KISHKINDA UNIVERSITY

Advancing Knowledge Transforming Lives

B.Tech– V to VIII Semester

Computer Science & Engg.

(2023 Scheme)

B.E. in Computer Science & Engineering Scheme of Teaching and Examinations – 2023 Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2025-26)

Vision of the University

To develop an ethical and a competent global workforce with an inquisitive mind.

Mission of the University

- To equip the students with professional skills, ethical values and competency.
- To offer state of the art programs by collaborating with industry, academia and society.
- To undertake collaborative & inter disciplinary research for overall development.
- To develop leaders and entrepreneurs for the real and sustainable world

Vision of the Department

To be a leading center of excellence in computer science education and research, dedicated to producing innovative, ethical, managerial and inquisitive professionals capable of addressing global challenges.

Mission of the department

Mission1: Offer a cutting-edge curriculum that equips students with the knowledge and skills to excel in the rapidly evolving field of computer science.

Mission2: Foster a vibrant research environment that encourages collaboration and breakthroughs in technology, driving advancements that address global challenges.

Mission3: Equip students with a strong ethical and managerial foundation, ensuring they become responsible technologists dedicated to societal and environmental well-being.

Program Educational Outcomes

PEO1: Graduates will create innovative solutions to global challenges using their computer science expertise.

PEO2: Graduates will lead with integrity, making decisions that benefit society and the environment.

PEO3: Graduates will pursue ongoing learning and research to stay at the forefront of technological advancements.

Program Outcomes

PO1: **Engineering Knowledge:** Apply principles of mathematics, natural sciences, computing, engineering fundamentals, and specialized engineering knowledge to develop solutions for complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, and analyze complex engineering problems by reviewing research literature and drawing well-founded conclusions, while considering sustainable development.

PO3: **Design/Development of Solutions:** Design innovative solutions for complex engineering problems and develop systems, components, or processes that address identified needs, considering public health and safety, whole-life cost, net-zero carbon goals, culture, society, and environmental impact.

PO4: **Conduct Investigations of Complex Problems:** Utilize research-based knowledge to investigate complex engineering problems, incorporating experiment design, modeling, data analysis, and interpretation to derive valid conclusions.

PO5: **Engineering Tool Usage:** Develop, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, while recognizing their limitations in solving complex engineering problems.

PO6: The Engineer and the World: Assess and evaluate societal and environmental factors when addressing complex engineering problems, considering their impact on sustainability in relation to the economy, health, safety, legal frameworks, culture, and the environment.

PO7: **Ethics**: Uphold ethical principles, demonstrate commitment to professional integrity, respect human values, and promote diversity and inclusion while adhering to national and international laws.

PO8: **Individual and Team Collaboration:** Work effectively both independently and as a member or leader in diverse, multidisciplinary teams.

PO9: **Communication:** Communicate clearly and inclusively within the engineering community and society, demonstrating the ability to write effective reports, develop design documentation, and deliver impactful presentations while considering cultural, language, and learning differences.

PO10: **Project Management and Finance:** Apply engineering management principles and economic decision-making to one's work, effectively managing projects and contributing as both a team member and leader in multidisciplinary environments.

PO11: **Life-Long Learning:** Acknowledge the importance of continuous learning and cultivate the skills necessary for:

i) Independent and sustained self-improvement,
ii) Adaptability to evolving and emerging technologies, and
iii) Critical thinking in the broader landscape of technological advancements

Program specific outcomes

PSO1: Develop proficiency in applying programming principles, algorithms, and modern software engineering practices to design, develop, and deploy robust software solutions across various platforms.

PSO2: Cultivate skills in employing data analysis techniques, machine learning models, and AI tools to extract insights, drive innovation, and support decision-making in real-world applications

PSO3: Acquire proficiency to design, implement, and manage complex computer-based systems, ensuring seamless integration of hardware and software components to meet the specified needs.

V SEMESTER

SN	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	23CS51	Web Technologies	CSE	3	0	2	0	03	50	50	100	4
2	IPCC	23CS52	Computer Networks	CSE	3	0	2	0	03	50	50	100	4
3	IPCC	23CS53	Introduction to Artificial Intelligence	CSE	3	0	2	0	03	50	50	100	4
4	PCC	23CS54	Software Engineering and Project Management	CSE	3	0	0	0	03	50	50	100	3
5	PEC	23CS55X	Professional Elective	CSE	3	0	0	0	03	50	50	100	3
6	SEC	23CS56X	Skill Enhancement Course	CSE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If the course is a Laboratory: 0	0	2		02				
7	AEC	23AA57	Advanced Aptitude	Any department	2	0	0		02	50	50	100	1
8	MC	23NS58	National Service Scheme (NSS)	NSS coordinator	0	0	2	0	-	100	---	100	0
		23PE58	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		23YO58	Yoga	Yoga Teacher									
Total										**450**	**350**	**800**	**20**

Professional Elective Course			
23CS551	Theory of Computation	23CS553	Unix System Programming
23CS552	Distributed Systems	23CS554	NoSQL
Skill Enhancement Course			
23CS561	Data Visualization Using Excel and Tableau	23CS563	Basics of MATLAB
23CS562	Foundations of Cloud Computing	23CS564	Python for Data Visualization and Analysis

VI SEMESTER

SN	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	23CS61	Cryptography and Network Security	CSE	3	0	2	0	03	50	50	100	4
2	IPCC	23CS62	Machine Learning	CSE	3	0	2	0	03	50	50	100	4
3	IPCC	23CS63	Cloud Computing	CSE	3	0	2	0	03	50	50	100	4
4	AEC	23RMI64	Research Methodology and Intellectual property rights	Any department	3	0	0	0	03	50	50	100	3
5	PEC	23CS65X	Professional Elective Course	CSE	3	0	0	0	03	50	50	100	3
6	OE	23CS66X	Open Elective Course	CSE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If the course is a Laboratory: 0	0	2		02				
7	PROJ	23CS67	Mini Project with seminar	CSE	0	0	2	1	03	100	-	100	1
8	MC	23IKS68	Indian knowledge system	Any department	1	0	0	0	0	100	---	100	0
Total										**500**	**300**	**800**	**20**

Professional Elective Course			
23CS651	Robotics Process Automation	23CS653	Compiler Design
23CS652	Big data analytics	23CS654	Advanced Java Programming

Open Elective Course			
23CS661	Ethical Hacking	23CS663	Automated Software Testing
23CS662	UI/UX	23CS664	Introduction to Microsoft Power BI

VII SEMESTER

SN	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC-1	23CS71	Deep Learning and Neural Networks	CSE	3	0	2	0	03	50	50	100	4
2	IPCC-2	23CS72	Full Stack development using python	CSE	3	0	2	0	03	50	50	100	4
3	IPCC-3	23CS73	IOT and applications	CSE	3	0	2	0	03	50	50	100	4
4	PEC	23CS74X	Professional Elective Course	CSE	3	0	0	0	03	50	50	100	3
5	PROJ	23CS75	Major Project	CSE	0	0	6	0	03	50	50	100	6
6	OE (CERT)	23CS76**	Open Elective (Credit Transfer Certification Course)	CSE	2	0	0	2	03	30	70	100	2
Total										**280**	**320**	**600**	**23**

Professional Elective Course			
23CS741	Block Chain Technology	23CS743	Introduction to DevOps Practices
23CS742	Software Defined Networks	23CS744	Data warehouse & Data mining

VIII SEMESTER

SN	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	23CS81	Advanced Cyber Security	CSE	3	0	0	0	03	50	50	100	3
2	PEC	23CS82X	Professional Elective Course	CSE	3	0	0	0	03	50	50	100	3
3	INT	23CS83	Internship	CSE	Must be completed during intervening vacations of VI&VII semester and/or VII&VIII semesters with minimum of 6-8 weeks.				03	100	100	200	8
4	OE (CERT)	23CS84**	Open Elective (Credit Transfer Certification Course)	CSE	2	0	0	2	03	30	70	100	3
Total										**230**	**270**	**500**	**17**

Professional Elective Course			
23CS821	Natural Language Processing	23CS823	Computer Vision & Image Processing
23CS822	AR/VR	23CS824	Generative AI

Assessment Details (Both CIE and SEE):

PCC: Professional Core Course,
PEC: Professional Elective Course,
PROJ: Project Work, L: Lecture,
T: Tutorial,
P: Practical
SDA: Skill Development Activity,
CIE: Continuous Internal Evaluation,
SEE: Semester End Evaluation.
TD: Teaching Department,
PSB: Paper Setting, department,
PEC: Professional Elective Course, SEC: Skill Enhancement Course.
OE: Open Elective
CERT: Credit Transfer Certification Courses.

INT: Internship

****Credit Transfer Certification Courses:** The Credit Transfer Certification Course is a UGC initiative offered through the SWAYAM platform/credible MOOCS, providing online credit-Eligible courses across various engineering domains. Students must enroll in an equivalent credit course, as decided by the department, and ensure it is a subject not studied in previous semesters and it may be inter-disciplinary also.

Universities must register with SWAYAM or establish a local chapter to enable participation. SWAYAM provides all learning materials and evaluates assignments, which carry 30 marks as part of the Continuous Internal Evaluation (CIE). The Semester End Examination (SEE) is conducted by the university under the Controller of Examinations for 70 marks.

