-services/

Web Resources:

1. https://github.com/PacktPublishing/Data-Engineering-with-AWS
2. https://www.youtube.com/watch?v=0HGzfO7hseI
3. https://www.youtube.com/watch?v=ckQ7d6ca2J0

SOFTWARE/Tools Used:

1. An Intel-compatible platform running Windows 10 /8.1/8 /7 /Vista /XP /2000 Windows server 2019 /2016 /2012 /2008 /2003
2. At least 256 MB of RAM, a mouse, and enough disk space for recovered files, image files, etc.
3. The administrative privileges are required to install and run Big Data utilities.
4. A network connection for data recovering over network.
5. A AWS Account is required for each student for implementing experiential learning.

VIDEO LECTURES:

1. https://www.youtube.com/live/KCEPoPJ8sWw?feature=share
2. https://youtu.be/bAyrObl7TYE

WEBRESOURCES:

1. https://www.simplilearn.com/introduction-to-big-data-and-hadoop-tutorial
2. https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html
3. https://www.developer.com/java/understanding-mapreduce-types-and-formats.html
4. https://prismoskills.appspot.com/lessons/System_Design_and_Big_Data/Chapter_01_-_Hadoop.jsp
5. https://www.simplilearn.com/introduction-to-zookeeper-tutorial
6. https://data-flair.training/blogs/top-hadoop-hdfs-commands-tutorial/
7. https://www.edureka.co/blog/hive-commands-with-examples
8. https://www.tutorialspoint.com/apache_pig/apache_pig_grunt_shell.htm
9. Transformations and Actions (databricks.com)

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA102029	**BUSINESS INTELLIGENCE TOOLS**	3	-	2	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course is emphasize on the fundamentals of business intelligence and tools including introduction of business intelligence and analytics, market research and operational intelligence, Agile Methodologies for BI Projects Data Modeling for BI Solutions business intelligence reporting interface and practical mastery of experiments using business intelligence open source tools.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Use different business intelligences and analyze them.

CO2. Apply market research and operational intelligence on different data sets.

CO3. Design and develop Agile Methodologies for BI Projects

CO4. Create Data Modeling for BI Solutions

CO5. Develop The BI Reporting Interface by choosing suitable BI Tool.

CO6. Work independently or in team to solve BI related problems with effective communication

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	2	2	-	2	-	-	-	-	-	3	-	3
CO3	3	3	3	3	3	-	-	-	-	-	2	-	3	-	3
CO4	2	3	3	3	3	-	-	2	-	-	-	-	3	-	3
CO5	3	3	3	3	3								3		3
CO6									3	3					
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	3	**3**	**2**	**-**	**3**	-	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction to Business Intelligence and Analytics ***(10 Periods)***

Introduction: Business Intelligence, Mobile Business Intelligence, Real-time Business Intelligence;

Analytics: Business Analytics, Software Analytics, Embedded Analytics, Learning Analytics, Predictive Analytics, Prescriptive Analytics, Social Media Analytics and Behavior Analytics.

Essential Aspects of Business Intelligence: Context Analysis, Business Performance Management, Business Process Discovery, Information System, Organizational Intelligence, Data Visualization, Data Profiling, Data Cleansing, Process Mining and Competitive Intelligence.

Module 2: Market Research and Operational Intelligence ***(08 Periods)***

Market Research: Introduction, Market Segmentation, Market Trend, SWOT Analysis, Marketing Research;

Operational Intelligence: Introduction, Business Activity Monitoring, Complex Event Processing, Business Process Management, Root Cause Analysis;

Module 3 Agile Methodologies for BI Projects ***(9 Periods)***

Introduction to Agile Methodologies, Agile Approaches : Our Recommended Mix between Scrum and Kanban, Developing Projects with Scrum, Maintenance with Kanban , Mix of Both Methodologies, Scrumban; Peculiarities of Scrum for BI, Agile Management Tools.

Data Modeling for BI Solutions:

Modeling Steps, Defining our Model, Exploring Data Modeling Possibilities: View Layer,

Data Split, Fact Normalization and Denormalization , Time Transformations , Fact Phases , Real vs. Potential , Historical Hierarchies ; Multiple Views Using a Table, Entity Isolation , Modifying Existing Structures, Adding More Sales Document Status , Data Modeling Tools : Erwin DataModeler, MySQL Workbench , Preparing the ETL.

Module 4 ETL Basics ***(9 Periods)***

Need of ETL Process, Details of the solution, Open Source ETL suites, Understanding ETL concepts.

Performance Improvements: Database Optimizations, ETL Optimizations.

Module 5 The BI Reporting Interface ***(09 Periods)***

How to Choose the BI Tool, Best Practices in Dashboarding: Starting from Top Left , Joining Related Information , Focus on Relevant Data , Formatting Recommendations, Graphic Usages; BI Tools: Microstrategy Desktop , Microsoft Power BI, Qlik Sense.

BI Process Scheduling: Finishing the ETL, PDI Command-Line Tools, Scheduling Jobs in the Task Scheduler, Running Database Maintenance Tasks.

Moving to a Production Environment: Multienvironment Scenario, Maintaining the Environment, Security, Auditing.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Power BI Desktop installation and familiarizing an Interface of Power BI. (*Study on features, architecture, building blocks, and components of Power BI*).
2. Import the data from different sources such as Excel, MySQL, SQLServer, Oracle etc. to load into Power BI and creating tables manually. (*Demonstration on getting data into Power BI Desktop*, *Data sources and modeling in Power BI*).
3. Implement Extraction, Transformation and Loading (ETL) process to create a database into MySQL/SQLServer/Power BI and then perform renaming, splitting, removing and reordering of columns; managing query groups, merge queries, SQL joins and union. (*Demonstration on data transformation*)
4. Create employee, department, and location tables using Power BI and then establish relationships between tables to display employee details such as employee name, employee no., department, date-of-join, gross salary and location. (*Demonstration on relationships*).
5. Design a dashboard to show units in stock by product and a total sale by year. (*Demonstration on List of Power BI chart types for visualization*).
6. Design a dashboard to check the total amount of sales made in each month and find out which month had the highest and lowest sales. Use a simple clustered column chart. Drag the date column on the axis and the sales on to the values then change the color of the bars by going to the format option and selecting data colors. (*Demonstration on format options of charts*).
7. Design a dashboard using a pie chart to analyze the sales made by each segment and find out which segment made the highest and lowest number of sales. Click on the pie chart option, select segment on to the legend, and sales on to the values. Create a map that depicts the sales made in each country and show the Donut chart to illustrate the profit made in each Segment. Positioning, Aligning, Sorting Visuals.
8. Design a dashboard to show sales, profits, regional cash inflows and the customers product-specific churn (stop using a product)of products over a period of time using necessary charts include Combo Charts, Bar Charts, Tables, Line Charts, Column Charts, and Point Maps. Interaction between Visuals.
9. Publish (Share or Embed) Power BI dashboards or reports that are designed on the Web (e-mail or social media).
10. Create a report that shows an employee detail such as employee name, employee no., designation, salary. In addition, create a custom column to show the stipend. If an employee designation is a manager, then the stipend should be 35% of his/her basic salary. If an employee is a senior consultant, then the stipend should be 25% of his/her basic, otherwise it should be 15% of the basic for remaining employees (*Study on DAX - Data Analysis Expressions functions include aggregate, counting, logical and date functions for creating calculated columns and measures*).

RESOURCES

TEXT BOOKS:

1. Drew Bentley, ”Business Intelligence and Analytics”, 1st edition, Library Press,2017.
2. Albert Nogues, Juan Valladares, “Business Intelligence Tools for small companies, 1st edition, APress, 2017.

REFERENCE BOOKS:

1. Swain Scheps,“Business Intelligence for Dummies”,1st edition, Wiley publishing, 2008

2. Wilfried Grossmann, Stefanie Rinderle-Ma,"Fundamentals of Business Intelligence", 1st edition, Springer Press, 2015.

3. Teo Lachev, "Applied Microsoft Power BI," Prologika, Seventh Edition, 2022.

4. Alberto Ferrari and Marco Russo, "Introducing Microsoft Power BI," Microsoft Press, 2016.

5. Brett Powel, "Mastering Microsoft Power BI," Packt Publishing, First Edition, 2018

SOFTWARE/TOOLS:

Microsoft Power BI Desktop (https://powerbi.microsoft.com/en-us/downloads/)

WEB RESOURCES:

1. https://docs.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview.
2. https://www.edureka.co/blog/power-bi-tutorial/
3. https://mindmajix.com/power-bi-visualization-types
4. https://intellipaat.com/blog/tutorial/power-bi-tutorial/
5. https://docs.microsoft.com/en-us/powerapps/maker/canvas-apps/sharepoint-scenario-build-report.
6. https://www.projectpro.io/article/power-bi-microsoft-projects-examples-and-ideas-for-practice/533

DATASET LINKS:

1. Customer segmentation (e-commerce) data - For dataset visit https://www.kaggle.com/fabiendaniel/customer-segmentation/data.
2. Financial Sample Excel workbook for Power BI - https://docs.microsoft.com/en-us/power-bi/create-reports/sample-financial-download.
3. Marketing Analytics dataset - https://www.kaggle.com/jackdaoud/marketing-data.

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA102030	Time Series Analysis	3	-	2	-	4

Pre-Requisite Machine Learning
Anti-Requisite
Co-Requisite

COURSE DESCRIPTION: This course provides a detailed discussion on
Time Series Concepts and Python, Time series analysis Exploratory Time Series Data Analysis, Stationary Time Series Models, ARMA and ARIMA Models, non-stationary time series models Modern Machine Learning Methods for Time Series Analysis, time series forecasting and tensor flow.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understanding the fundamental concepts of time series analysis and forecasting.

CO2 Perform Data Analysis using Time Series analysis methods.

CO3 Perform Data Analysis using stationary time series models.

CO4 Forecast data trends using Non-stationary Time Series Models.

CO5 Apply Deep Learning Techniques for Time Series Analysis.

CO6 Work independently or in team to solve Time Series related problems with effective communication.

CO-PO-PSO Mapping Table:

Learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3	3	
CO2	3	3	2	2	2								3	3	
CO3	3	3	2	2	2								3	3	
CO4	3	3	2	2	2								3	3	
CO5	3	3	2	2	2								3	3	
CO6									3	3					
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**				**3**	**3**			3	3	

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: TIME SERIES CONCEPTS AND PYTHON (09 Periods)

The Concept of Time Series, History of Time Series Analysis, Objectives of Time Series Analysis, The Programming Language python, Introduction and Installing, Demonstrations, Python Extension Packages and Some Usages, Time Series Moment Functions and Stationarity, Moment Functions, Stationarity and Ergodicity, Sample Autocorrelation Function, White Noise and Random Walk, Time Series Data Visualization.

Module 2: EXPLORATORY TIME SERIES DATA ANALYSIS (09 Periods)

Partial Autocorrelation Functions, Definition of PACF, Sample PACF and PACF Plot, White Noise Test, Simple Time Series Compositions, Time Series Decomposition and Smoothing, Deterministic Components and Decomposition Models, Decomposition and Smoothing Methods.

Module 3 STATIONARY TIME SERIES MODELS (08 Periods)

Introduction, Backshift Operator, Differencing, and Stationarity Test, Moving Average Models, Definition of Moving Average Models, Properties of MA Models, Invertibility, Autoregressive Models, Definition of Autoregressive Models, Durbin-Levinson Recursion Algorithm, Properties of Autoregressive Models, Stationarity and Causality of AR Models, Autoregressive Moving Average Models, Properties of ARMA Models.

Module 4 ARMA AND ARIMA MODELING AND FORECASTING (11 Periods)

Model Building Problems, Estimation Methods, The Innovations Algorithm, Method of Moments, Method of Conditional Least Squares, Method of Maximum Likelihood, Order Determination, Diagnosis of Models, Forecasting.

Nonstationary Time Series Models: The Box-Jenkins Method, Seasonal Differencing, SARIMA Models, SARIMA Model Building, REGARMA Models.

Module 5 MODERN MACHINE LEARNING METHODS FOR TIME SERIES ANALYSIS (08 Periods)

Introduction, Brief History of Artificial Intelligence, AI in Time Series Analysis, Artificial Neural Networks, Artificial Neural Network Developments, Neural Network Models, Deep Learning and Back propagation Algorithms, Gradient Descent and Backpropagation Algorithms.

Time Series Forecasting and TensorFlow: Introduction, Time Series Forecasting, TensorFlow and Keras Implementation Steps, case study on forecasting.

Total Periods: *45*

EXPERIENTIAL LEARNING

1. Fit a trend line by the method of freehand method for the given data.

Year	2000	2001	2002	2003	2004	2005	2006	2007
Sales	30	46	25	59	40	60	38	65

2. Given below are the data relating to the production of sugarcane in a district.
   Fit a straight line trend by the method of least squares and tabulate the trend values.

Year	2000	2001	2002	2003	2004	2005	2006
Prod. of Sugarcane	40	45	46	42	47	50	46

3. Compute the average seasonal movement for the following series

year	Quarterly Production			
	I	II	III	IV
2002	3.5	3.8	3.7	3.5
2003	3.6	4.2	3.4	4.1
2004	3.4	3.9	3.7	4.2
2005	4.2	4.5	3.8	4.4
2006	3.9	4.4	4.2	4.6

4. The following figures relates to the profits of a commercial concern for 8 years

Year	1986	1987	1988	1989	1990	1991	1992	1993
Profit (₹)	15,420	15,470	15,520	21,020	26,500	31,950	35,600	34,900

.

Find the trend of profits by the method of three yearly moving averages.

5. Find the trend of production by the method of a five-yearly period of moving average for the following data:

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Production('000)	126	123	117	128	125	124	130	114	122	129	118	123

The following table gives the number of small-scale units registered with the Directorate of Industries between 1985 and 1991. Show the growth on a trend line by the free hand method.

Year	1985	1986	1987	1988	1989	1990	1991	1992
No. of units (in'000)	10	22	36	62	55	40	34	50

The annual production of a commodity is given as follows :

Year	1995	1996	1997	1998	1999	2000	2001
Production (in tones)	155	162	171	182	158	180	178

Fit a straight line trend by the method of least squares.

Determine the equation of a straight line which best fits the following data

Year	2000	2001	2002	2003	2004
Sales (₹ '000)	35	36	79	80	40

Compute the trend values for all years from 2000 to 2004

The sales of a commodity in tones varied from January 2010 to December 2010 as follows:

in year 2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales (in tones)	280	240	270	300	280	290	210	200	230	200	230	210

Fit a trend line by the method of semi-average.

Use the method of monthly averages to find the monthly indices for the following data of production of a commodity for the years 2002, 2003 and 2004.

2002	15	18	17	19	16	20	21	18	17	15	14	18
2003	20	18	16	13	12	15	22	16	18	20	17	15
2004	18	25	21	11	14	16	19	20	17	16	18	20

Calculate the seasonal indices from the following data using the average from the following data using the average method:

	I Quarterly	II Quarterly	III Quarterly	IV Quarterly
2008	72	68	62	76
2009	78	74	78	72
2010	74	70	72	76
2011	76	74	74	72
2012	72	72	76	68

6. The following table shows the number of salesmen working for a certain concern:

Year	1992	1993	1994	1995	1996
No. of salesmen	46	48	42	56	52

Use the method of least squares to fit a straight line and estimate the number of salesmen in 1997.

7. Read temperature dataset with MinTemp, MaxTemp, AvgTemp, Sunrise, Sunset and apply preprocessing techniques to handle Detrending/stationary, Anomaly detection, and Missing data. Apply ARIMA model to predict future temperatures, Focus on the AvgTemp column and, and set Date as our index. Calculate the mean squared error to check how the model performance.

RESOURCES:

TEXT BOOKS:

1. Changquan Huang Alla Petukhina, Applied Time Series Analysis and Forecasting with Python, Springer, 2022.
2. Peter J. Brockwell Richard A. Davis Springe, Introduction to Time Series and Forecasting, springer, 2nd Edition, 2001.

REFERENCE BOOKS:

1. Douglas C. Montgomery Cheryl L. Jennings Murat Kulahci, Introduction to Time Series Analysis and Forecasting, Wiley Series, 2nd Edition, 2015.

WEB REFERENCES:

1. https://www.analyticsvidhya.com/blog/2021/10/a-comprehensive-guide-to-time-series-analysis/
2. https://link.springer.com/chapter/10.1007/978-3-030-57805-3_26
3. https://www.brainkart.com/article/Exercise-9-1--Time-Series-Analysis-and-Measurements-of-Trends_39020/

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ch28/preview
2. https://www.udemy.com/course/machine-learning-time-series-forecasting-in-python/
3. https://www.coursera.org/learn/machine-learning-accounting-python

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CA101030	PREDICTIVE ANALYTICS	3	-	-	-	3

Pre-Requisite Machine Learning

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This Course provides a detailed discussion on Overview of Predictive analytics, Predictive Modeling, Data understanding, Data preparation, Item sets and Association Rules, Descriptive modeling, Assessing Predictive Models.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on the basics of Predictive Analytics and Modelling.
CO2. Analyze the insights of data using data visualization and preparation methods for improved decision making.
CO3. Apply data pre-processing techniques to prepare data for predictive analytics.
CO4. Identify patterns in categorical data and build descriptive models using Association rules, Principal Component Analysis and Clustering algorithms.
CO5. Identify and deploy appropriate predictive models using batch approach, Regression and Ensemble Models to improve corporate operations.

CO-PO-PSO Mapping Table

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	3										
Average	3	2	2	**2**	**3**		-	-	-	-	-	-	3	3	3
Course Correlation Level	3	2	2	**2**	**3**		-	-	-	-	-	-	3	3	3

Correlation Level: 3-High 2-Medium 1-Low

COURSE CONTENT:

Module–1: INTRODUCTION (9 periods)

Overview of Predictive Analytics: Analytics, Predictive Analytics, Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Challenges in Using Predictive Analytics, Educational Background. Setting up the Problem: Predictive Analytics Processing Steps, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, and Case Study: Recovering Lapsed Donors and Fraud Detection.

Module-2: DATA UNDERSTANDING (8 periods)

What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.

Module-3: DATA PREPARATION (8 periods)

Variable Cleaning: Incorrect Values, Consistency in Data Formats, Outliers, Multi-dimensional Outliers, Missing Values, Fixing Missing Data. Feature Creation: Simple Variable Transformations, Fixing Skew, Binning Continuous Variables, Numeric Variable Scaling, Nominal Variable Transformation, Ordinal Variable Transformations, Date and Time Variable Features, ZIP Code Features, Multidimensional Features, Variable Selection Prior to Modelling, Sampling.

Module-4: ASSOCIATION RULES AND DESCRIPTIVE MODELING (10 periods)

Item sets and Association Rules: Terminology, Condition, Left-Hand-Side, Antecedent, Right-Hand-Side, Consequent, Output, Conclusion, Rule (Item Set), Support, Antecedent Support, Confidence, Accuracy, Lift. Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules.
Descriptive Modeling: Data Preparation Issues with Descriptive Modeling, Principal Component Analysis, Clustering Algorithms.

UNIT–V: PREDICTIVEMODELING (10 periods)

Predictive Modeling and Assessing Predictive Models: Batch Approach to Model Assessment, Assessing Regression Models. Model Ensembles: Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam's razor, Interpreting Model Ensembles. Model Deployment, Help Desk Case Study.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Develop a case study on Healthcare prediction using Predictive Analytics
2. How predictive analytics will enable Customer Churn Prediction.
3. Prepare a Report on Challenges that Organizations need to face with Predictive analytics.
4. Demonstrate how Privacy and Security can be ensured in Predictive Analytics.

RESOURCES:

TEXT BOOK:

1. DeanAbbott-AppliedPredictiveAnalytics_PrinciplesandTechniquesfortheProfessional DataAnalyst-Wiley,2014.

REFERENCE BOOKS:

1. Siegel, Eric, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.
2. Theobald, Oliver, Data Analytics for Absolute Beginners Cengage Learning, 2nd Edition,2019.
3. Bari, A., Chaouchi, M., Jung, T. Analytics for Dummies, 2nd Edition, 2016.

VIDEO LECTURES

- https://onlinecourses.nptel.ac.in/noc21_mg86
- http://www.nitttrc.edu.in/nptel/courses/video/110104086/L08.html
- https://www.coursera.org/articles/predictive-analytics
- https://onlinecourses.swayam2.ac.in/imb20_mg19
- https://nptel.ac.in/courses/110105089

WEB RESOURCES:

- https://www.investopedia.com/terms/p/predictive-analytics.asp
- www.ibm.com/topics/predictive-analytics
- https://cloud.google.com/learn/what-is-predictive-analytics
- https://www.mathworks.com/discovery/predictive-analytics

UNIVERSITYELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101701	**AI IN HEALTHCARE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the fundamental concepts of AI in Healthcare sector.

CO2 Analyse the present state and future of AI in Healthcare specialties for different scenarios.

CO3 Apply design concepts and metrics for AI in Healthcare.

CO4 Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.

CO5 Develop AI applications through AI techniques for healthcare

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	2	2	-	-	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-	-
CO5			3									
Course Correlation Mapping	2	-	3	2	2	2	2	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE ***(08 Periods)***

Introduction to AI in Healthcare, Benefits & Risks, AI in the health sector, AI versus human intelligence, The future of AI in health sector, AI & Neural networks.

Module 2: THE PRESENT STATE & FUTURE OF AI IN HEALTHCARE SPECIALTIES ***(10 Periods)***

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE ***(08 Periods)***

IBM Watson, The role of Google & Deep mind in AI in Healthcare, Baidu, Facebook & AI in Healthcare, Microsoft & AI in Healthcare.

Module 4: FUTURE OF HEALTHCARE IN AI ***(10 Periods)***

Evidence-based medicine, personalized medicine, Connected medicine, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Incentivized Wellness, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals.

Module 5: APPLICATIONS OF AI IN HEALTHCARE ***(09 Periods)***

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering A Scalable and Engaging Digital Therapy.

Case Study 4: Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy.

Case Study 5: Big Data, Big Impact, Big Ethics: Diagnosing Disease Risk from Patient Data.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Analyze how the artificial intelligence is used to predict the disease result and Prognosis Assessment of a patient.
2. How does drug discovery happen and how does AI is helping in drug discovery and Labs.
3. Justify that artificial intelligence provide engineering solutions for early detection andDiagnosis of diseases.
4. Demonstrate the prediction of bladder volume of a patient.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare*, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, *Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, First Edition 2019.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=-aHBwTQQyNU
2. https://intellipaat.com/blog/artificial-intelligence-in-healthcare/

Web Resources:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/
2. https://www.ibm.com/topics/artificial-intelligence-healthcare
3. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CM101701	**BANKING AND INSURANCE**	3	-	-	-	3

Pre-Requisite

Anti-Requisite

Co-Requisite

COURSE DESCRIPTION: Introduction to Banking; Bank-Customer Relationship; Electronic Payment System and Business Models; Introduction to Risk and Insurance; Insurance Overview.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the importance of Banking and functions of the Reserve Bank of India and its role in the country's sustainable development.