The combined CIE and SEE marks must be uploaded to the SWAYAM portal for certification.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective (OE)
Students may choose open electives offered by other departments. They are also allowed to take open electives offered by their own department, subject to eligibility. If a student opts to take an equivalent credit course from another department, they must forgo a corresponding course from their parent department. Any course selected as an open elective must not duplicate a course the student has already completed or is currently enrolled in.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:
Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

No SEE component for Mini-Project

MAIN PROJECT:
The objective of the Project work is
To encourage independent learning and the innovative attitude of the students.
To develop interactive attitude, communication skills, organization, time management, and presentation

skills.
To impart flexibility and adaptability.
To inspire team working.
To expand intellectual capacity, credibility, judgment and intuition.
To adhere to punctuality, setting and meeting deadlines.
To install responsibilities to oneself and others.
To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Project: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey, problem identification, methodology, system design/Prototype design. Students have to complete implementation of project, perform testing and validation and submit a final report. Finally, students have to publish a paper or patent.

B.Tech– V Semester

Computer Science & Engg.

(2023 Syllabus)

COURSE NAME: WEB TECHNOLOGIES

Course Code	**23CS51**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Knowledge on basic programming languages
- Basic understanding of Networks
- Fundamentals of DBMS

Course Objectives:

This course will enable students to,

1. Illustrate the Semantic Structure of HTML and CSS
2. Compose forms and tables using HTML and CSS
3. Design Client-Side programs using JavaScript and Server-Side programs using PHP
4. Infer Object Oriented Programming capabilities of PHP
5. Integrating PHP in HTML to access data from backend.

Module-I **8 Hours**

Introduction to HTML and CSS: What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

Chapter:2,3

Module-II **8 Hours**

Advanced concepts of HTML and CSS: Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

Chapters: 4, 5

Module-III **8 Hours**

JavaScript: Client-Side Scripting, what is JavaScript and What can it do? JavaScript Design Principles, where does JavaScript Go? Syntax, JavaScript Objects,

The Document Object Model (DOM): JavaScript Events, Forms

Web Media: Digital Representation of Images, Color Models, Image Concepts, File Formats, Audio and Video, HTML5 Canvas.

Chapters: **6, 7**

Module-IV **8 Hours**

Introduction to Server-Side Development with PHP: What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions.

PHP Arrays and Superglobals: Arrays, $_GET and $_POST Superglobal Arrays,$_SERVER Array, $_Files Array, Reading/Writing Files.

Chapters: **8, 9**

Module-V	8 Hours

PHP Classes and Objects: Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design.

Managing MySql Database: Accessing MySql in PHP, Case Studies.

Chapters: 10, 11

Practical Components: **20 hours**

1. **Share Your Travel Photos** – A web app for users to upload, view, and organize travel photos.
2. **Book Repository Customer Relations Management** – A CRM system to manage customers and orders for a book repository.
3. **Art Store** – An online art store showcasing artworks with shopping cart and user login features.
4. **Simple Login Form Prevalidation** – A login form using JavaScript for client-side input validation.
5. **Write a Node Highlighting Helper Script** – A Java script to traverse and highlight HTML document nodes.
6. **Progressive Enhancement Art Gallery Search** – A search feature for an art gallery that adapts to browser capabilities using progressive enhancement.

Course Outcomes:

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

CO1: Acquire the fundamentals of HTML and CSS, including semantic markup and the box model.

CO2: Develop structured tables and forms with accessibility features and implement responsive layouts using CSS frameworks.

CO3: Utilize JavaScript for client-side scripting, DOM manipulation, event handling, and media integration.

CO4: Implement server-side development using PHP, handling user input, file operations.

CO5: Apply OOP Concepts in PHP and integrate MySQL for database management.

Text Books:

1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development",** 1st Edition, Pearson Education India. (**ISBN:**978-9332575271))

References:

1. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development",** 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
2. Nicholas C Zakas, **"Professional JavaScript for Web Developers",** 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
3. Zak Ruvalcaba Anne Boehm, **"Murach's HTML5 and CSS3"**, 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (**ISBN:**978-9352133246).

E-References:

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

COURSE NAME: COMPUTER NETWORKS

Course Code	**23CS52**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic knowledge of Operating Systems
- Programming skills in languages such as Java or Python

Course Objectives:

This course will enable students to,

1. Understand data communication basics, network models (TCP/IP, OSI), transmission media, and switching.
2. Learn error detection/correction, data link control (framing, flow/error control), and MAC protocols.
3. Study network layer services, IPv4/IPv6, routing algorithms (DVR, LSR, PVR), and protocols (RIP, OSPF, BGP).
4. Analyze transport layer protocols (UDP, TCP), including flow, error, and congestion control.
5. Explore application layer protocols (HTTP, FTP, DNS, email) and client-server models.

Module-I	**8 Hours**

Introduction: Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching: Packet Switching and its types.

Textbook: Ch. 1.1 - 1.3, 2.1 - 2.3, 7.1 – 7.3, 8.3.

Module-II	**8 Hours**

Data Link Layer: Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol

Textbook: Ch. 10.1-10.4, 11.1 -11.4, 12.1 - 12.2

Module-III	**8 Hours**

Network Layer: Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF

Textbook: Ch. 18.1, 18.2, 18.4, 22.2,20.1-20.3, 21.3.2

Module-IV	**8 Hours**

Introduction to Transport Layer: Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control.

Textbook: Ch. 23.1- 23.2, 24.1-24.3.4, 24.3.6-24.3.9

Module-V	**8 Hours**

Introduction to Application Layer: Introduction, Client-Server Programming, Standard Client-Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH)

Textbook: Ch. 25.1-25.2, 26.1-26.6

Practical Components: **10 hours**

PART A-Simulation using NS2

1. Write TCL Script for connecting two nodes and sending packets in wired network.
2. Write TCL Script for given STAR topology using SFQ on queue at intermediate node & use different colors for packet originated from different nodes.
3. Write TCL Script for given RING topology in wired network using For loop & making topology dynamic.
4. Write TCL Script in wired network for the given topology using TCP connection and sending data through the node.
5. Write TCL Script in wired network for the given topology using UDP connection and sending data through node.

PART B-Implement the following in the Java Programming language: **10 hours**

1 Write a program for error detecting code using CRC-CCITT (16- bits).
2. Write a program to find the shortest path between vertices using bellman-ford algorithm.
3. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels.
4. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.

5.Write a program for simple RSA algorithm to encrypt and decrypt the data

Course Outcomes:

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

CO1: Explain network models, transmission media, and switching techniques.
CO2: Implement error detection (block/cyclic codes) and data link protocols (HDLC, PPP).
CO3: Compare IPv4/IPv6 and evaluate routing algorithms and protocols.
CO4: Differentiate UDP/TCP and analyze their control mechanisms.
CO5: Demonstrate application layer protocols in client-server systems.

Text Books

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition

Reference Books:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.
3. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
4. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson

E-References:

1. https://broman.dev/download/Computer%20Networking:%20A%20Top-Down%20Approach%206th%20Edition.pdf
2. https://ptgmedia.pearsoncmg.com/images/9780133814743/samplepages/9780133814743.pdf

COURSE NAME: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Code	**23CS53**	CIE Marks	**50**
Teaching Hours / Week	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**4**	Exam Hours	**3**

Prerequisites:

- Basic programming (Python)
- Linear Algebra
- Probability & Statistics

Course Objectives:

This course will enable students to,

1. Realize AI's definition, historical development, applications, and future advancements.
2. Comprehend the architecture of intelligent agents and apply problem-solving methods to formulate and solve problems.
3. Implement uninformed and informed search strategies, including heuristic functions, to solve complex problems.
4. Be proficient in using propositional and first-order logic for knowledge representation and logical inference.
5. Recognize the basics of supervised, unsupervised, and reinforcement learning, and demonstrate knowledge in advanced AI applications like NLP and planning.

Module-I **8 hours**

Introduction: What is AI? Foundations and History of AI **Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents**.**

Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4

Module-II **8 hours**

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4

Module-III **8 hours**

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions **Logical Agents**: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

Text book 1: Chapter 3-3.5,3.6

Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5

Module-IV **8 hours**

First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic: Propositional** Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5

Module-V **8 hours**

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited

Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge

acquisition

Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6

Text Book 2: Chapter 20

Practical Components: **20 hours**

1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2. Implement and Demonstrate Best First Search Algorithm on Missionaries-Cannibals Problems using Python
3. Implement A* Search algorithm
4. Implement AO* Search algorithm
5. Solve 8-Queens Problem with suitable assumptions
6. Implementation of TSP using heuristic approach
7. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining
8. Implement resolution principle on FOPL related problems
9. Implement Tic-Tac-Toe game using Python
10. Build a bot which provides all the information related to text in search box

Course outcomes:

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

CO1: Apply knowledge of agent architecture, searching and reasoning techniques for different applications.

CO2: Compare various Searching and Inferencing Techniques.

CO3: Develop knowledge base sentences using propositional logic and first order logic

CO4: Describe the concepts of quantifying uncertainty.

CO5: Use the concepts of Expert Systems to build applications

Text Book:

1. Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015
2. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition,Tata McGraw Hill,2013

Reference Books:

1. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011 Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier,1980
2. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Web links and Video Lectures (e-Resources)

1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/

COURSE NAME: SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Course Code	**23CS54**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Programming Knowledge
- Basic Understanding of Databases
- Problem-Solving & Logical Thinking

Course Objectives:

This course will enable students to,

1. Outline software engineering principles and activities for large software development.
2. Identify ethical and professional issues in software engineering.
3. Describe requirement gathering, classification, specification, and validation.
4. Recognize the importance of project management methods and methodologies.
5. Identify software quality parameters, measurements, metrics, and standards.

Module-I **8 Hours**

Software and Software Engineering: The nature of Software, The unique nature of WebApps, Software Engineering, The software Process, Software Engineering Practice, Software Myths. Process Models: A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models. Unified Process, Personal and Team process models

Textbook 1: Chapter 1: 1.1 to 1.6, Chapter 2: 2.1 to 2.5

Module-II **8 Hours**

Understanding Requirements: Requirements Engineering, Establishing the ground work, Eliciting Requirements, developing use cases, Building the requirements model, Negotiating Requirements, Validating Requirements. Requirements Modeling Scenarios, Information and Analysis classes: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts, Class-Based Modeling. Requirement Modeling Strategies: Flow oriented Modeling, Behavioral Modeling.