CO2 Demonstrate the role, relationships, and operations between Banker and Customer.

CO3 Demonstrate the Online Banking system, various types of Electronic Payments, and Business models.

CO4 Demonstrate the concept of risk and principles, functions, and, types of Insurance companies.

CO5 Understand the principles of insurance and its functions.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3							2				1
CO2	3							2				1
CO3	3							2				1
CO4	3							2			1	1
CO5	3							2			1	1
Course Correlation Mapping	**3**							**2**			**1**	**1**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO BANKING ***(09 Periods)***

Meaning - Importance of banking- Functions of banking - Reserve Bank of India: Functions – Role of RBI in sustainable development.

Module 2: BANK-CUSTOMER RELATIONSHIP (09 Periods)

Debtor-creditor relationship, deposit products or services, payment, and collection of cheques. Accounts – Types of accounts, the procedure for opening and closing an account - Loans and Advances- principles of lending.

Module 3 ELECTRONIC PAYMENT SYSTEM&BUSINESS MODELS (09 Periods)

Introduction to Online Banking - types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards. **Business models**- B2B, B2C, C2C, and B2G.

Module 4 INTRODUCTION TO RISK AND INSURANCE (09 Periods)

Insurance: Definition, Insurance as risk mitigation mechanism, elements of insurance. Concept of risk, risk *Vs* uncertainty.

Module 5 INSURANCE OVERVIEW ***(09 Periods)***

Principles of insurance - insurance types - LIC & GIC – insurance functions, IRDA - Insurance Players in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Make a PowerPoint presentation on the banking system in India.
2. Submit a report on the working of insurance companies.
3. Prepare a report on the functions of RBI & IRDA in India.
4. Submit a report on electronic banking facilities provided by Indian banks.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. RanganadhaChary, A.V. and Paul, R.R., *Banking and Financial system*, Kalyani

Publisher, New Delhi, 3rdedition, 2016.
2. Sharma, R.K., Shashi K. Gupta and Jagwant Singh, *Banking and Insurance*, Kalyani Publishers, New Delhi, 17th edition, 2014

REFERENCES BOOKS:

1. *Indian Institute of Banking & Finance, Digital Banking*, Taxman Publications Pvt. Ltd., 2016 edition, 2016.
2. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning Pvt. Ltd., 2nd edition, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a1_p8zhbAfE
2. https://www.youtube.com/watch?v=bxNw9VB5Y_0

WEB RESOURCES:

1. https://unacademy.com/content/railway-exam/study material/economics/importance-of-banking-sector-in-the-country/
2. https://www.geeksforgeeks.org/ life-insurance-meaning-elements-and-types-of-life-insurance-policies/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS101701	BIOINFORMATICS	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course focus onBiological Data Acquisition, Databases, Data Processing, Methods of Analysis, Applications of Bio-informatics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand basic biological data acquisition in bioinformatics.
CO2 Identify the proper databases for the information search by choosing the biological databases and also submission and retrieval of data from databases.
CO3 Analyze the results of bioinformatics data using text and sequence-based searching techniques.
CO4 Analyze the secondary and tertiary structures of proteins by applying different alignment programs
CO5 Design biological databases by using contextual knowledge on bioinformatics.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	3	3	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	3	3	-	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BIOLOGICAL DATA ACQUISITION ***(09 Periods)***

Biological information, Retrieval methods for DNA sequence, protein sequence and protein structure information

Module 2: DATABASES ***(09 Periods)***

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary and secondary sequence databases, protein sequence and structure databases.

Module 3: DATA PROCESSING ***(09 Periods)***

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local and global. Distance metrics. Similarity and homology. Scoring matrices, PAM and BLOSUM

Module 4: METHODS OF ANALYSIS ***(09 Periods)***

Dynamic programming algorithms, Needleman-Wunsch and Smith-waterman.Heuristic Methods of sequence alignment, FASTA and BLAST; Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment, CLUSTAL program, Prediction of Tertiary structure of proteins.

Module 5: APPLICATIONS ***(09 Periods)***

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis, Genomics, Proteomics, Genome analysis – Genome annotation, DNA Microarray, computer aided drug design (CADD).

Total Periods: 45

EXPERIENTIAL LEARNING

1. Calculate the dynamic programming matrix and one or more optimal alignment(s) for the sequences GAATTC and GATTA, scoring +2 for a match, −1 for a mismatch and with a linear gap penalty of d = 2.
2. Determine whether the RNA string GGACCACCAGG should be folded into two substructures.
3. Discuss how to carry out the multiple sequence alignment of the following three sequences: TTTTAAAA, AAAACCCC, CCCCTTTT.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Lesk, A. K., *Introduction to Bioinformatics*, Oxford University Press, 4th Edition, 2013
2. Dan Gusfield, *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Cambridge University Press, 1997.

REFERENCE BOOKS:

1. Baldi, P. and Brunak, S., *Bioinformatics: The Machine Learning Approach*, MIT Press, 2nd Edition, 2001.
2. Mount, D.W., *Bioinformatics Sequence and Genome Analysis*, Cold Spring Harbor Laboratory Press, 2nd Edition, 2004.
3. Tindall, J., *Beginning Perl for Bioinformatics: An introduction to Perl for Biologists*, O'Reilly Media, 1st Edition, 2001.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=liNblw4x50E
2. https://www.youtube.com/watch?v=eZfyWdHnzR0

WEB RESOURCES:

1. https://www.britannica.com/science/bioinformatics
2. https://www.ebi.ac.uk/training/online/courses/bioinformatics-terrified/what-bioinformatics/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101701	**CONSTITUTION OF INDIA**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides and in-depth knowledge about Constitution of India's Preamble and its Philosophy; Union Legislature; Federalism in India; Judiciary and Public Services; Nation Building. The students can gain first-hand information and knowledge about these dynamics and accordingly act based on these sources in their professional and routine activities.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge in the Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.

CO2: Apply the reasoning informed by the various aspects of the Constitution and its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	3	2	-	-	-	-	-
CO2	2	-	-	-	-	3	-	3	-	-	-	-
Course Correlation Mapping	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: PREAMBLE AND ITS PHILOSOPHY *(9 Periods)*

Introduction to Indian Constitution; Evolution of Indian Constitution; preamble and its philosophy

Module 2: UNION LEGISLATURE *(9 Periods)*

The Parliament, Parliamentary Structure, Process of Legislation; President of India – Powers and Functions; Prime Minister and Council of Ministers; Constitution Amendment Procedure.

Module 3: FEDERALISM IN INDIA ***(9 Periods)***

Centre-State Administrative Relationship; Governors – Powers and Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions; The Election Commission – Powers and Functions.

Module 4: JUDICIARY AND PUBLIC SERVICES ***(9 Periods)***

The Union Judiciary - Supreme Court and High Court; Fundamental Rights and Duties All India Services - Central Civil Services -State Services - Local Services.

Module 5: INTERNATIONAL PARTICIPATION ***(9 Periods)***

Foreign Policy of India; International Institutions Influence: UNO, WTO, WHO, SAARC, International Summits: BRICS, NSS, UNEP – India's Role in International Negotiations; Environmentalism in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Review newspapers and submit a report on critical analysis of Indian Civil Servants exercise of powers, in the awake of constitutionally assigned authority.
2. Visit your village Panchayat office or Municipality office and generate a report on your observations about maintained Constitutional symbolism.
3. Watch few videos on recent Indian Independence Day and Republic Day celebrations as marked in New Delhi and present a detailed report, by considering the following aspects:
    a) Comparatively analyze the speeches of the President of India and Prime Minister of India as delivered on these two occasions.
    b) Compare these two events relevance in terms of Indian Armed Forces presence.
    c) Observe, compare and analyse 'flag code' relevance as marked in these two events.
4. Watch a few videos on recent 'proceedings' of any state Legislative Assembly session and submit a detailed report.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005

REFERENCE BOOKS:

1. Mahendra Pal Singh,V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011.
2. Pandey J. N., *Constitutional Law of India*, Central Law Agency, 1998

VIDEO LECTURES:

1. Doctrine of Basic Structure: https://www.youtube.com/watch?v=cvUf9ZeEe8Y
2. Significance of the Constitution: https://www.youtube.com/watch?v=vr1Dc_-ZKbQ

Web Resources:

1. The Constitution of India: https://www.youtube.com/watch?v=of2SoO8i8mM
2. Protection of Constitutional Democracy: https://www.youtube.com/watch?v=smJ99cdPrns

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CM101702	**COST ACCOUNTING AND FINANCIAL MANAGEMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Cost accounting; cost sheet & preparation of cost sheet; standard costing & variance analysis; financial management & ratio analysis; introduction to investment**.**

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the concepts of Cost Accounting and Management Accounting and the elements of costing.

CO2 Determine the Cost of Production for pricing decisions.

CO3 Apply the Standard Costing and Variance techniques for the control of the cost of production

CO4 Analyze the Profitability and financial condition of an organization using Ratios.

CO5 Apply Capital Budgeting techniques for making investment decisions in an organization.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3				2			1				
CO2	3				2			1			1	
CO3	3				2			1			1	
CO4	3				2			1			1	
CO5	3				2			1				
Course Correlation Mapping	**3**				**2**			**1**			**1**	

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: COST ACCOUNTING ***(09 Periods)***

Meaning of Cost and Cost Accounting, Objectives, Scope, Advantages, and Disadvantages – Cost Accounting *Vs* Management Accounting – Elements of Costing – Installation of costing system – Material Control, Labor Control, Overhead Control.

Module 2: COST SHEET & PREPARATION OF COST SHEET (09 Periods)

Analysis of Cost – Preparation of cost sheet, estimate, tender, and quotation (Simple problems) – Importance of Costing while pricing the products

Module 3 STANDARD COSTING & VARIANCE ANALYSIS (09 Periods)

Introduction to Standard Costing & Variances – Variance Analysis: Material variances, Labor variances (Simple Problems).

Module 4 FINANCIAL MANAGEMENT & RATIO ANALYSIS (09 Periods)

Meaning, Objectives - Nature and Scope, Importance of FM – Ratio Analysis**:** Types of Ratios: Solvency Ratios, Liquidity Ratios, Turnover Ratios, and Profitability Ratios - Financial Statement Analysis through Ratios (Simple Problems).

Module 5 INTRODUCTION TO INVESTMENT ***(09 Periods)***

Investment - Meaning and Definition- concept of risk and returns - Capital budgeting techniques – Security Analysis and Portfolio Management (Basic concepts).

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a report on the role of cost accountants in the growth of a company.
2. To visit the manufacturing unit to observe how they used various techniques for analyzing the financial health of a company.
3. Prepare a report on factors influencing the form of business organization.
4. Prepare the cost sheet with practical examples of any two manufacturing companies.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. S.P. Jain and K.L. Narang: *Cost Accounting*, Kalyani Publishers, Ludhiana, 10th edition, 2016.
2. I.M. Pandey, *Financial Management*, Vikas Publishing House Pvt. Ltd., 14th edition, 2016.

REFERENCE BOOKS:

1. The Institute of Company Secretaries of India, *Cost and Management Study Material*, New Delhi.
2. CA Saravana Prasath, *Cost Accounting and Financial management*, Wolters Kluwer India Pvt. Ltd., New Delhi,2018.

VIDEO LECTURES:

1 https://www.youtube.com/watch?v=ESqO8sFgQa0&list=PLLhSIFfDZcUVE2kzOhEubO9rkvUOAgZbz

2 https://www.youtube.com/watch?v=tzasFmP1CpAhttps://www.youtube.com/watch?v=tzasFmP1CpA

WEB RESOURCES:

1 https://www.tutorialspoint.com/accounting_basics/management_versus_cost_accounting.htm

2 https://www.netsuite.com/portal/resource/articles/financial-management/financial-management.shtml

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101701	CYBER LAWS AND SECURITY	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing ad Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber
Crime and Terrorism; Cyber Crime Illustrations

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Cyber security, Cybercrimes and its related laws in Indian and Global Act.
CO2. Analyze the legal perspectives and laws related to cybercrimes in Indian context.
CO3. Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.
CO4. Solve Cyber security issues using privacy policies and Use antivirus tools to minimize the impact of cyber threats.
CO5. Apply security standards for the implementation of Cyber Security and laws.

CO-POMapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	3	2	3									
CO4	3	2	3									
CO5	3	2	2									
Course Correlation Mapping	**3**	**2**	**3**									

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO CYBER CRIMES AND OFFENSES ***(09 Periods)***

Cyber Crimes: Introduction, Definition, Origin, Cybercrime and information security, Cyber criminals, Classifications of cybercrimes, The legal perspectives and Indian perspective, Cybercrime and Indian ITA 2000, Global perspective on cybercrimes.
Cyber Offenses: Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

Module 2: TOOLS AND METHODS USED IN CYBER CRIME AND PHISHING AND IDENTITY THEFT ***(09 Periods)***

Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.

Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Module 3 CYBER CRIMES AND CYBER SECURITY-LEGAL PERSPECTIVES ***(08 Periods)***

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cybercrime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber law, Technology and Students in India scenario.

Module 4 CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS ***(10 Periods)***

Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

Module 5 CYBER CRIME AND TERRORISMAND ILLUSTRATIONS ***(09 Periods)***

Cyber Crime & Terrorism: Introduction, Intellectual property in the cyber space, The ethical dimension of cybercrimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.

Cyber Crime Illustrations: Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The Cyber Security Risks on Social Media – Learn from Case Studies: https://www.rswebsols.com/tutorials/internet/cyber-security-risks-social-media
2. SIX automates key cybersecurity tasks to actively protect itself against social media threats: https://www.hootsuite.com/resources/six-group-case-study
3. Important Cyber Law Case Studies :https://www.cyberralegalservices.com/detail-casestudies.php

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Nina Gobole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.

REFERENCE BOOKS:

1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.
2. Alfred Basta and et al, *Cyber Security and Cyber Laws*, Cengage Learning India 2018

VIDEO LECTURES:

1. Learn Cyber Security | Cyber Security Training: https://www.youtube.com/watch?v=PlHnamdwGmw
2. Cyber Security For Beginners: https://www.youtube.com/watch?v=4RE4d23tDFw

WEB RESOURCES:

1. https://study.com/academy/course/computer-science-110-introduction-to-cybersecurity.html
2. https://www.pandasecurity.com/en/mediacenter/panda-security/types-of-cybercrime/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MG101701	**ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: To understand the setting up and management of MSMEs and initiatives of Government and other institutions support for growth and development of MSMEs

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basic of SME and challenges of MSMEs
CO2. Explain the opportunities to Set-Up SSI/SME Units and role of rural & women entrepreneurship.
CO3. Illustrate roles of various institutions supporting MSMEs.
CO4. Understand Management of MSME, NPA & sickness units
CO5. Evaluate role of Government in Promoting Entrepreneurship

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	2	-	-		2		1			-
CO3	2	2	1	-	-	-	-	1	-	-	2	
CO4	3	1	2	-	-	-	-	-	-	-	-	2
CO5	2	2	1	-	-	1	-	-	-	-	-	1
Course Correlation Mapping	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	1	**-**	**2**	**2**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: Introduction2 ***(07 Periods)***

Concept & Definition, Role of Business in the modern Indian Economy SMEs in India, Employment and export opportunities in MSMEs. Issues and challenges of MSMEs

Module 2: MSME Setting ***(09 Periods)***

Identifying the Business opportunity, Business opportunities in various sectors, formalities for setting up an enterprise - Location of Enterprise – steps in setting up an enterprise – Environmental aspects in setting up, Incentives and subsidies.

Module 3: MSMEs Supporting Institutions ***(09 Periods)***

Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions, Central level institutions, State level institutions, Other agencies, Commercial Bank – Appraisal of Bank for loans

Module 4: Management of MSME ***(10 Periods)***

Management of Product Line; Communication with clients – Credit Monitoring System - Management of NPAs - Restructuring, Revival and Rehabilitation of MSME, Problems of entrepreneurs – sickness in SMI – Reasons and remedies –– Evaluating entrepreneurial performance

Module 5: Entrepreneurship Promotion ***(10 Periods)***

MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB)

Total Periods: 45

EXPERIENTIAL LEARNING

4. Present a case study on MSMEs Business Strategies.
5. Collect the data about nearby MSMEs and Present their structures in a PPT
6. Discuss in the group MSMEs opportunities in terms of Orientation and Develop mentation.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

2 Vasant Desai, *Small Scale Industries and Entrepreneurship*, Himalaya Publishing House, 2003..

3 Poornima M Charanthimath, *Entrepreneurship Development Small Business Enterprises*, Pearson, 2006.

REFERENCE BOOKS:

20. SumanKalyanChaudhury, *Micro Small and Medium Enterprises in India Hardcover*, Raj Publications, 2013.
21. Aneet Monika Agarwal, *Small and medium enterprises in transitional economies, challenges and opportunities*, DEEP and DEEP Publications
22. Paul Burns & Jim Dew Hunt, *Small Business Entrepreneurship*, Palgrave Macmillan publishers, 2010.

VIDEO LECTURES:

1. https://sdgs.un.org/topics/capacity-development/msmes
2. https://blog.tatanexarc.com/msme/msme-schemes-in-india-for-new-entrepreneurs-and-start-ups/

Web Resources:

6. ncert.nic.in/textbook/pdf/kebs109.pdf
7. https://www.jetir.org/papers/JETIR1805251.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101702	**ENVIRONMENTAL POLLUTION AND CONTROL**	3	-	-	-	3

Pre-Requisite ---

Anti-Requisite ---

Co-Requisite ---

COURSE DESCRIPTION: This course provides a detailed discussion on fundamentals of air pollution, dispersion of pollutants, effects and control of air pollution, water pollution, soil pollution and control, and municipal solid waste management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze air and noise pollution using appropriate tools and techniques to solve complex environmental issues following relevant standards considering society, environment and sustainability besides communicating effectively in graphical form.

CO2 Analyze air and noise pollution control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO3 Analyze water pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO4 Analyze soil pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO5 Analyze solid waste and its management measures using appropriate tools and techniques to solve solid waste disposal issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	2	2	3	3	2	-	1	-	-
CO2	2	3	-	2	2	3	3	2	-	1	-	1
CO3	2	3	-	2	2	3	3	2	-	1	-	1
CO4	2	3	-	2	2	3	3	2	-	1	-	1

CO5	2	3	-	2	2	3	3	2	-	1	1	1
Course Correlation Mapping	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**-**	**1**	**1**	**1**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: AIR AND NOISE POLLUTION ***(08 Periods)***

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.
Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise, Noise standards.

Module 2: AIR AND NOISE POLLUTION CONTROL ***(10 Periods)***

Self-cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution, Case studies, Latest developments in the air and noise pollution control.

Module 3: WATER POLLUTION AND CONTROL ***(10 Periods)***

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment process and disposal – Primary, Secondary, Tertiary; Case studies, Latest developments in the water pollution control.

Module 4: SOIL POLLUTION AND CONTROL ***(08 Periods)***

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Soil quality standards, Case studies, Latest developments in the soil pollution control.

Module 5: MUNICIPAL SOLID WASTE MANAGEMENT ***(09 Periods)***

Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation; Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept, Recovery and recycling and Energy Recovery; Latest developments in solid waste management.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Explain plume patterns due to air pollution and meteorology effects and draw a neat sketch of plume pattern from any chimney that you have observed in recent times.

2. Compare the different air pollution control equipment used in India and draw a neat sketch line diagram of equipment you have seen in any of your industrial visit.

3. Submit a study report on Coagulation, Flocculation, Sedimentation, Filtration and Disinfection in your own words after watching a YouTube video on water treatment.

4. Enumerate the effective measures to control soil pollution with any two case studies.

5. Submit a report on case studies on the use of 6Rs concept of Municipal Solid Waste Management.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.
2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution,* Tata McGraw–Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution,* Academic Press (Elsevier), 5th Edition, 2014.
3. S. M. Khopkar, *Environmental Pollution Monitoring and Control,* New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, *Environmental Engineering*, DhanpatRai& Co. Pvt. Ltd., New Delhi, 2014.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/123/105/123105001/
2. https://archive.nptel.ac.in/courses/105/107/105107213/
3. https://archive.nptel.ac.in/courses/103/107/103107084/

WEB RESOURCES:

1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200501211601643 5Ranv

ijay-Pratap-Singh-Environmental-Pollution.pdf

2. https://www.deshbandhucollege.ac.in/pdf/resources/1585622878_HIST_(HONS.)_II_Env-Pollution.pdf
3. https://www.jica.go.jp/jica-ri/IFIC_and_JBICI-Studies/english/publications/reports/study/topical/health/pdf/health_08.pdf
4. https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/proceeding_of_short-term_training/diploma/Environmental_Sciences_May_24-28_2007/Lecture_notes/Env_Pollution-rb.pdf
5. https://anits.edu.in/online_tutorials/es/Unit%203.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101702	**INTRODUCTION TO ETHICAL HACKING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on ethical hacking overview, role of security and penetration testers, foot printing, reconnaissance and scanning networks, enumeration and vulnerability analysis, system hacking, network protection systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand and recognize role of security and penetration testers to protect the system from malware attacks.

CO2. Apply the foot printing tools to find the vulnerabilities in the system.

CO3. Analyze vulnerabilities to find the system security loopholes or flaws in networked systems within a given range of IP

CO4. Apply the web attackers tools to assess the website's security

CO5. Identify the possible incidents and threats, alert administrators, and prevent potential attacks using IDS

CO-POMapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-
CO5	3	2	3	2								
Average	3	3	3	2								
Course Correlation mapping	**3**	**3**	**3**	**2**								

Correlation Levels: 3: High; 2: Medium;1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(10 Periods)***

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, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

Module 2: FOOT PRINTING, RECONNAISSANCE AND SCANNING ***(09 Periods)*** **NETWORKS**

Foot printing Concepts, Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Foot printing through Social Engineering, Foot printing Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall

Module 3: ENUMERATION AND VULNERABILITY ANALYSIS ***(09 Periods)***

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.

Module 4: SYSTEM HACKING ***(10 Periods)***

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.

Module 5: NETWORK PROTECTION SYSTEMS ***(07 Periods)***

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 Periods: 45

EXPERIENTIAL LEARNING

1. List out various ways usedto Protect Yourself from Hackers.
2. Demonstrate how do White Hackers work?
3. Demonstrate The bug bounty program.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

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. Patrick Engebretson, *The Basics of Hacking and Penetration Testing*, SYNGRESS, Elsevier, 2013.

REFERENCE BOOKS:

1. Dafydd Stuttard and Marcus Pinto, *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*,Wiley, 2nd Edition, 2011.
2. Justin Seitz, *Black Hat Python: Python Programming for Hackers and Pentesters*, 2nd Edition, 2014.