Textbook 1: Chapter 5: 5.1 to 5.7, Chapter 6: 6.1 to 6.5, Chapter 7: 7.1 to 7.3

Module-III **8 Hours**

Agile Development: What is Agility? Agility and the cost of change. What is an agile Process? Extreme Programming (XP), Other Agile Process Models, A tool set for Agile process. Principles that guide practice: Software Engineering Knowledge, Core principles, Principles that guide each framework activity.

Textbook 1: Chapter 3: 3.1 to 3.6, Chapter 4: 4.1 to 4.3

Module-IV **8 Hours**

Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices. Project

Evaluation: Evaluation of Individual projects, Cost–benefit Evaluation Techniques, Risk Evaluation

Textbook 2: Chapter 1: 1.1 to 1.17 , Chapter 2: 2.4 to 2.6

Module-V **8 Hours**

Software Quality: Introduction, The place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, product versus process quality management. Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models.

Textbook 2: Chapter 13: 13.1 to 13.5, 13.7, 13.8, Text Book 1: Chapter 26: 26.5 to 26.7

Course Outcomes:

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

CO1: Differentiate process models to judge which process model has to be adopted for the given scenarios.

CO2: Derive both functional and nonfunctional requirements from the case study.

CO3: Analyze the importance of various software testing methods and agile methodology.

CO4: Illustrate the role of project planning and quality management in Project Development.

CO5: Identify appropriate techniques to enhance software quality.

Text Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition,Tata McGraw Hill.
2. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.

E-References:

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg01/preview

COURSE NAME: THEORY OF COMPUTATION (PEC)

Course Code	**23CS551**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic of discrete mathematics.
- Proficiency in any programming language.
- Understanding of recursion, trees, and graphs.

Course Objectives:

This course will enable students to,

1. Understand the Fundamentals of Finite Automata
2. Explore Regular Expressions and Their Relationship with Finite Automata
3. Analyze Context-Free Grammars and Their Role in Language Processing
4. Understand Pushdown Automata and Parsing Techniques
5. Explore Turing Machines and Computability Theory

Module-I **8Hours**

FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

Textbook1: Chapter2

Module-II **8Hours**

REGULAR EXPRESSIONS (RE): Identities for Regular Expressions, Finite Automata and Regular Expressions, NDFAs with A-moves and Regular Expressions,Conversion of Nondeterministic Systems to Deterministic Systems, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata,Equivalence of Two Regular Expressions, Regular Sets and Regular Grammars, Construction of a Regular Grammar Generating T(M) for a Given DFA MConstruction of a Transition System M Accepting L(G) for a Given Regular Grammar G.

Textbook2:Chapter5

Module-III **8Hours**

CONTEXT FREE GRAMMER: Context-free Languages and Derivation Trees, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars: Construction of Reduced Grammars, Elimination of Null Productions, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages,Decision Algorithms for Context-free Languages

Textbook2: Chapter6

Module-IV **8Hours**

PUSHDOWN AUTOMATA:Basic Definitions,Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata,Top-down Parsing,Top-down Parsing Using Deterministic pda's,Bottom-up Parsing

LR(k) GRAMMARS: LR(k) Grammars,Properties of LR(k) Grammars,Closure Properties of Languages.

Textbook 2: Chapter7,8

Module-V **8Hours**

TURING MACHINES AND LINEAR BOUNDED AUTOMATA: Turing Machine Model, Representation of Turing Machines: Representation by Instantaneous Descriptions, Representation by Transition Table, Representation by Transition Diagram, Language Acceptability by Turing Machines, Design of Turing Machines, Description of Turing Machines, Techniques for TM Construction, Turing Machines and Type 0 Grammars.

Textbook 2: Chapter 9

Course Outcomes:

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

CO1: Analyze and Design Finite Automata
CO2: Apply Regular Expressions and Their Equivalences with Finite Automata
CO3: Interpret Context-Free Grammars and Their Properties
CO4: Demonstrate Proficiency in Pushdown Automata and Parsing Techniques
CO5: Explain the Concept of Turing Machines and Computability Theory

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India.
2. K. L. P Mishra, N. Chandrasekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

Reference books:

1. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
2. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
3. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
4. lex & yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly Compiler Construction, Kenneth C. Louden, Thomson. Course Technology

E-References:

1. https://cseexamhacks.wordpress.com/wp-content/uploads/2017/02/toc-klp-mishra.pdf
2. https://www-2.dc.uba.ar/staff/becher/Hopcroft-Motwani-Ullman-2001.pdf
3. https://methodist.edu.in/web/uploads/files/toc-klp-mishra.pdf

COURSE NAME: DISTRIBUTED SYSTEMS

Course Code	**23CS552**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Operating Systems
- Basics of Computer Networks
- Programming Skills
- Database Management Systems

Course objectives:

This course will enable students to

1. Understand the Fundamentals of Distributed Systems.
2. Analyze Distributed Architectures
3. Implement Synchronization Mechanisms.
4. Explore Distributed Transactions and Replication
5. Evaluate System Performance and Fault Tolerance

Module-I	**8 Hours**

Characterization of distributed systems: Introduction, Focus on resource sharing, Challenges.
Remote invocation: Introduction, Request-reply protocols, Remote procedure call, Introduction to Remote Method Invocation.
Textbook: Chapter- 1.1,1.4,1.5, 5.1-5.5

Module-II	**8 Hours**

Distributed file systems: Introduction, File service architecture.
Name services: Introduction, Name services and the Domain Name System, Directory services.
Textbook: Chapter- 12.1,12.2, 13.1-13.3

Module-III	**8 Hours**

Time and global states: Introduction, Clocks, events and process states, Synchronizing Physical clocks, Logical time and logical clocks, Global states
Textbook: Chapter- 14.1-14.5

Module-IV	**8 Hours**

Coordination and agreement: Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems.
Textbook: Chapter -15.1-15.5

Module-V	**8 Hours**

Distributed transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.
Replication: Introduction.
Textbook: Chapter -17.1-17.6, 18.1

Course Outcome:

CO1: Identify the goals and challenges of distributed systems
CO2: Demonstrate the remote invocation techniques for communication
CO3: Describe the architecture of distributed file systems and name services
CO4: Apply clock synchronization algorithms to monitor and order the events.
CO5: Evaluate Distributed Transactions and Replication

Textbook:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

E-References:

1. https://www.youtube.com/watch?v=Azyizl9w2xo&list=PLrjkTql3jnm9FEOXHA_qjRTMODlaIk-W

COURSE NAME: UNIX SYSTEM PROGRAMMING

Course Code	**23CS553**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Programming Concepts.
- Understanding Operating System Fundamentals.
- Understanding how hardware and software interact at a low level.

Course objectives:

This course will enable students to

1. Understand UNIX Concepts and File System.
2. Explain the Design of the UNIX Operating System.
3. Explore UNIX System Calls and Process Management.
4. Develop Shell Scripts and UNIX Utilities.
5. Build Applications and Services on UNIX.

Module-I **8Hours**

Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command.

Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.

Text Book1: Chapter-1, 2, 3, 4, 5

Module-II **8Hours**

File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.

The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection.

Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.

Shell programming: Ordinary and environment variables. The. profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples.

Text Book1: Chapter-6,8,13,14

Module-III	8Hours
Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. **File I/O:** Introduction, File Description, open, create, read, write, close, fcntl functions. **Files and Dictionaries:** mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. **The Environment of a UNIX Process:** Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. **Text Book 2: 2,3,4,7**	
Module-IV	**8Hours**
Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. **Overview of IPC Methods**: Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores, Shared Memory, Client-Server Properties. **Advanced IPC**: Passing File Descriptors, An Open Server-Version 1 **Text Book2: Chapter 8, 15,17**	
Module-V	**8Hours**
Signals and Daemon Processes: Signals: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. **Daemon Processes:** Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. **Text Book 2: Chapter 10, 13**	
Course outcome: At the end of the course, the student will be able to: **CO1**: Demonstrate the basics of Unix concepts and commands. **CO2**: Demonstrate the UNIX file system. **CO3**: Apply commands to reflect changes in file system. **CO4**: Demonstrate IPC and process management. **CO5**: Develop an application/service over a Unix system.	
Text Books and References: **Text Books:** 1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill 2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 3rd Edition, Pearson Education. **Reference Books:** 1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. 2. M.G. Venkatesh Murthy: UNIX & Shell Programming**,** Pearson Education. 3. Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2ndEdition, Wiley, 2014	
E-References: • https://www.youtube.com/watch?v=ffYUfAqEamY	

- https://www.youtube.com/watch?v=Q05NZiYFcD0
- https://www.youtube.com/watch?v=8GdT53KDIyY
- https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo

COURSE NAME: NoSQL

Course Code	**23CS554**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Database Programming
- SQL

Course objectives:

This course will enable students to

1. Understand relational and NoSQL databases with focus on aggregate data models.
2. Explore distributed data systems and consistency trade-offs.
3. Learn Map-Reduce for scalable data processing.
4. Analyze features and applications of document databases.
5. Understand graph databases and their use in connected data scenarios

Module-I **8Hours**

Why NoSQL?: The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

Aggregate Data Models: Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.

More Details on Data Models: Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access

Textbook1: Chapter 1,2,3

Module-II **8Hours**

Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

Consistency: Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums.