VIDEO LECTURES:

1. https://www.coursera.org/learn/ethical-hacking-essentials-ehe
2. https://www.udacity.com/course/ethical-hacker-nanodegree--nd350

WEB RESOURCES:

1. https://github.com/PacktPublishing/Python-Ethical-Hacking
2. https://www.youtube.com/watch?v=x3IwvPvDpKE

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101703	**FORENSIC SCIENCE**	3	-		-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Forensic Science, Tools and Techniques in Forensic Science, Forensic Photography, Crime Scene Management, Crime Scene Management Laws and Forensic Science.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1 Understand the basic concepts of Forensic science.
CO2 Apply various tools and techniques in forensic science for crime investigation.
CO3 Understand Forensic Photography fundamentals.
CO4 Perform Crime scene investigation, scene reconstruction and prepare reports.
CO5 Understand Legal aspects of Forensic Science.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3	3	2	2	2							
CO3	3	3										
CO4	3	3	2	2	2							
CO5	3	3	2	2	2							
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**							

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION ***(09 Periods)***

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science,

Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

Module 2: TOOLS AND TECHNIQUES IN FORENSIC SCIENCE ***(09 Periods)***

Basic principles of microscopy, spectroscopy, chromatography, Electrophoresis, Enzyme_Linked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies; Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance. Analysis of variance, Correlation and Regression.

Module 3: FORENSIC PHOTOGRAPHY ***(8 Periods)***

Basic principles of Photography, Techniques of black & white and color photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

Module 4: CRIME SCENE MANAGEMENT ***(11 Periods)***

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences, Chain of custody and Reconstruction of scene of crime. Report writing.

Module 5: LAW AND FORENSIC SCIENCE ***(8 Periods)***

Legal aspects of Forensic Science: Forensic Science in the Criminal Justice System, The Criminal Investigation Process, Production of Evidence: The Subpoena, The Rules of Evidence, Authentication of Evidence: The Chain of Custody, The Admissibility of Evidence, Laboratory Reports, Examples of Analysis and Reports, Expert Testimony, Getting into Court, Testifying, Being a Witness and an Expert, Considerations for Testimony.

Total Periods: 45

EXPERIENCIAL LEARNING

1. Study of Computer Forensics and different tools used for forensic investigation
2. Identify and list the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Houck M.M and Siegel J.A, *Fundamentals of Forensic Science*, Elsevier, 2nd edition, 2010.
2. Sharma B.R, *Forensic Science in Criminal Investigation and Trials*, Universal Publishing Co., New Delhi, 2003.

REFERENCE BOOKS:

1. Nanda B.B and Tewari, R.K, *Forensic Science in India- A vision for the Twenty First Century*, Select Publisher, New Delhi, 2001.
2. James, S.H and Nordby, J.J, *Forensic Science- An Introduction to Scientific and Investigative Techniques*, CRC Press, USA, 2003.
3. Saferstein, Criminalistics, *An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
4. Barry, A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, NewYork, 7th edition, 2003.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106178
2. https://www.youtube.com/watch?v=X5fo1H7bc0g

WEB RESOURCES:

1. https://www.nist.gov/forensic-science
2. https://www.coursera.org/learn/forensic-science

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101702	**GENDER AND ENVIRONMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the Family & Community, Gender and sustainable development, Gender in environmental justice, Gender & Environmental Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Apply the knowledge of gender & environmental connections by analyzing key issues and topics within global environmental politics in environmental decision-making.

CO2 Demonstrate knowledge of the concepts of gender and sustainable development through debates and policy documents.

CO3 Analyze the concept of environmental security and justice by identifying the sources of insecurity.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	-	-	-	3	3	-	-	-	-	-
CO2	3	-	-	-	-	2	3	1	-	2	-	-
CO3	3	1	-	-	-	3	3	-	-	-	-	2
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**3**	**3**	**1**	**-**	**2**	**-**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: GENDER AND ENVIRONMENT RELATIONSHIP ***(09 Periods)***

Introduction – Gender and Environment – Development of gender roles – Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism – Cultural eco-feminism – Social eco-feminism – Feminist political ecology

Module 2: GENDERED ROLES IN THE FAMILY & COMMUNITY ***(09 Periods)***

Organization of the household – Domestic division of labour – Food: growing, harvesting, shopping, preparing, and cooking

Gender & Power – Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

Module 3: GENDER AND SUSTAINABLE DEVELOPMENT ***(09 Periods)***

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development

Module 4: GENDER IN ENVIRONMENTAL JUSTICE ***(09 Periods)***

Normative Concerns (Fairness, Inequality & Justice) –Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender &Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

Module 5: GENDER AND ENVIRONMENTAL SECURITY ***(09 Periods)***

Connections between security & the environment – **Gender, environment & security:** Sustainability as security – poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security - **Case Study** – The impacts of natural disasters

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on the family setup of different countries and their peculiar customs.
3. Prepare poster presentation on "Ancient hominin walked like a human but climbed like an ape."
4. Find out the problems of present society and being part of future generations how you may help to strengthen environmental security.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment,* Polity Press, Cambridge, UK. 2017
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London. 2000

REFERENCE BOOKS:

1. Promillakapur ed., *Empowering Indian Women*, Publication Division, Government of India, New Delhi. 2000.
2. Ronnie Vernooy, Ed., *Social and Gender Analysis Natural Resource Management:*

Learning Studies and Lessons from Asia, Sage, New Delhi. 2006

3. Swarup Hemlata and Rajput, Pam, *Gender Dimensions of Environmental and Development Debate: The Indian Experience,* In Sturat S. Nagel, (ed). *India's Development and Public Policy*. Ashgate, Burlington. 2000

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=BRMvBWaQLVk
2. https://www.youtube.com/watch?v=U3mqFizVkaE

WEB RESOURCES:

1. https://www.uncclearn.org/courses/open-online-course-on-gender-and-environment/
2. https://www.genevaenvironmentnetwork.org/resources/updates/gender-and-the-environment/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101701	GLOBAL STRATEGY AND TECHNOLOGY	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Introduction to strategic management; Strategic management process; Principles of good strategy; Globalization strategies; Research and Development strategies; Technology Management and Transfer; Elements of Transfer Process; Corporate Governance in the Indian scenario.

COURSE OUTCOMES:

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

CO1 Demonstrate the knowledge on strategic management, its approaches, and tools through ethical decision making.

CO2 Analyse the globalization challenges for scrupulous selection of globalization strategies.

CO3 Apply the R&D strategies and trends to enhance the technological breakthroughs for new products and applications.

CO4 Demonstrate the knowledge on technology management and transfer that strengthen the economy and accelerate the application of technology and resources.

CO5 Analyze the challenges of corporate governance in Indian scenario for the effective development of value-oriented organizations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	1	1	-	1	-	-	1	-
CO2	3	2	1	-	1	1	-	-	-	-	1	-
CO3	3	2	1	-	1	1	-	-	-	-	1	-
CO4	3	2	1	-	1	1	-	-	-	-	1	-
CO5	3	2	1	-	1	1	-	1	-	-	1	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: STRATEGIC MANAGEMENT (09 Periods)

Introduction, Classes of decisions, Levels of strategy, Core competence, Strategic intent and stretch, Approaches to strategy making, Roles of different strategists, Strategic

Management-Process, Benefits, Limitations; Ethics in strategic decision making, Principles of good strategy, Strategic Management in India; Common managerial strategy formulation tools.

Module 2: GLOBALIZATION (09 Periods)
Definition, Stages, Essential conditions for globalization, Globalization strategies, Competitive advantage of Nations and regions, Factors affecting Globalization, Globalization of Indian business.

Module 3: RESEARCH & DEVELOPMENT STRATEGIES (09 Periods)
Concept, Evolution of R and D Management, R and D as a business, R and D as competitive advantage, Elements of R and D strategies, Integration of R and D, Selection and implementation of R and D strategies, R and D trends and challenges.

Module 4: TECHNOLOGY MANAGEMENT AND TRANSFER (09 Periods)
Technology Management: Introduction, Technology-Definition, Components, Classification Features; Technology Management-Concept, Nature; Drivers of Management of Technology-Significance, Scope, Responding to technology challenges.
Technology Transfer: Introduction, Definition, Classification, Significance, Elements of process, Types of Technology Transfer, Package, Modes of Transfer, Routes, Channels and Effectiveness of Technology Transfer.

Module 5: CORPORATE GOVERNANCE: THE INDIAN SCENARIO (09 Periods)
Emergence of corporate governance in India-Landmarks, Models, Codes and status in India, Role and Responsibilities of Regulators, The Board of Directors; Corporate Governance- Specific issues in India, Family-owned Business, Corporate Governance and the Indian ethos.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Case studies: Using real-world examples of global businesses and their technological strategies, students can examine the challenges and opportunities presented by different markets and technologies. This can involve analyzing data, conducting market research, and making decisions based on their findings.

2. Simulation games: Students can participate in simulation games that allow them to make decisions about global strategy and technology in a virtual environment. This can help them understand the complexities of international business, such as navigating different cultures, regulations, and economic systems.

3. Industry partnerships: Partnerships with technology companies and global businesses can provide students with hands-on experience in global strategy and technology. This can include internships, shadowing, or working on real projects with industry professionals.

4. Project-based learning: Students can work on real-world projects that require them to apply their knowledge of global strategy and technology. This can include developing a business plan for a new product or service, designing a marketing campaign for a global audience, or analyzing the impact of a new technology on a specific industry.

5. Field trips: Visiting international businesses or attending technology conferences can provide students with a first-hand look at global strategy and technology in action. This can help them understand the challenges and opportunities of different markets and technologies, as well as connect with industry professionals.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

CASE STUDIES:

1. Tesla: Can Elon Musk's electric car company succeed globally?
2. Uber: How the ride-sharing giant is expanding its global footprint.
3. Alibaba: How China's e-commerce giant is competing on the global stage.
4. Airbnb: How the home-sharing platform is disrupting the global hotel industry.
5. Netflix: How the streaming service is expanding globally and adapting to local markets.

ARTICLES:

1. "Digital Transformation: Why it Matters for Global Business" by Forbes
2. "How AI is Changing Global Business Strategy" by Harvard Business Review
3. "The Future of Globalization: Exploring the Role of Technology" by World Economic Forum
4. "Globalization 4.0: What it Means for Technology and Strategy" by McKinsey & Company
5. "How Technology is Transforming Global Supply Chains" by MIT Sloan Management Review

RESOURCES

TEXT BOOKS:

1 Francis Cherunilam, *Strategic Management*, Himalaya Publishing House, 3rdEdition, 2002.

2 C. S. G. Krishnamacharyulu and Lalitha Ramakrishnan, *Management of Technology*, Himalaya Publishing House, Second Edition, 2012.

REFERENCE BOOKS:

1 White and Bruton, *The Management of Technology and Innovation: A Strategic Approach*, Cengage Learning, 1stEdition, 2007.
2 S.K.Mandak, *Ethics in Business and Corporate Governance*, TMH, 2ndEdition, 2012.

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/110106157/L01.html
2. https://www.digimat.in/nptel/courses/video/110106157/L43.html

WEB RESOURCES:

1. https://www.coursera.org/learn/global-strategy-two
2. https://learn.saylor.org/mod/book/view.php?id=37857&chapterid=22086

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EE101704	**GREEN TECHNOLOGIES**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on green technology concepts, the role of industry and government in establishing green energy footprints and cleaner development mechanisms. It also presents energy-efficient and sustainable green production systems, concepts of energy ecosystems, and concepts of green buildings.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the green technology concepts and the consequences of greenhouse gas emissions.
CO2. Acquire basic knowledge on cleaner development mechanism, the importance of re-use of materials, and the oxidation technology for wastewater.
CO3. Go beyond energy-efficient machinery, biofuels, and environmentally friendly materials.
CO4. Acquire basic knowledge on man-made ecosystems, sources, and control of pollution.
CO5. Understand the concepts and requirements for green buildings.