Version Stamps: Business and System Transactions, Version Stamps on Multiple Nodes

Textbook1: Chapter 4,5,6

Module-III **8Hours**

Map-Reduce: Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce

Key-Value Databases: What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

Textbook1: Chapter 7,8,

Module-IV	8Hours
Document Databases: What Is a Document Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure. **Textbook1: Chapter 9**	
Module-V	**8Hours**
Graph Databases: What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. **Textbook1: Chapter 11**	
Course Outcomes: **CO1:** Identify and compare NoSQL models like key-value, document, and column-family. **CO2:** Apply distribution models and explain consistency using CAP theorem. **CO3:** Design data solutions using Map-Reduce and key-value stores. **CO4:** Evaluate document databases for real-world applications. **CO5:** Model complex relationships using graph databases.	
Text Books and References: **Text Books:** 1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence , Sadalage, P. & Fowler, Pearson Addision Wesley 2012 **Reference Books:** 1. NoSQL For Mere Mortals , Dan Sullivan, Pearson Education India, 1st Edition, 2015 2. Making Sense of NoSQL: A guide for Managers and the Rest of us" Dan McCreary and Ann Kelly, Manning Publication/Dreamte ch Press, 20131st Edition 3. Mongodb: The Definitive Guide- Powerful and Scalable Data Storage, Kristina Chodorow, O'Reilly Publications, 2nd Edition, 2013	
E-References: 1. https://youtu.be/0buKQHokLK8?si=Bl_VKEMaQuRtXWoa 2. https://youtu.be/xh4gy1lbL2k?si=ufnp91xEw_sYrULh	

COURSE NAME: DATA VISUALIZATION USING EXCEL AND TABLEAU

Course Code	**23CS561**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic programming and logic building
- Microsoft Excel basics (formulas, charts, pivot tables)
- Basic database management concepts

Course Objectives:

This course will enable students to:

1. Understand the principles and importance of data visualization.
2. Learn to use Excel and Tableau for effective data visualization.
3. Develop interactive dashboards and reports to communicate insights.
4. Gain proficiency in advanced visualization techniques for engineering datasets.
5. Apply visualization techniques to solve real-world engineering problems.

Module-I	**3 hours**

Introduction to Data Visualization: Importance and Fundamentals of Data Visualization, Principles of Effective Data Visualization, Types of Data and their Representation, Overview of Excel & Tableau as Visualization Tools.

Textbook-1: chapter: 1, Textbook-2: chapter: 1

Module-II	**3 hours**

Data Visualization Using Excel: Creating Basic Charts (Bar, Line, Pie, Scatter) , Advanced Excel Charts (Histogram, Box Plot, Waterfall, Radar) , Using Pivot Tables and Pivot Charts for Data Analysis, Creating Interactive Dashboards in Excel.

Textbook-2: chapter: 2 & 3

Module-III	**3 hours**

Introduction to Tableau: Tableau Interface and Connecting to Data Sources, Data Preparation and Cleaning in Tableau, Basic Charts and Graphs in Tableau, Filters, Sets, and Hierarchies for Dynamic Data Representation.

Textbook-1: chapter: 2, 3 & 4

Textbook-2: chapter: 4

Module-IV	**3 hours**

Advanced Data Visualization with Tableau: Advanced Chart Types (Tree Maps, Heat Maps, Dual-Axis Charts), Geospatial Visualization and Maps in Tableau, Advanced Calculations and Statistical Analysis in Tableau, Implementing Actions, Filters, and Animations in Dashboards.

Textbook-1: chapter: 5,6,7,8

Textbook-2: chapter: 5

Module-V	**3 hours**

Engineering Applications and Case Studies: Case Studies in Engineering Data Visualization, Integrating Excel and Tableau for Comprehensive Analysis, Optimization and Performance

Tuning in Tableau, Final Project: Engineering Data Dashboard.

Textbook-1: chapter: 9,10,11

Textbook-2: chapter: 6

Course Outcomes:

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

CO1: Apply best practices in data visualization and storytelling.
CO2: Use Excel to create charts, pivot tables, and dashboards.
CO3: Develop interactive and dynamic dashboards in Tableau.
CO4: Implement advanced visualization techniques such as geospatial and statistical analysis.
CO5: Work with large engineering datasets to generate meaningful insights.

Text Books:

1. "Mastering Data Visualization with Tableau" – Dr. Arpana Chaturvedi & Prof. Praveen Malik (BPB Publications)
2. "Data Visualization with Excel and Tableau" – Seema Acharya (Wiley)

Reference Books:

1. Communicating Data with Tableau by *Ben Jones*
2. Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software by *Daniel G. Murray*

E-References:

1. **Microsoft Excel Official Documentation**
   - https://support.microsoft.com/en-us/excel
   - Covers Excel charting, pivot tables, and data visualization best practices.
2. **Tableau Learning Resources**
   - https://www.tableau.com/learn
   - Official Tableau training, tutorials, and case studies.
3. **Data Visualization Best Practices by Harvard University**
   - https://guides.library.harvard.edu/dataviz

COURSE NAME: FOUNDATIONS OF CLOUD COMPUTING

Course Code	**23CS562**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic knowledge of computer networks
- Awareness of database management and storage concepts.

Course Objectives:

This course will enable students to,

1. To introduce various computing paradigms and their applications.
2. To provide an in-depth understanding of cloud computing fundamentals, architecture, and management.
3. To explore cloud service models, their characteristics, and real-world applicability
4. To study cloud migration strategies and infrastructure management.
5. To analyze different cloud service providers and their offerings

Module-I **3 Hours**

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing

Textbook1:Chapter1

Module-II **3 Hours**

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models

Textbook1:Chapter 2

Module-III **3 Hours**

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approach**.**

Textbook1:Chapter 3

Module-IV **3Hours**

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models

Textbook1:Chapter 5

Module-V **3 Hours**

Cloud Service Providers: EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App

Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint

Textbook1:Chapter 11

Course Outcomes:

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

CO1: Explain different computing paradigms and their role in modern computing Environments.

CO2: Describe the fundamentals and principles of cloud computing**.**

CO3: Explore cloud computing architecture, management strategies, and migration approaches.

CO4: Differentiate between various cloud service models such as IaaS, PaaS, and SaaS.

CO5: Evaluate and compare services provided by different cloud service providers

Text Books

1.Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

Reference books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, 2011.

E-References:

1. https://api.pageplace.de/preview/DT0400.9781482205442_A24097357/preview-9781482205442_A24097357.pdf
2. https://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/CLOUD%20COMPUTING%20Principles%20and%20Paradigms.pdf

COURSE NAME: BASICS OF MATLAB

Course Code	**23CS563**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**2**
Examination type (SEE)	**Practical**		

Prerequisites:

- Basic Programming Concepts

Course Objectives:

This course will enable students to,

1. Understand the Basics of MATLAB Programming
2. Apply Numerical Methods for Curve Fitting and Data Approximation
3. Implement Numerical Integration and Differentiation Methods
4. Solve Linear and Nonlinear Systems of Equations
5. Model and Solve Ordinary Differential Equations (ODEs)

Experiments

1. **Introduction to MATLAB Programming:** Basics of MATLAB Programming, array operations in MATLAB, loops and execution of control, working with files: Scripts and functions, plotting and programming output, examples.
2. **Numerical Methods and their applications:** Curve Fitting: Straight line fit, Polynomial fit.
3. **Numerical Integration and Differentiation:** Trapezoidal method, Simpson method.
4. **Linear and Nonlinear Equations:** Eigen values, Eigen vectors, Solution of linear algebraic equations using Gauss Elimination and LU decomposition, Solution of nonlinear equation in single variable using Gauss-Siedal and Newton-Raphson method.
5. **Ordinary Differential Equations:** Introduction to ODE's, Euler's method, second order RungaKutta method,
6. **MATLAB ode45 algorithm in single variable and multivariable, Transforms:** Discrete Fourier Transforms
7. **Application of MATLAB** to analyse problems in basic engineering mechanics, mechanical vibrations, control system, statistics and dynamics of different circuits.
8. **MATLAB Simulink:** Introduction to MATLAB Simulink, Simulink libraries, development of basic models in Simscape Power Systems

Course Outcomes:

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

CO1: Implement loops, branching, control instruction and functions in MATLAB programming environment.

CO2: Program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems.

CO3: Implement the ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB.

CO4: Simulate MATLAB Simulink examples

CO5: Solve ordinary differential equations.

Text Books

1. Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", OXFORD Higher Education.
2. Dr. Shailendra Jain, "Modeling& Simulation using MATLAB – Simulink", Wiley – India.

Reference books:

1. Won Y.Tang, Wemun Cao, Tae-Sang Ching and John Morris, "Applied Numerical Methods Using MATLAB", A John Wiley & Sons.
2. Steven T. Karris, "Introduction to Simulink with Engineering Applications", Orchard Publications.

E-References:

1. https://www.youtube.com/watch?v=tBWMn4y1Yfo

COURSE NAME: PYTHON FOR DATA VISUALIZATION AND ANALYSIS

Course Code	**23CS564**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic python Programming.
- Basic Mathematics.
- Data Structures.

Course Objectives:

This course will enable students to,

1. Able to apply basic python data structures to solve real-world problems.
2. Master Data Analysis: Teach students how to analyze data using NumPy for data analysis.
3. Proficient Visualization: Equip learners with skills to manipulate data efficiently using pandas.
4. Advanced Data Operations: Enhance understanding of matplotlib module features to visualize the data efficiently.
5. Hands-on Learning: Provide practical experience through mini projects using real-world datasets.

Module-I	**3 hours**

Review of basic python: Variable, control statements, data types, Loops: while loop, for loop, nested loop, Lists, Dictionaries, Tuples basics

Reference book1: chapters 1.3,2.3,4.2,,5,9,10,

Module-II	**3 hours**

Working with NumPy for Data Analysis: Computation on NumPy Arrays, Universal Functions Aggregations, Min, Max, and Everything In Between Computation on Arrays, Broadcasting Comparisons, Masks, and Boolean Logic, Fancy Indexing ,Sorting, Arrays ,Structured Data, NumPy's Structured Arrays

Textbook 1: Chapter 2

Module-III	**3 hours**

Data Manipulation with Pandas: Data Indexing and Selection, Operating on Data in Pandas**,**Handling Missing Data**,**Hierarchical Indexing**,**Combining Datasets, Concat, Append, Merge, and Join**,**Aggregation and Grouping**,**Pivot Tables**,**Vectorized String Operations**,**Working with Time Series**,**High-Performance Pandas, eval() and query()

Textbook 1: Chapter 3

Module-IV	**3 hours**

Visualization with Matplotlib: Simple Line and Scatter Plots,Visualizing Errors,Density and Contour PlotsHistograms, Binnings, and Density,Customizing Plot Legends, Ticks, and Colorbars,Multiple Subplots,Text and Annotation,Configurations and Stylesheets,Three-Dimensional Plotting in Matplotlib Geographic Data with Basemap.

Textbook 1: Chapter 4

Module-V	**3 hours**

Visualization with Seaborn & Mini Project: Introduction to Seaborn**,**Visualizing Distributions and Relationships**,**Pairplot, Boxplot, Violinplot, Heatmap, and More**,**Hands-on Mini Project using

Pandas + Seaborn + Matplotlib *(e.g., COVID data, sales data, or any real-world dataset)*
Textbook 1: Chapter 4

Course Outcomes:

CO1: Solve simple problems using python data structures, decision making and iterative statements.

CO2: Efficiently analyze data using NumPy for real-world applications.

CO3: Manage time series, missing data, and hierarchical indexing using Pandas.

CO4: Create effective visualizations with Matplotlib and Seaborn to communicate data insights.

CO5: Apply learned techniques in hands-on mini projects with real-world datasets.

Text Book:

1. Python Data Science Handbook by Jake VanderPlas, O'Reilly Media

Reference Books:

1. Introduction to python programming senior contributing authors udayan das, saint mary's college of california aubrey lawson, wiley chris mayfield, james madison university narges norouzi, uc Berkeley.

E-References:

1. https://jakevdp.github.io/PythonDataScienceHandbook/
2. **https://openstax.org/details/books/introduction-python-programming**

Course Name: ADVANCED APTITUDE

Course Code	**23AA57**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Fundamentals of Mathematics
- Basic knowledge of Reasoning.

Course Objective

This course will enable students to,

1. Solve questions based on logical thinking and critical reasoning.
2. Solve quantitative aptitude problems
3. Solve aptitude problems using fast track techniques
4. Solve puzzle based questions
5. Solve problems on numerical computation and numerical estimation

Module-I	**3 hours**
Numerical Ability Based: Simplifications, Squares and Square Roots, Cubes and Cube roots, BODMAS Rule, LCM, HCF, Fractions and Decimals	
Module-II	**3 hours**
Percentage Based: Percentages, Profit and Loss, Discounts, Simple Interest and Compound Interest	
Module-III	**3 hours**
Time Based: Time and Work, Pipes and Cisterns, Time and Distance, Trains, Boats and Streams	
Module-IV	**3 hours**
Ratio Based: Ratio-proportion, Partnership, Averages and Ages	
Module-V	**3 hours**
Logical and Analytical Based : Seating Arrangement, Series, Analogy, Odd man out and Blood Relations	

Course Outcomes:

At the end of course students will be able to

CO1: Analyze and solve questions based on logical thinking and critical reasoning.
CO2: Analyze and solve quantitative aptitude problems
CO3: Solve aptitude problems using fast track techniques
CO4: Solve puzzle based questions
CO5: Analyze and solve problems on numerical computation and numerical estimation

B.Tech– VI Semester

Computer Science & Engg.

(2023 Syllabus)

COURSE NAME: CRYPTOGRAPHY & NETWORK SECURITY

Course Code	**23CS61**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Good Knowledge on networking systems.
- Good Knowledge on Real world Cyber networking threats and Vulnerabilities.

Course Objectives:

This course will enable students to:

1. Understand Cryptography, Network Security and its principles.
2. Analyze Different Cryptography algorithms.
3. Illustrate Public and Private Key cryptography.
4. Explain Key management, distribution and certification.
5. Understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Module-I **8 Hours**

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and BruteForce Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the Data Encryption Standard: Traditional block Cipher structure, Stream Ciphers and Block Ciphers, Motivation for the Feistel Cipher structure, the Feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm

Textbook 1: Chapter 2, 3

Module-II **8 Hours**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.

Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.

Textbook 1: Chapter 9, 10

Module-III **8 Hours**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with

confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates. X-509 certificates. Certificates, X-509 version 3 Public key infrastructure.

Textbook 1: Chapter 14.1 – 14.3

Module-IV	**8 Hours**

User Authentication: Remote user Authentication principles, Mutual Authentication, one-way authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication

Kerberos: Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one-way Authentication.

Textbook 1: Chapter 14.4 – 15.4

Module-V	**8 Hours**

Electronic Mail Security: Pretty good privacy, S/MIME

IP Security: IP Security overview, IP Security policy, Encapsulating Security payload, Combining security associations, Internet key exchange.

Textbook 1: Chapter 19.1, 19.2, 20.1 – 20.5

Practical Components: **20 hours**

1. Write a python program to implement Caesar Cipher encryption & decryption technique.
2. Write a python program to implement DES (Data Encryption Standard) Algorithm.
3. Write a python program to implement RSA Algorithm.
4. Write a python program to implement Diffie-Hellman Key Exchange Algorithm.
5. Write a python program to implement Symmetric Key Distribution Using Symmetric Encryption (Manual Key Exchange).
6. Write a python program to implement Public-Key Cryptography for Key Distribution (Hybrid Scheme).
7. Demonstrate the process of creating, managing, and verifying X.509 certificates as part of a Public Key Infrastructure (PKI).
8. Implement the Kerberos authentication protocol.
9. Implement Pretty Good Privacy (PGP) for Email Security.
10. Implement IP Security (IPSec) in a Virtual Private Network (VPN).

Course Outcomes:

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

CO1: Realize Cryptography, Network Security theories, algorithms and systems.

CO2: Apply different Cryptography and Network Security operations on different applications.

CO3: Analyze different methods for authentication and access control.

CO4: Evaluate Public and Private key, Key management, distribution and certification.

CO5: Design necessary techniques to build protection mechanisms to secure computer networks.

Suggested Learning Resources:

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

Reference Books:

1. V. K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

E-References:

1. https://nptel.ac.in/courses/106105031
2. https://www.digimat.in/nptel/courses/video/106105031
3. https://www.youtube.com/watch?v=DEqjC0G5KwU
4. https://www.youtube.com/watch?v=FqQ7TWvOaus
5. https://www.youtube.com/watch?v=PHsa_Ddgx6w

COURSE NAME: MACHINE LEARNING

Course Code	**23CS62**	CIE Marks	**50**
Teaching Hours / Week (L:T:P: S)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Understanding basic algorithms and data structures is crucial.
- Knowledge of probability and statistics is essential.
- Proficiency in Python is necessary for implementing learning algorithms.

Course Objectives:

This course will enable students to:

1. Identify well-posed learning problems and concept learning.
2. Explore decision tree representation and algorithms.
3. Introduce artificial neural networks and their learning algorithms.
4. Examine Bayesian learning and its applications.
5. Evaluate hypotheses and compare learning algorithm

Module-I **8 Hours**

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7

Module-II **8 Hours**

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Text Book1, Sections: 3.1-3.7

Module-III	8 Hours
Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **Text book 1, Sections: 4.1 – 4.6**	
Module-IV	**8 Hours**
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL Principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm. **Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12**	
Module-V	**8 Hours**
Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. **Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, **Reinforcement Learning:** Introduction, Learning Task, Q Learning. **Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3**	

Practical Components: **20 hours**

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using ***k*-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data

points. Select appropriate data set for your experiment and draw graphs.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Course Outcomes:

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

CO1: Implement basic concept learning algorithms.

CO2: Apply decision tree learning to appropriate problems and analyse results.

CO3: Evaluate neural network models using backpropagation.

CO4: Apply Bayesian methods to concept learning and probability prediction.

CO5: Assess hypothesis accuracy and implement instance-based and reinforcement learning techniques.

Textbooks:

1. Tom M. Mitchell, Machine Learning**,** India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

Web links and Video Lectures (e-Resources):

1. https://www.drssridhar.com/?page_id=1053
2. https://www.cs.cmu.edu/~tom/mlbook.html
3. https://www.cs.cmu.edu/%7Etom/10701_sp11/lectures.shtml
4. https://www.universitiespress.com/resources?id=9789393330697
5. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

COURSE NAME: CLOUD COMPUTING with AWS

Course Code	**23CS63**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic knowledge of computer networks
- Awareness of database management and storage concepts.

Course Objectives:

This course will enable students to:

1. Understand the Fundamental Models of Distributed and Cloud Systems
2. Explore Virtualization Techniques and Infrastructure Management
3. Examine Cloud Platform Architectures and Service Models
4. Evaluate Cloud Security Mechanisms and Trust Management
5. Gain Hands-on Knowledge of Cloud Programming Environments

Module-I	**8Hours**

Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.

Textbook 1: Chapter 1: 1.1 to 1.5.

Module-II	**8Hours**

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

Textbook 1: Chapter 3: 3.1 to 3.5

Module-III	**8Hours**

Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.

Textbook 1: Chapter 4: 4.1 to 4.5.

Module-IV	**8Hours**

Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.

Textbook 2: Chapter 11: 11.1 to 11.3, 11.5 to 11.8, 11.10 to 11.14

Module-V	**8Hours**

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.