CO-PO Mapping Table

Course Outcome	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	3	-	-	-	-	1
CO2	3	-	-	-	-	-	3	-	-	-	-	1
CO3	3	-	-	-	-	-	3	-	-	-	-	1
CO4	3	-	-	-	-	-	3	-	-	-	-	1
CO5	3	-	-	-	-	-	3	-	-	-	-	1
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**-**	**3**	-	-	-	-	**1**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO GREEN TECHNOLOGY ***(09 Periods)***

Green technology-definition, importance, factors affecting green technology. Global atmosphere- green house gases, global warming, acid rain, ozone depletion and photochemical smog. Role of industry, government and institutions; industrial ecology, role of industrial ecology in green technology.

Module 2: CLEANER DEVELOPMENT TECHNOLOGIES ***(08 Periods)***

Cleaner development mechanisms, role of industry; reuse, reduce and recycle, raw material substitution; wealth from waste; carbon credits, carbon trading, carbon sequestration, eco labeling. Oxidation technology for wastewater treatment - cavitation, fenton chemistry, photocatalysis and hybrid processes.

Module 3: ENERGY EFFICIENT SYSTEMS AND PROCESSES ***(09 Periods)***

Energy efficient motors, energy efficient lighting, control and selection of luminaries; bio-fuels, fuel cells- working, selection of fuels, Green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of sustainable green production systems.

Module 4: ENERGY ECOLOGY AND ENVIRONMENT ***(08 Periods)***

Concept and theories of ecosystems - energy flow in major manmade ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and environment - environmental laws on pollution control – innovation and sustainability: - eco-restoration / phyto-remediation, renewable energy technologies, industrial ecology and agro ecology.

Module 5: GREEN BUILDINGS ***(10 Periods)***

Definition- Features and benefits, Fundamental planning decisions for energy efficient building- site selection, buildings forms and orientations, building fabrics and insulation, ventilation, passive solar features. Eco-friendly and cost effective materials, energy management. Rooftop solar photovoltaic system and solar tracking system, alternating roofing systems.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The student shall prepare a report on the causes of global warming and should suggest possible remedies for reducing the global warming
2. The student shall prepare a report on the wastewater management system.
3. The student shall prepare a report on controlling pollution in the environment.
4. The student shall observe the various considerations in a greenhouse building and should prepare the report on the observations made and should suggest possible avenues for improvement.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1. Khan B.H, *Non conventional energy resources*, Tata McGraw-Hill, New Delhi 2006.
2. Paul L. Bishop, *Pollution prevention –Fundamentals and Practices*, McGraw-Hill-international 2000.

REFERENCE BOOKS:

1. P. Aarne Veslind, *Introduction to environmental engineering*, Cenage Learning 2010.
2. Joseph A. Salvato, *Environmental engineering,* Wiley
3. Tom D Reynolds, *Unit operations and processes in environmental engineering*, PWS Publishing.
4. D. Y. Goswami, F. Kreith and J. F. Kreider, *Principles of Solar Engineering*, Taylor and

Francis.

5. C. S. Solanki, *Solar Photovoltaics: Fundamental Applications and Technologies*, Prentice Hall.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=kQSgIpU0PNU
2. http://www.digimat.in/nptel/courses/video/112104225/L08.html

WEB RESOURCES:

1. N. Vinutha bai, R. Ravindra, Energy efficient and green technology concepts, International Journal of Research in Engineering and Technology p 253-258, Volume: 03 Special Issue: 06, 2014, eISSN: 2319-1163 pISSN: 2321-7308.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101702	HUMAN RESOURCE MANAGEMENT	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:
Concepts of HRM; Environmental Scanning; Human Resource Planning; Job analysis; Job design; Job evaluation; Recruitment; Selection; Placement; Orientation; Training and Development; Performance appraisal; Merit rating; Compensation; Industrial relations; Trade unions; Industrial disputes; Ethical issues; Employee safety.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- **CO** Demonstrate the knowledge on the principles, processes and practices of human resource management.
- **CO** Analyze the key issues related to administering the human elements such as motivation, recruitment, training and development, compensation, appraisal, and career development.
- **CO** Provide solutions to plan and manage human resource functions effectively within organization.
- **CO** Apply HRM concepts and techniques in strategic planning to improve organizational effectiveness.
- **CO** Evaluate HRM related social, cultural and safe responsibilities and issues in a global context.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	1	-	-	-	-	-	-
CO2	3	3	1	1	-	1	-	-	-	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	-	-
CO4	2	1	1	1	3	1	-	-	-	-	-	-
CO5	3	1	1	1	1	1	2	3	-	-	-	-
Course Correlation Mapping	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**3**				

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO HRM & HRP ***(09 Periods)***

Introduction to Human Resource Management (HRM): Objectives, Scope and significance of HRM, Functions of HRM, Prospects in HRM, Environmental scanning.

Human Resource Planning (HRP): Introduction, Nature and importance of HRP, Factors affecting HRP, The planning process, Human resource planning and the Government, Requisites for successful HRP, Barriers to HRP.

Module 2: RECRUITMENT AND PLACEMENT ***(09 Periods)***

Job Analysis – Nature and process of job analysis, Methods of collecting job data, Potential problems with job analysis, Requisites for job analysis; Job Design - Factors, Job design approaches, Contemporary issues; Job evaluation - Process, Methods; Recruitment - Nature, Purposes and importance, Factors governing recruitment, Recruitment process, Evaluation and control; Selection – Nature, Process, Barriers to effective selection, Evaluation of selection process, Placement; Separation.

Module 3: HUMAN RESOURCE DEVELOPMENT AND COMPENSATION ***(09 Periods)***

Orientation - Orientation programme, Requisites of an effective programme, Evaluation of orientation programme, Problems of orientation; Training and development – Nature, Inputs, Training process, Methods, Impediments to effective training, Management development, Career development, Talent management; Performance Appraisal - Nature, Appraisal process, Challenges of performance appraisal; Merit rating; Compensation - Philosophy, Components, Theories, Factors influencing employee compensation, Challenges, Wage and salary administration.

Module 4: INDUSTRIAL RELATIONS AND TRADE UNIONS ***(09 Periods)***

Industrial Relations (IR): Nature of IR, Importance of Peaceful IR; Approaches to IR - Unitary Approach, Pluralistic approach, Marxist approach; Parties to IR; IR strategy; Industrial Disputes - Nature, Causes, and Settlement.

Trade unions: Nature of trade unions, Strategic choices before unions, Union tactics, Trade union movement in India, Trends in trade union movement, Managing unions; Indian Factories Act; Employee's compensation Act; Industrial disputes Act.

Module 5: ETHICAL ISSUES AND SAFETY ADMINISTRATION ***(09 Periods)***

Managing Ethical Issues in HRM: Nature of ethics, Sources of business ethics, Myths about ethics, Ethical dilemmas, HR ethical issues, Managing ethics, Improving ethical decision making.

Employee Safety: Safety, Need for safety, Types of accidents, Safety programme, ISO safety standards.

Total Periods: 45

EXPERIENTIAL LEARNING

1. What are the challenges that are faced by HR in effective performance management including performance appraisal in MNCs? Discuss in detail in the contemporary of HRM.
2. Evaluate employee relations in a comparative perspective across few countries of your choice. Describe in brief by taking a case study.
3. Visit an organization or industry and Evaluate HRM related social, cultural, ethical and environmental responsibilities and issues in a global context.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1. Aswathappa K, *Human Resource Management,* Tata McGraw Hill Private Limited, 8th edition, 2017.
2. Garry Dessler and Biju Varkkey, *Human Resource Management,* Pearson India, 16th Edition, 2020.

REFERENCE BOOKS:

1. Raymond A. Noe, John R. Hollenbeck, *HRM: Gaining a Competitive Advantage*, TMH, 7th edition, 2010.
2. Bohlander George W, Snell Scott, *Principles of Human Resource Management,* Cengage Learning, 16th edition, 2016.
3. Edwin B. Flippo, *Personnel Management,* McGraw-Hill International editions, 6th edition, 1984.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/122105020
2. https://onlinecourses.nptel.ac.in/noc20_mg15/preview
3. https://www.digimat.in/nptel/courses/video/122105020/L01.html

WEB RESOURCES:

1. https://www.coursera.org/specializations/human-resource-management
2. https://www.techtarget.com/searchhrsoftware/definition/human-resource-management-HRM

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101703	**INDIAN ECONOMY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction; Elementary Economic Analysis; Economic Planning; Time Value of Money; Value Analysis/Value Engineering.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the basic concepts of economics, economic analysis, economic planning and strata.

CO2 Demonstrate knowledge in capital budgeting, evaluation of engineering projects, depreciation policy and familiarize with the concepts of value analysis vs value engineering.

CO3 Analyze and apply financial information for the evaluation of finance.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	2	-	-	-	-	-	-
CO2	3	-	-	-	-	2	-	-	-	-	-	2
CO3	3	-	-	-	-	2	-	-	-	-	-	2
Course Correlation Mapping	3	-	-	-	-	2	-	-	-	-	-	2

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION ***(09 Periods)***

Economics-Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

Module 2: ELEMENTARY ECONOMIC ANALYSIS ***(09 Periods)***

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection-Process Planning, Process Modification.

Module 3: ECONOMIC PLANNING ***(09 Periods)***

Introduction - Need For Planning in India, Five-year plans(1951-2012), NITI Aayog (from 2014 onwards); Inclusive Growth-Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

Module 4: TIME VALUE OF MONEY ***(12 Periods)***

Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of Engineering Projects - Present Worth Method, Future Worth Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy-Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

Module 5: VALUE ANALYSIS/VALUE ENGINEERING ***(06 Periods)***

Introduction-Value Analysis, Value Engineering, Functions, Aims; Value Analysis vs Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on family setups of different countries and their peculiar customs if any.
3. Prepare a poster presentation on "Ancient hominin walked like a human but climbed like an ape."
4. Find out the problems of present society and being part of future generations and how you may help to strengthen environmental security.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Panneerselvam. R., *Engineering Economics*, PHI Learning Private Limited, New Delhi, 2nd edition, 2013.
2. Jain. T. R., V. K. Ohri, O. P. Khanna., *Economics for Engineers*, VK Publication, 1st edition, 2015.

REFERENCE BOOKS:

1. DuttRudar & Sundhram K. P. M., *Indian Economy*, S. Chand, New Delhi, 62nd revised edition, 2010.
2. Misra, S. K. & V. K. Puri., *Indian Economy*: *Its Development Experience*, Himalaya Publishing House, Mumbai, 32nd edition, 2010.

VIDEO LECTURES:

1. https://www.youtube.com/playlist?list=PLFW6lRTa1g83winAoIK92HL4xTytJaW7S
2. https://www.youtube.com/watch?v=aUiw5hRChC0

WEB RESOURCES:

1. https://archive.nptel.ac.in/courses/109/104/109104184/
2. https://onlinecourses.swayam2.ac.in/cec23_hs47/preview

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101704	**INDIAN HISTORY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate contextual knowledge in the evolution of ancient and medieval Indian History and acquire an awareness of societal and cultural transformation.

CO2 Analyze the situations before and after Independence and assess the societal reforms implemented in India after Independence.

CO3 Practice culture transformations and appreciate its influence to adapt themselves in global scenarios.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	1	-	-	-	-	-	-
CO2	1	2	-	-	-	1	-	-	-	-	-	-
CO3	1	1	-	-	-	2	-	-	-	-	-	-
Course Correlation Mapping	2	1	-	-	-	2	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO INDIAN HISTORY *(08 Periods)*

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; Sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

Module 2: ANCIENT INDIA ***(09 Periods)***

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

Module 3: CLASSICAL & MEDIEVAL ERA ***(12 Periods)***

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

Module 4: MODERN INDIA ***(06 Periods)***

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947)

Module 5: INDIA AFTER INDEPENDENCE (1947 -) ***(10 Periods)***

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and Inclusion, Changing Nature of Work and Organization.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a write-up on how to safeguard ancient monuments.
2. Analyze the most famous historically important place you visited.
3. Prepare a presentation on the ancient Seven Wonders of the World with their significance and how they are destroyed.
4. Prepare a presentation on "Wars of the past not only destroyed people and their livelihood but also the people's tradition and culture."
5. Prepare a poster on " Continents that No Longer Exist" with causes

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. K. Krishna Reddy, *Indian History,* Tata McGraw-Hill, 21st reprint, 2017.

REFERENCE BOOKS:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan, 2007.
2. Romila Thapar, *Early India***,** Penguin India, New Delhi 2002.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=PtCi8OmNHGs
2. https://www.youtube.com/watch?v=eHEv5aF5td8

WEB RESOURCES:

1. https://www.historyskills.com/classroom/modern-history/india/
2. https://www.britannica.com/place/India/The-Indian-Paleolithic

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101705	**INDIAN TRADITION AND CULTURE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Basic traits of Indian Culture; Humanistic Reforms under Jainism and Buddhism; Culture in the medieval period; Socio Religious reforms in Indian Culture; Reform movements for harmonious relations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge of Vedic and Upanishadic culture and society to consider human aspirations, values and theories.

CO2 Understand the contributions of Buddhism and Jainism to Indian culture.

CO3 Examine the cultural conditions and achievements of India under Mouryas and Guptas.

CO4 Analyze social religious reforms and reform movements.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	1	-	-	-	-	-	-
CO2	3	-	-	-	-	1	-	-	-	-	-	2
CO3	2	-	-	-	-	3	-	-	-	-	-	-
CO4	2	-	-	-	-	3	-	-	-	-	-	2
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BASIC TRAITS OF INDIAN CULTURE ***(08 Periods)***

Meaning and definition and various interpretations of culture - Culture and its features -

The Vedic and Upanishad culture and society - Human aspirations and values in these societies - Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

Module 2: HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM ***(09 Periods)***

Salient features of Jainism - contributions of Jainism to Indian culture - Contributions of Aachaarya and Mahaapragya - Buddhism as a humanistic culture - The four noble truths of Buddhism - Contributions of Buddhism to Indian culture.

Module 3: CULTURE IN THE MEDIEVAL PERIOD ***(09 Periods)***

Unifications of India under Mouryas and Guptas and their cultural achievements - Cultural conditions under satavahanas - Contributions to Pallavas and cholas to art and cultural achievements of Vijayanagara rulers

Module 4: SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE ***(09 Periods)***

Western impact on India - Introduction of Western education - social and cultural awakening and social reform movements of Rajaramohan Roy - Dayanandha Saraswathi - Anne Besant (theosophical society).

Module 5: REFORM MOVEMENTS FOR HARMONIOUS RELATIONS ***(09 Periods)***

Vivekananda, Eswarchandravidyasagar and Veeresalingam - emancipation of women and struggle against caste - Rise of Indian nationalism - Mahatma Gandhi – Non-violence and satyagraha and eradication of untouchability.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Identify different cultural festivals of Indian States and prepare a write-up on their uniqueness.
2. India has a rich history with numerous architectural wonders. Prepare a report on any three famous architectural wonders in India.
3. Explore the diverse flavors of Indian cuisine and prepare a poster on the different dishes and their distinctiveness.
4. India is a country of Unity in Diversity. Make a PowerPoint presentation on different traditional dresses of various cultural people.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Valluru Prabhakaraiah, *Indian Heritage and Culture*, Neelkamal Publications Pvt. Ltd. Delhi, 1/e, reprint 2015.

REFERENCE BOOKS:

1. L. P. Sharma, *History of Ancient India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
2. L. P. Sharma, *History of Medieval India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
3. The Cultural Heritage of India Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/109103019/L03.html
2. http://acl.digimat.in/nptel/courses/video/109104106/L07.html

WEB RESOURCES:

1. https://onlinecourses.swayam2.ac.in/nos19_hs03/preview
2. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/186

University Elective

Course Code	Course Title	L	T	P	S	C
22ME101703	MANAGEMENT SCIENCE	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

Concepts of Management; Concepts Related to ethics and social responsibility; Human Resource Management; Operations Management; Statistical Process Control; Inventory Management; Marketing; Project Management; Project Crashing.

COURSE OUTCOMES:

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

CO1 Demonstrate the concepts of management, its functions and processes used in optimum resource utilization within the context of ethics and social responsibility.

CO2 Apply the concepts of HRM for selection and management of human resources.

CO3 Analyze different operations management problems using quality management tools to produce effective, efficient and adoptable products/services

CO4 Identify different marketing strategies to maximize enterprise profitability and customer satisfaction within the realistic constraints

CO5 Develop network models in time-cost trade-off for effective project management.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1		1	1	1	1			1	
CO2	3	2	1		1						1	
CO3	3	3	1	1	1						1	
CO4	3	2	1		1	1					1	
CO5	3	3	3	1	1	1					2	
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			**1**	

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: MANAGERIAL FUNCTION AND PROCESS ***(10 Periods)***

Concept and foundations of management, Evolution of management thought; Managerial functions – Planning, Organizing, Directing and Controlling; Decision-making; Role of manager, managerial skills; Managing in a global environment, Flexible systems management; Social responsibility and managerial ethics; Process and customer orientation; Managerial processes on direct and indirect value chain.

Module 2: HUMAN RESOURCE MANAGEMENT ***(08 Periods)***

Human Resource challenges; Human Resource Management functions; Human Resource

Planning; Job analysis; Job evaluation, Recruitment and selection; Training and Development; Promotion and transfer; Performance management; Compensation management and benefits; Employee morale and productivity; Human Resource Information System.

Module 3: OPERATIONS MANAGEMENT ***(10 Periods)***

Fundamentals of Operations Management, Services as a part of operations management; Facilities location and layout; Line balancing; Quality management – Statistical Process Control, Total Quality Management, Six sigma; Role and importance of materials management, Value analysis, Make or Buy decision, Inventory control, Materials Requirement Planning, Enterprise Resource Planning, Supply Chain Management.

Module 4: MARKETING MANAGEMENT ***(08 Periods)***

Concept, evolution and scope; Marketing strategy formulation and components of marketing plan; Segmenting and targeting the market; Positioning and differentiating the market offering, Analyzing competition; Product strategy; Pricing strategies; Designing and managing marketing channels; Integrated marketing communications.

Module 5: PROJECT MANAGEMENT ***(09 Periods)***

Project management concepts; Project planning – Work Breakdown Structure, Gantt chart; Project scheduling – Critical Path Method, Program Evaluation and Review Technique, Crashing the project for time-cost trade off; Resource Levelling.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Find the social responsibilities in the context of management theoretically and practically in an organization? Explain them by taking a real case study in any organization (preferably in your organization).
2. Gaining market share should be one of management's primary goals because of its effect on operations and profitability. Comment. What Strategies Do Companies Employ to Increase Market Share?
3. A Gantt chart is a visualization that helps in scheduling, managing, and monitoring specific tasks and resources in a project. Prepare a gantt chart for Online food ordering system.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1. MartandT. Telsang, *Industrial Engineering and Production Management,* S. Chand, 3rd Edition, 2018.
2. Koontz and Weihrich, *Essentials of Management*, TMH, New Delhi, 11th Edition, 2020.

REFERENCE BOOKS:

1. O.P. Khanna, *Industrial Engineering and Management,* Dhanpat Rai and Sons, 2018.
2. N.D. Vohra, *Quantitative Techniques in Management,* TMH, New Delhi, 5th Edition, 2014.
3. L.M. Prasad, *Principles and practice of Management,* S. Chand and Sons, 2019.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/122/106/122106032/
2. https://www.digimat.in/nptel/courses/video/122102007/L01.html

WEB RESOURCES:

1. https://www.coursera.org/learn/fundamentals-of-management
2. https://www.coursera.org/specializations/foundations-management

University Elective

Course Code	Course Title	L	T	P	S	C
22ME101704	MANAGING INNOVATION AND ENTERPRENEURSHIP	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation &Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO1. Demonstrate the principles of innovation process for establishing Industrial ventures.
CO2. Identify and analyze the gaps in an organization for innovation in the context of developed economies
CO3. Develop a comprehensive and well-planned business structure for a new venture.
CO4. Demonstrate knowledge on intellectual property rights, patents, trademarks, copyrights, trade secrets and commercialization of intellectual property.
CO5. Apply ethics in constructive innovation framework and problem solving.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1		1	1	1	1			1	
CO2	3	2	1		1						1	
CO3	3	3	1	1	1						1	
CO4	3	2	1	1	1	1					1	
CO5	3	3	3	1	1	1					2	
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			**1**	

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: CREATIVITYANDINNOVATION ***(09 Periods)***

Introduction, Levels of innovation, Purposeful innovation and the sources of innovative

opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

Module 2: PARADIGMSOFINNOVATION ***(09 Periods)***

Systems approach to innovation, Innovation in the context of developed economies and Emerging economies, Examining reverse innovation and itsapplication,Performancegap,Infrastructuregap,Sustainabilitygap,Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

Module 3: SOUCESOFFINANCEANDVENTURECAPITAL ***(09 Periods)***

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

Module 4: INTELLECTUAL PROPERTY INNOVATION AND ENTREPRENEURSHIP ***(09 Periods)***

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

Module 5: OPEN INNOVATION FRAME WORK &PROBLEM SOLVING ***(09 Periods)***

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and Opportunities of open innovation frame work, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification

TotalPeriods:45

EXPERIENTIAL LEARNING

1. Identify the Innovative Marketing Strategies for Startups
2. Identify the Coca-cola Company Intellectual Property Rights

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

CASESTUDIES/ARTICELS:

Contemporary relevant case studies/ Articles will be provided by the course instructor at the beginning.

1. Tesla Inc.: Disrupting the Automobile Industry
   This case study examines how Tesla Inc. disrupted the traditional automobile industry through its innovative electric vehicles and sustainable energy solutions. It discusses the sources of innovative opportunity that Tesla leverages, the ideation and creativity dynamics involved in new product development, and the strategies that the company uses to introduce and market its innovations.

2. Google Inc.: Innovation in Developed Economies
   This case study explores how Google Inc. became a global leader in the technology industry through its innovative search engine, advertising, and cloud computing solutions. It highlights the performance gap that Google addressed, the regulatory and sustainability gaps that it leveraged, and the impact of its innovation strategies on the company's growth and profitability.

3. Flipkart: From Startup to Unicorn
   This case study examines how Flipkart, an Indian e-commerce company, secured venture capital funding to become one of the largest online marketplaces in India. It discusses the importance of finance in entrepreneurship, the advantages and disadvantages of venture capital, and the strategies that Flipkart used to attract venture funding.

4. Patanjali Ayurved: Building a Brand through Intellectual Property
   This case study explores how Patanjali Ayurved, an Indian consumer goods company, built a strong brand through its intellectual property strategies. It discusses the forms of IP that Patanjali leverages, the patent process in India, and the impact of IP on the company's growth and profitability.

5. Procter & Gamble: Innovation through Open Innovation
   This case study analyzes how Procter & Gamble, a global consumer goods company, leveraged open innovation to achieve unprecedented success in product development and marketing. It discusses the difference between open and cloud innovation approaches, the limitations and opportunities of open innovation, and the role of strategic alliances in global innovation.