Textbook 1: Chapter 6: 6.1 to 6.5

Practical Components: **20 hours**

1. Exploring AWS CloudShell and the AWS Cloud9 IDE
2. Working with Amazon S3 Orchestrating Serverless Functions with AWS Step Functions
3. Working with Amazon DynamoDB
4. Developing REST APIs with Amazon API Gateway
5. Cloud SQL for MySQL: Discover how Google Cloud SQL for MySQL provide automated management and high availability for MySQL databases
6. Cloud Pub/Sub: Experiment how Google Cloud Pub/Sub facilitate real-time messaging and communication between distributed applications
7. Implementing CloudFront for Caching and Application Security
8. Cloud Monitoring: Discover how Cloud Monitoring help in tracking and analyzing the performance and health of cloud resources
9. Automating Application Deployment Using a AWS CI/CD Pipeline

Course Outcomes:

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

CO1: Explain distributed system models and enabling technologies
CO2: Demonstrate an understanding of virtualization concepts
CO3: Analyze cloud computing architectures and service models
CO4: Evaluate security challenges and trust management techniques
CO5: Develop and deploy cloud-based applications using cloud platforms

Suggested Learning Resources:

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, 2nd Edition, Elsevier 2018

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, Mastering Cloud Computing McGrawHill Education, 1st Edition, 2017
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017.
3. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication, 1st Edition, 2009
4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.
5. Google Cloud Teaching Resources – LMS [for practical component]
6. AWS Cloud Developing – AWS Academy Courses [for practical component]

E-References:

1. https://freevideolectures.com/course/4639/nptel-cloud-computing/1.
2. https://www.youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
3. https://www.youtube.com/watch?v=EN4fEbcFZ_E
4. https://www.youtube.com/watch?v=RWgW-CgdIk0
5. https://www.geeksforgeeks.org/virtualization-cloud-computing-types/
6. https://www.javatpoint.com/cloud-service-provider-companies

COURSE NAME: RESEARCH METHODOLOGY & IPR

Course Code	**23RMI64/54**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic understanding of engineering concepts.
- Familiarity with research methodologies and academic writing.
- Knowledge of intellectual property and its significance in innovation and technology.

Course Objectives:

This course will enable students to:

1. Understand research fundamentals, including types, approaches, and ethics.
2. Formulate research problems and conduct literature reviews
3. Collect and analyze data using statistical and multivariate methods.
4. Design research strategies and test hypotheses using statistical tests
5. Learn about intellectual property rights and the patent filing process.

Module-I	**8 Hours**

Introduction - Objective of Research; Definition and Motivation; Types of Research; Research Approaches, Steps in Research Process; Criteria of Good Research; Ethics in Research.

Research Formulation and Literature Review: Problem Definition and Formulation; Literature Review; Characteristics of Good Research Question; Literature Review Process.

Module-II	**8 Hours**

Data Collection - Primary and Secondary Data; Primary and Secondary Data Sources; Data Collection Methods; Data Processing; Classification of Data.

Data Analysis - Statistical Analysis; Multivariate Analysis; Correlation Analysis; Regression Analysis; Principle Component Analysis; Samplings

Module-III	**8 Hours**

Research Design - Need for Research Design; Features of a Good Design; Types of Research Designs; Induction and Deduction.

Hypothesis Formulation and Testing - Hypothesis; Important Terms; Types of Research Hypothesis; Hypothesis Testing; Z-Test; t-Test; f-Test; Making a Decision; Types of Errors; ROC Graphics.

Module-IV	**8 Hours**

Test Procedures - Parametric and Non Parametric Tests; ANOVA; Mann-Whitney Test; Kruskal-Wallis Test; Chi-Square Test; Multi-Variate Analysis.

Presentation of the Research Work - Business Report; Technical Report; Research Report; General Tips for Writing Report; Presentation of Data; Oral Presentation; Bibliography and References; Intellectual Property Rights; Open-Access Initiatives; Plagiarism.

Module-V	**8 Hours**

Law of Patents, Patent Searches, Ownership, Transfer Patentability Design Patents - Double Patenting,Patent Searching , Patent Application Process – Prosecuting the Application, Post-issuance Actions, Term and Maintenance of Patents. Ownership Rights, Sole and Joint Inventors, Inventions Made by Employees and Independent Contractors – Assignment of Patent Rights, Licensing of Patent Rights – Invention Developers and Promoters.

Patent Infringement, New Developments and International Patent Law - Direct Infringement - Inducement to Infringe – Contributory Infringement – First Sale Doctrine – Claims Interpretation – Defenses to Infringement – Remedies for Infringement – Resolving an Infringement Dispute – Patent Infringement Litigation. New Developments in Patent Law

Course Outcomes:

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

CO1: Distinguish between various research methods and approaches in technical fields.

CO2: Demonstrate the ability to write and publish a technical research paper in a peer-reviewed journal.

CO3: Effectively review and critique technical research papers, identifying strengths and weaknesses.

CO4: Develop research designs, formulate hypotheses, and test them using suitable statistical tests (t-tests, chi-square) with proper interpretation.

CO5: Understand Intellectual Property Rights (IPR) and demonstrate the ability to file patents for innovative ideas

Suggested Learning Resources:

Text Books and References:

1. Research Methodology. Methods & Technique : Kothari. C.R.
2. Research Methodology, S.S Vinod Chandra, S Anand Hareendran, Pearson
3. Intellectual Property – Copyrights, Trademarks, and Patents by Richard Stim, Cengage Learning

E-References:

1. Practical Research : planning and Design(8th Edition) – Paul D. Leedy and Jeanne E. Ormrod.
2. A Hand Book of Education Research – NCTE
3. Methodology of Education Research – K.S. Sidhu.
4. Tests, Measurements and Research methods in Behavioural Sciences- A.KSingh.

COURSE NAME: ROBOTIC PROCESS AUTOMATION

Course Code	**23CS651**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Programming Concepts

Course objectives:

This course will enable students to:

1. Outline the basic concepts of RPA.
2. Understand the various components of RPA and Data Manipulation Techniques.
3. Describe the different types of variables, Control Flow and Excel automation.
4. Model the workflow of various control techniques and OCR in RPA.
5. Interpret use of PDF automation and exception handling techniques.

Module-I **8 Hours**

RPA Foundations: What is RPA, Flavors of RPA, History of RPA, The Benefits of RPA, The downsides of RPA, RPA Compared to BPO, BPM and BPA – Consumer Willingness for Automation, The Workforce of the Future, RPA Skills,On,Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR,Databases,APIs, AI,Cognitive Automation,Agile, Scrum, Kanban and Waterfall DevOps, Flowcharts

Textbook 1:chapter 1, chapter 2

Module,II **8 Hours**

RPA Platforms & Data Manipulation : Components of RPA, RPA Platforms, About Ui Path, About UiPath , The future of automation , Record and Play , Downloading and installing UiPath Studio ,Learning Ui Path Studio , Task recorder , Step, by, step examples using the recorder, variables and scope, collections, Arguments, RegEx builder in UiPath Studio to perform complex string manipulation, string activities in Studio to perform string manipulation, basic concepts of Lists and Perform data manipulation on Lists, dictionary variables and perform data manipulation using dictionary variables.

Textbook 2:chapter 1, chapter 4

Module,III **8 Hours**

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities , Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step,by,step example)

Textbook 2: chapter 3

Module,IV **8 Hours**

Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points.

Textbook 2:chapter 5

Module-V	8 Hours
RPA Implementations & Exception Handling: File & Folder Activities, PDF Automation, Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them Logging and taking screenshots- Debugging techniques- Collecting crash dumps- Error reporting. **Textbook 2: chapter 8**	
Course outcome: The students should be able to: **CO1:** Demonstrate the fundamental & basic principles of Robotic Process Automation, Applications in various industries. **CO2:** Summarize the various components & Data Manipulation Techniques. **CO3:** Make use of the different types of variables, control flow and Excel automation. **CO4:** Apply various control techniques and OCR in RPA. **CO5:** Experimenting to handle the PDF automation and various types of Exceptions and strategies.	
Suggested Learning Resources: **Text Books:** 1. The Robotic Process Automation Handbook: A Guide to Implementing RPA SystemsTom Tauli A Press 2020 2. Learning Robotic Process Automation Alok Mani Tripathi March 2018	
Reference Books: 1. Introduction to Robotic Process Automation: a Primer Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston Institute of Robotic Process Automation 1st Edition, 2015. 2. Richard Murdoch Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant 1st Edition, 2018	
E-References: 1. https://www.uipath.com/rpa/robotic-process-automation 2. http://www.academy.uipath.com	

COURSE NAME: BIG DATA ANALYTICS

Course Code	**23CS652**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Database Management System.
- Social Network Analytics.

Course objectives:

This course will enable students to::

1. Understand fundamentals of Big Data analytics
2. Explore the Hadoop framework and Hadoop Distributed File system
3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4. Employ MapReduce programming model to process the big data
5. Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis

Module-I	**8 Hours**

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

Text book 1: Chapter 1: 1.2 -1.7

Module-II	**8 Hours**

Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.

Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.

Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

Text book 1: Chapter 2 :2.1-2.6

Text Book 2: Chapter 3

Text Book 2: Chapter 7 (except walk throughs)

Module-III	**8 Hours**

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

Text book 1: Chapter 3: 3.1-3.7

Module-IV	**8 Hours**

MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

Text book 1: Chapter 4: 4.1-4.6

Module-V	**8 Hours**

Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships,

Outliers, Variances, Probability Distributions, and Correlations,
Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Item sets and Association Rule Mining.

Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics.

Text book 1: Chapter 6: 6.1 to 6.5

Text book 1: Chapter 9: 9.1 to 9.5

Course outcome:

The students should be able to:

CO1: Explore the fundamentals of Big Data analytics.

CO2: Investigate Hadoop framework and Hadoop Distributed File system.

CO3: Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.

CO4: Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.

CO5: Use Machine Learning algorithms for real world big data.

Suggested Learning Resources:

Textbooks:

1. Raj Kamal and Preeti Saxena,"**Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning",** McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline,**"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem",** 1st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351

Reference Books:

1. Tom White,**"Hadoop: The Definitive Guide",** 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, **"Professional Hadoop Solutions",** 1st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer,**"Hadoop Operations: A Guide for Developers and Administrators",**1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madisetti,**"Big Data Analytics: A Hands-On Approach",** 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

COURSE NAME: COMPILER DESIGN

Course Code	**23CS653**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Fundamentals of Programming Languages.
- Discrete Mathematics.
- Data Structures and Algorithms.
- Theory of Computation

Course Objectives:

This course will enable students to:

1. Understanding Compiler Design and Implementation
2. Proficiency in Parsing Techniques.
3. Syntax-Directed Translation and Intermediate Code Generation.
4. Understanding and Implementing Run-Time Environments.
5. Code Generation and Optimization.

Module-I	**8 Hours**

Introduction, **Lexical analysis:** Language processors; The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

Textbook 1: Chapter: 1, 3.1 to 3.4

Module-II	**8 Hours**

Context-free Grammars: Writing a Grammar. Top-down Parsing; Bottom-up Parsing, Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables); Using ambiguous grammars; Parser Generators.

Textbook 1: Chapter: 4 excluding 4.7.5 and 4.7.6

Module-III	**8 Hours**

Syntax-Directed Translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes. Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch statements; Procedure calls.

Textbook 1: Chapter: 5.1 to 5.4, 6.1, 6.2, 6.4, 6.6, 6.7 to 6.9

Module-IV	**8 Hours**

Run-Time Environments: Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

Textbook 1 :Chapter: 7.1 to 7.5

Module-V	**8 Hours**

Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator.
Textbook 1: Chapter: 8.1 to 8.6

Course Outcomes:

The students should be able to:

CO1: Apply the concepts of Regular Expressions and grammar for tokenization and rule checking
CO2: Analyze the syntax and semantic concepts of a compiler.
CO3: Design various types of parsers and Address code generation.
CO4: Explore Run-Time Environments
CO5: Analyses Code Generation

Suggested Learning Resources:

Text Books:

1. Compilers Principles, Techniques and Tools Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman 2 nd Pearson Education 2012

References:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Andrew W Apple: Modern Compiler Implementation in C,Cambridge University Press, 1997.
3. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997.

E-References:

1.https://onlinecourses.nptel.ac.in/noc21_cs07/preview

COURSE NAME: ADVANCED JAVA PROGRAMMING

Course Code	**23CS654**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Core Java & OOP Concepts
- Data Structures, Generics & Type Handling
- Web and Database Basics

Course Objectives:

This course will enable students to:

1. Understanding the fundamental concepts of Enumerations and Annotations
2. Apply the concepts of Generic classes in Java programs
3. Demonstrate the fundamental concepts of String operations
4. Design and develop web applications using Java servlets and JSP
5. Apply database interaction through Java database Connectivity

Module-I	**8 Hours**

Enumerations, Autoboxing and Annotations:

Enumerations, Enumeration fundamentals, the values() and valueOf() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers, Autoboxing, Autoboxing methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of warning

Annotations, Annotation basics, specifying retention policy, obtaining annotations at run time by use of reflection, Annotated element interface, Using default values, Marker Annotations, Single member annotations, Built in annotations

Textbook 1: Chapter12

Module-II	**8 Hours**

Generics: What are Generics, A Simple Generics Example, A Generic Class with Two Type Parameters, The General Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Bounded Wildcards, Creating a Generic Method, Generic Interfaces, Raw types and Legacy code, Generic Class Hierarchies, Erasure, Ambiguity errors, Some Generic Restrictions

Textbook 1: Chapter 14

Module-III	**8 Hours**

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the case of characters within a String, String Buffer, String Builder

Textbook 1: Chapter 15

Module-IV	**8 Hours**

Servlets: The life cycle of a servlet; A simple servlet; the servlet API; The javax.servlet package Reading servlet parameter; the javax.servlet.http package; Handling HTTP Requests and Responses; using Cookies; Session Tracking**, Java Server Pages (JSP)**: JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects

Textbook 1: Chapter 31
Textbook 2: Chapter 11

Module-V **8 Hours**

The concept of JDBC; JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data Types; Exceptions.

Textbook 2: Chapter 6

Course Outcomes:

The students should be able to:

CO1: Exploring the fundamental concepts of Enumerations and Annotations
CO2: Apply the concepts of Generic classes in Java programs
CO3: Demonstrate the concepts of String operations in Java
CO4: Develop web-based applications using Java servlets and JSP
CO5: Illustrate database interaction and transaction processing in Java

Suggested Learning Resources:

Text Books:

1. Herbert Schildt: JAVA the Complete Reference. 9th Edition, Tata McGraw-Hill
2. Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill

Reference Books:

Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.

E-References:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://nptel.ac.in/courses/106/105/106105225/

COURSE NAME: ETHICAL HACKING

Course Code	**23CS661**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Computer Knowledge
- Networking Fundamentals
- Basic Cybersecurity Knowledge
- Basic Programming/Scripting

Course Objectives:

This course will enable students to

1. Understand the basics of computer-based vulnerabilities.
2. Explore different foot printing, reconnaissance and scanning methods.
3. Expose the enumeration and vulnerability analysis methods.
4. Understand hacking options available in Web and wireless applications.
5. Explore the options for network protection.

Module-I	**3 Hours**

Ethical Hacking Overview : Role of Security and Penetration Testers , Penetration Testing Methodologies, Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.

TEXTBOOK 1 : CHAPTER :1,2 ,3

Module-II	**3 Hours**

FOOT PRINTING and Social Engineering

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email ,Competitive Intelligence , Footprinting through Social Engineering , Footprinting Tools .

TEXTBOOK 1 : CHAPTER : 4

Module-III	**3 Hours**

ENUMERATION AND VULNERABILITY ANALYSIS

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.

TEXTBOOK 1 : CHAPTER : 6,8

Module-IV	**3 Hours**

SYSTEM HACKING

Hacking Web Servers , Web Application Components,Vulnerabilities ,Tools for Web Attackers and Security Testers Hacking Wireless Networks ,Components of a Wireless Network .

TEXTBOOK 1: CHAPTER : 10,11

Module-V **3 Hours**

NETWORK PROTECTION SYSTEMS

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.

TEXTBOOK 1 : CHAPTER : 13

Course Outcomes:

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

CO1: Express knowledge on basics of computer-based vulnerabilities

CO2: Gain understanding on different foot printing, reconnaissance and scanning methods.

CO3: Demonstrate the enumeration and vulnerability analysis methods

CO4: Gain knowledge on hacking options available in Web and wireless applications.

CO5: Acquire knowledge on the options for network protection.

Suggested Learning 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. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

References:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

E-References:

1. https://www.youtube.com/watch?v=ibnJ1oViVAk

COURSE NAME: UX/UI

Course Code	**23CS662**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Understanding of Design Principles: Visual Design Basics, User-Centered Design (UCD), Design Systems
- Proficiency in Design Tools:UI/UX Tools, Prototyping Tools, Graphic Design Tools.
- Basic Understanding of Front-End Development: HTML/CSS, JavaScript, Frameworks.

Course Objectives:

This course will enable students to

1. Understand user experience design requirements, with design goals, metrics and targets.
2. Explore different prototyping methods, UX design principles with case examples.
3. Understand the role of design thinking concepts and mental models in UX design.

Module-I	**3 Hours**

Introduction: Usability to user experience, Emotional impact as part of user experience, User experience needs a business case.

Extracting Interaction Design Requirements: Needs & Requirements, Formal requirement extraction, Methods for requirement extraction.

Textbook1: Chapter 1, Chapter 5

Module-II	**3 Hours**

Design Thinking, Ideation, and Sketching: Design Thinking, Design Perspectives, User Personas, Ideation, Sketching.

Mental Models and Conceptual Design: Storyboards, Design influencing user behavior.

Textbook1: Chapter 7, Chapter 8

Module-III	**3 Hours**

Design Production: Detailed Design, Wireframes. UX Goals, **Metrics and Targets**: UX Goals, UX Measures, Measurement instruments, UX Metrics

Textbook1: Chapter 9,10

Module-IV	**3 Hours**

Prototyping: Depth & breadth of a prototype, Fidelity of prototypes, Paper prototypes.

Connections with Software Engineering: Foundations for success in SE-UX development, The challenge of connecting SE and UX.

Textbook1: Chapter 11,23

Module-V	**3 Hours**

UX Design Guidelines: Using and interpreting design guidelines, Human memory limitations, UX design guidelines & examples, Planning, Translation, Physical action, Outcomes, Assessment,

Overall.

Textbook1: Chapter 22

Course Outcomes:

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

CO1: Explain the user experience design requirements.

CO2: Relate design thinking concepts and mental models to UX design.

CO3: Illustrate UX design in line with design goals, metrics and targets.

CO4: Demonstrate different prototyping in relation with software engineering.

CO5: Explain UX design principles with case examples.

Suggested Learning Resources:

Text Books:

1. REX HARTSON and PARDHA S. PYLA, The UX Book-Process and Guidelines for Ensuring a Quality User Experience, Morgan Kaufmann, Elsevier, 2012.

References:

1. "The Design of Everyday Things" by Donald Norman
2. "About Face: The Essentials of Interaction Design" – Alan Cooper

E-References:

1. https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-withwireframe-prototype-figma/
2. https://www.edureka.co/blog/ui-ux-design-tutorial/
3. https://www.udemy.com/course/introtoux/

COURSE NAME: AUTOMATED SOFTWARE TESTING

Course Code	**25CS663**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**2**
Examination type (SEE)	**Practical**		

Prerequisites:

- Basic knowledge of Java or Python.
- Installed Katalon Studio, Selenium WebDriver, and Selenium IDE.
- Familiarity with HTML, CSS, and JavaScript.
- Proper browser and driver setup.