RESOURCES

TEXT BOOKS:

1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.
2. Drucker, P.F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Robert D Hisrich, Claudine Kearney, *Managing Innovation and Entrepreneurship,* Sage Publications,1st Edition,2014.
2. V.K. Narayanan, *Managing Technology and Innovation for Competitive Advantage,* PearsonIndia,1st Edition,2002.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=wWsl48VLfVY
2. https://www.youtube.com/watch?v=dDpQ9ALKX0U
3. https://www.youtube.com/watch?v=Eu_hkxkJGTg

WEB RESOURCES:

1. https://www.coursera.org/specializations/innovation-entrepreneurship
2. https://www.coursera.org/certificates/innovation-management-entrepreneurship-hec

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22LG201701	**PERSONALITY DEVELOPMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course gives awareness to students about the various dynamics of personality development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Self-Management and Planning Career

CO2. Analyze the functional knowledge in attitudes and thinking strategies

CO3. Learn and apply soft skills for professional success.

CO4. Function effectively as an individual and as a member in diverse teams

CO5.Communicate effectively in public speaking in formal and informal situations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	2	-	-
CO4	1	1	-	-	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	2	2	3	-	3	-	-	-	3	3	-	-

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: SELF-ESTEEM & SELF-IMPROVEMENT ***(09 Periods)***

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself- Exercises- case studies

Module 2: DEVELOPING POSITIVE ATTITUDES ***(09 Periods)***

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies

Module 3 SELF-MOTIVATION & SELF-MANAGEMENT ***(09 Periods)***

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

Module 4 GETTING ALONG WITH THE SUPERVISOR ***(09 Periods)***

Know your Supervisor – Communicating with your Supervisor – Special Communication with your Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expe of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

Module 5 WORKPLACE SUCCESS ***(09 Periods)***

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Exercises- case studies

Total Periods: 45

EXPERIENTIAL LEARNING

11. List out the self-improvements in you on the charts and explain in detail.
12. Discuss different famous personalities and their attitudes.
13. Describe different personalities with respect to self-motivation and self-management.
14. Imagine you are a supervisor and illustrate different special communications.
15. Assume and Interpret different experiences on the first day of your job.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXTBOOK:

1. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)
2. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

REFERENCE BOOKS:

1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=6Y5VWBLi1es
2. https://www.youtube.com/watch?v=H9qA3inVMrA

Web Resources:

1. https://www.universalclass.com/.../the-process-of-perso...
2. https://www.ncbi.nlm.nih.gov/pubmed/25545842
3. https://www.youtube.com/watch?v=Tuw8hxrFBH8

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101704	REMOTE SENSING, GIS AND GPS	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on photogrammetry, remote sensing, geographic information system, GIS spatial analysis. This course also examines remote sensing and GIS applications, global positioning system and its real-time applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze photogrammetry and remote sensing to solve complex surveying problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society and environment besides communicating effectively in graphical form.

CO2 Analyze GIS to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.

CO3 Analyze GIS spatial analysis to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.

CO4 Analyze remote sensing and GIS applications to solve complex civil engineering problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society, environment, sustainability and management principles besides communicating effectively in graphical form.

CO5 Analyze global positioning system to solve complex surveying problems using appropriate tools and techniques considering society and environment besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	2	2	1	1	1	-	1	-	1
CO2	2	3	-	-	2	1	1	-	-	1	-	1
CO3	2	3	-	2	2	1	1	-	-	1	-	1
CO4	2	3	-	-	2	1	1	1	-	1	1	1
CO5	2	3	-	-	2	1	1	-	-	1	-	-
Course	**3**	**3**	**-**	**2**	**2**	**1**	**1**	**1**	-	**1**	**1**	**1**

Correlation Mapping												

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: PHOTOGRAMMETRY AND REMOTE SENSING **(10 Periods)**

Photogrammetry: Principle of photogrammetry, Types of aerial photographs, Planning and execution of photographic flights, Geometry of aerial photographs, Scale of aerial photographs and its determination, Stereoscopy, Ground control, Mosaics, Parallax measurements for height determinations, Latest developments in photogrammetry.

Remote Sensing: Elements of remote sensing, Electromagnetic spectrum, Energy resources, Physics of radiant energy, Energy interactions with earth surface features and atmosphere, Data acquisition platforms Spectral reflectance curves, Resolution; Spectral properties of water bodies, soil and vegetation; Sensors and platforms, Visual interpretation techniques.

Module 2: GEOGRAPHIC INFORMATION SYSTEM **(09 Periods)**

GIS categories, Components of GIS, Fundamental operations of GIS, Spatial and non spatial data, Raster data and vector data, File management, Layer based GIS, Feature based GIS, Map projections, Latest developments.

Module 3: GIS SPATIAL ANALYSIS **(08 Periods)**

Database models, Data storage, Vector data storage, Attribute data storage, Data manipulation and analysis, Integrated analysis of the spatial and attribute data - DTM/DEM, Softwares – Arc GIS, QGIS and Global mapper, Latest developments in GIS software.

Module 4: REMOTE SENSING AND GIS APPLICATIONS **(09 Periods)**

Land use/Land cover classification, Rainfall-runoff studies, Flood and drought impact assessment and monitoring, Drainage morphometry, Watershed management for sustainable development, GIS based precision farming, GIS based natural resources management, Inland water quality survey and management, Regional and urban planning and management, GIS based highway alignment, GIS based traffic congestion analysis, GIS for public health – Case Studies.

Module 5: GLOBAL POSITIONING SYSTEM **(09 Periods)**

Global Positioning System (GPS) – Fundamental concepts, Components of GPS – Space segment, Control segment, User segment, Reference systems, Satellite orbits; Classification of GPS receivers, GPS observations, GPS measurements and accuracy of GPS, Applications.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Sound composing project: In this assignment, Select area and collect the geometry of aerial photographs and analyze the views.
2. Visit any meteorological department and understand about rain gauges and collect, analyse the data
3. Visit Geographical Information Systems Laboratory and understand about GIS and GPS Systems

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Shivam, P. and Shashikanth, T., *A Text Book of Basic Concept of Remote Sensing*, *GPS and GIS*, Sankalp Publication, 2020.
2. Anji Reddi, M., *A Text Book of Remote Sensing and Geographical Information Systems*, B. S. Publications, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Bhatta, B., *Remote Sensing and GIS*, Oxford University Press, 2nd Edition, 2011.
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W., *Remote Sensing and Image Interpretation*, John Willey and Sons (Asia) Pvt. Ltd., 7th Edition, 2014.
3. Chandra, A. M. and Ghosh, S. K., *Remote Sensing and Geographic Information System*, Narosa Publishing House, 2nd Edition, 2015.
4. Panigrahi, N., *Geographical Information Science*, University Press, 2nd Edition, 2013.
5. Peter A. Burragh and Rachael Mc Donnell, *Principles of Geographical Information Systems*, Oxford University Press, 2nd Edition, 2014.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/105/107/105107206/
2. https://syslab.ceu.edu/videos/geospatial-technologies

WEB RESOURCES:

1. Digital Audio Signal Processing: https://www.udemy.com/course/introduction-to-geospatial-technologies-and-arcgis-interface/
2. Learn Audio Editing - for Beginners: https://www.youtube.com/ watch?v=xGgaV9r_kH8
3. https://storymaps.arcgis.com/stories/47e984aae614442cb80aa40d121b5fe

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101706	**WOMEN EMPOWERMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concept & Framework, Status of Women, Women's Right to Work, International Women's Decade, and Women Entrepreneurship.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the knowledge of the characteristics and achievements of empowered women and women's empowerment techniques by analyzing women's legal and political status.

CO2 Apply the knowledge of women's rights by analyzing various societal issues and obstacles in different fields, including science and technology.

CO3 Demonstrate the knowledge of the significance of women's participation in policy debates, National conferences, and common forums for equality and development by identifying and analyzing issues.

CO4 Analyze the concept of women's entrepreneurship, government schemes, and entrepreneurial challenges and opportunities.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	1	3	-	1	–	–	-	-
CO2	3	1	-	-	-	2	-	-	-	–	-	-
CO3	3	1	-	-	-	2	-	-	-	3	-	-
CO4	3	1	-	-	-	-	-	-	-	-	2	-
Course Correlation Mapping	3	1	-	-	1	3	-	1	–	3	2	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: CONCEPT & FRAMEWORK ***(09 Periods)***

Introduction– Empowered Women's Characteristics – Achievements of Women's Empowerment **Concept of Empowerment:** Meaning & Concept – Generalizations about Empowerment – Empowerment Propositions – Choices women can make for empowerment – Women's participation in decision making, development process & in Governance. **Framework for Empowerment** – Five levels of equality – Tenets of Empowerment– Elements – Phases and aspects – Techniques – Categories and Models – Approaches.

Module 2: STATUS OF WOMEN ***(09 Periods)***

Legal Status: Present Scenario – Call for Social Change – Significant Trends – Legal & Schemes – Personal Law – Joint Family – Criminal Law – Shift towards Dowry – Deterrent Punishment – Criminal Law (II Amendment) – Discrimination in Employment.

Political Status: Present Scenario – Political Participation & its NatureSocio–economic Characteristics – Political Mobilization: Mass Media – Campaign Exposure – Group Orientation – Awareness of issues and participation – Progress & Future Thrust.

Module 3: WOMEN'S RIGHT TO WORK ***(09 Periods)***

Introduction – Present Scenario – Changes in Policy & Programme – National Plan of Action– Women's Cells and Bureau – Increase in the work participation rate – Discrimination in the labour market – Women in unorganized sector – Issues and Obstacles– Women in Education – Women in Science & Technology – Case Study: Linking Education to Women's Access to resources.

Module 4: WOMEN'S PARTICIPATORY DEVELOPMENT ***(09 Periods)***

Dynamics of social change – conscious participation – Information Explosion – Organized Articulation – National Conference – Common Forums – Participatory Development – New Issues Identified – Role of other Institutions.

Module 5: WOMEN ENTREPRENEURSHIP ***(09 Periods)***

Introduction – Definition – Concept – Traits of women Entrepreneurs – Role of Women Entrepreneurs in India – Reasons for Women Entrepreneurship – Government schemes & Financial Institutions to develop Women Entrepreneurs – Key policy recommendations – Project Planning – Suggestions and measures to strengthen women entrepreneurship – Growth & Future challenges – Training and Opportunities – Case Study: Training Women as Hand–pump Mechanics– Case Study: Literacy for Empowering Craftswomen

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare poster presentation on "impact of women's self-help groups on their empowerment and socio-economic development."
2. Prepare a comparative analysis chart on the status of women in various countries.
3. Prepare a presentation on women and cultural responsibilities in different societies.
4. Prepare a presentation on the women of the past, present and future in terms of responsibilities and duties.
5. Prepare a presentation on the great women entrepreneurs of India.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. SahaySushama,*Women and Empowerment,*Discovery Publishing House, New Delhi, 2013.
2. NayakSarojini, Jeevan Nair,*Women's Empowerment in India*, Pointer Publishers, Jaipur, 2017.

REFERENCE BOOKS:

1. Baluchamy. S,*Women's Empowerment of Women*, Pointer Publishers, Jaipur, 2010.
2. Khobragade Grishma,*Women's Empowerment: Challenges and Strategies Empowering Indian Women*, Booksclinic Publishing, Chhattisgarh, 2020.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=1TDjdyX3hnc
2. https://www.youtube.com/watch?v=exAuB8Gyw90

Web Resources:

1. https://www.economicsdiscussion.net/entrepreneurship/women–entrepreneurs–in–india
2. https://www.businessmanagementideas.com/entrepreneurship–2/women entrepreneurs