Course Objectives:

This course will enable students to:

1. Configuring Katalon Studio and Selenium.
2. Interacting with web elements using Selenium.
3. Writing and executing Selenium test scripts.
4. Managing test suites.
5. Applying best practices in automation testing.

SL No	Topic	Description
1	**Setting Up Katalon Studio :**Installation process, configuration, web locators, techniques, selectors hub, and browser Dev tools.	
2	**Understanding Automation Modes in Katalon Studio:** Overview of Record Mode, Manual Mode, Keywords, and Script Mode.	
3	**Working with Katalon Recorder Tool:** Using the recorder in Chrome, Firefox, and Explorer; executing test cases within the recorder.	
4	**Exploring Web Spy & Object Repository:**Understanding Web Spy and Object Repository, inspecting web elements in a browser, and strategies for object locators.	
5	**Utilizing Predefined Web UI Keywords:** Working with browser, window, checkbox, combo box, textbox, file upload, screenshot, scroll functions, alerts, frames, mouse hover, drag-and-drop, and keystroke-related keywords.	
6	**Installing Selenium:** Steps to configure Selenium RC and Selenium WebDriver.	
7	**Creating Test Cases:** Designing test cases, converting mapping and templates using Selenium tools, and mapping manual test cases with automated Selenium test cases.	
8	**Using Selenium IDE:** Developing a test suite containing at least four test cases.	
9	**Executing a Test Suite:** Conducting a test suite for two different websites.	
10	**Developing Test Scripts:** Writing and executing a Selenium script to automate user login for a specific website.	
11	**Object Identification in Test Scripts:** Creating a Selenium script to determine the total number of objects present on a webpage.	
12	**Hands-on Practice and Final Review:** Building a test suite for a chosen application, completing an end-to-end automation process, discussing best practices, and Q&A.	

Course Outcomes:

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

CO1: Install and configure Katalon Studio and Selenium.

CO2: Identify and interact with web elements.

CO3: Write and execute Selenium test scripts.

CO4: Develop and manage test suites.

CO5: Apply best practices in automation testing.

Suggested Learning Resources:

Reference Books:

1. **"Selenium WebDriver 3 Practical Guide – Second Edition"** – Unmesh Gundecha and Satya Avasarala, Packt Publishing, July 31, 2018, ISBN-13: 978-1788999762.
2. **"Mastering Selenium WebDriver 3.0 – Second Edition"** – Mark Collin, Packt Publishing, June 29, 2018, ISBN-13: 978-1788299671.
3. **"Test Automation with Selenium"** – Navneesh Garg, Adactin Group, April 1, 2014, ISBN-13: 978-0992293512.
4. **"Software Testing: A Craftsman's Approach – Fourth Edition"** – Paul C. Jorgensen, CRC Press, April 25, 2013, ISBN-13: 978-1466560680.
5. "Katalon Studio Beginner's Guide" – Official Katalon Documentation, available at https://docs.katalon.com.

E-References:

1. Katalon Studio Documentation **–** https://docs.katalon.com
2. Selenium Official Website **–** https://www.selenium.dev
3. Katalon YouTube Channel **–** https://www.youtube.com/c/KatalonStudio
4. Guru99 Selenium Tutorials **– https://www.guru99.com/selenium-tutorial.html**
5. Mozilla Developer Network (MDN) for Web Elements **–** https://developer.mozilla.org

COURSE NAME: INTRODUCTION TO MICROSOFT POWER BI

Course Code	**23CS664**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**1**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Computer Knowledge
- Fundamentals of Microsoft Excel
- Basic Understanding of Databases
- Analytical Mindset & Problem-Solving Skills

Course Objectives:

This course will enable students to:

1. Master the Power BI Interface.
2. Transform and Clean Data.
3. Build Interactive Reports.
4. Develop Data Models and Use DAX.
5. Collaborate and Share Power BI Dashboards.

Module-I	**3 hours**

Introduction to Power BI and Setup: Getting started with Power BI, Uploading data to Power BI, Introducing natural-language queries, Introducing Quick Insights, reports, Visual Interactions, Decorating the report, Saving and pinning the report, Refreshing the budget workbook, Filtering a report.

Textbook-1: Chapter -1

Module-II	**3 hours**

Sharing the dashboard: Inviting a user to see a dashboard, Inviting users outside your organization, Creating a group workspace in Power BI, Turning on sharing with Microsoft OneDrive for Business, Viewing reports and dashboards on mobile devices.

Textbook-1: Chapter -2

Module-III	**3 hours**

Understanding data refresh: Introducing data refresh, Introducing the Power BI refresh architecture, Introducing Power BI Desktop, Publishing to Power BI, Installing the Power BI Personal Gateway, Configuring automatic refresh. **Using Power BI Desktop:** Connecting to a database, Loading from multiple sources, Using Query Editor, Hiding or removing tables.

Textbook-1: Chapter-3 & 4

Module-IV	**3 hours**

Building a data model: Loading individual tables, Implementing measures, Creating calculated columns, Impro **FOUNDATIONS OF CLOUD COMPUTING** ving the report by using measures, Integrating budget information, Reallocating the budget. **Improving Power BI reports:** Choosing the right visualizations, Choosing between standard visuals, Using custom visualizations, First steps with custom visualizations, Using DAX in data models.

Textbook-1: Chapter 6 & 7

Module-V	**3 hours**

Using Microsoft Power BI: Getting data from existing systems, Understanding differences between data refresh and live connections, Using relational databases on-premises, Using live connections to

Analysis Services, Publish Excel data models in Power BI, Consume Power BI content from Excel, Using Power BI Tiles, Managing security to access data, Creating custom visualizations for Power BI, Introducing the Power BI REST API, Pushing real-time data to Power BI dashboards, Power BI embedded in applications.

Textbook-1: Chapter- 8

Course Outcomes:

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

CO1: Proficient Use of Power BI Tools.

CO2: Effective Data Transformation.

CO3: Create Dynamic Dashboards.

CO4: Perform Advanced Calculations with DAX.

CO5: Collaborate Using Power BI Service.

Text Book:

1. Introducing Microsoft Power BI - *Alberto Ferrari and Marco Russo, 2016*

Reference Books:

1. Microsoft Power BI Cookbook – *Brett Powell*
2. Beginning Microsoft Power BI: A Practical Guide to Self-Service Data Analytics – *Dan Clark*

E-References:

1. https://www.google.co.in/books/edition/Introducing_Microsoft_Power_BI/U1qsDAAAQBAJ?hl=en&gbpv=1&dq=microsoft+power+bi+data+analyst+certification+guide&printsec=frontcover

INDIAN KNOWLEDGE SYSTEMS

Course Code	**23IKS68**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**1:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**15**	Total Marks	**100**
Credits	**01**	Exam Hours	**2**

Prerequisites:

- Basic understanding of Indian history, culture, and traditions
- Interest in interdisciplinary studies (history, culture, science, and philosophy)
- General familiarity with basic concepts in humanities and sciences
- Basic literacy in reading and analysing academic texts

Course Objectives:

The students will be able to

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Module-I **8 hours**

Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge

Module-II **8 hours**

Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.

Module-III **8 hours**

Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Course outcomes

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

1. Explore the foundations and philosophy of Indian Knowledge Systems.
2. Differentiate between traditional, indigenous, and Western knowledge frameworks.
3. Explain the contributions of IKS to science, mathematics, art, and engineering.
4. Apply traditional knowledge concepts to professional fields like health, agriculture, and governance.
5. Evaluate the relevance of IKS in the context of sustainable development and global challenges.

References:

1. **Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2. **Traditional Knowledge System in India**, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3. **Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

Web links and Video Lectures (e-Resources):

1. **https://www.youtube.com/watch?v=LZP1StpYEPM**
2. **http://nptel.ac.in/courses/121106003/**
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf

B.Tech– VII Semester

Computer Science & Engg.

(2023 Syllabus)

COURSE NAME: DEEP LEARNING AND NEURAL NETWORKS

Course Code	**23CS71**	CIE Marks	**50**
Teaching Hours / Week (L:T:P: S)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic knowledge of linear algebra, calculus, probability, and Python programming.

Course Objectives:

This course will enable students to,

1. Understand the fundamentals of deep learning.
2. Know the theory behind Convolutional Neural Networks, Auto encoders, RNN.
3. Illustrate the strength and weaknesses of many popular deep learning approaches.
4. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
5. Learn the open issues in deep learning, and have a grasp of the current research directions.

Module-I	**8 Hours**

Introduction to Deep Learning: Introduction, Deep learning Model, Historical Trends in Deep Learning,

Machine Learning Basics: Learning Algorithms, Supervised Learning Algorithms, Unsupervised Learning Algorithms.

Textbook 1: Chapter1–1.1, 1.2, 5.1,5.7-5.8.

Module-II	**8 Hours**

Feedforward Networks: Introduction to feedforward neural networks, Gradient-Based Learning, Back- Propagation and Other Differentiation Algorithms.

Regularization for Deep Learning,

Textbook 1: Chapter 6, 7

Module-III	**8 Hours**

Optimization for Training Deep Models: Empirical Risk Minimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Parameter Initialization Strategies.

Algorithms with Adaptive Learning Rates: The AdaGrad algorithm, The RMSProp algorithm, Choosing the Right Optimization Algorithm.

Textbook 1: Chapter: 8.1-8.5

Module-IV	**8 Hours**

Convolutional Networks: The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features- LeNet, AlexNet.

Textbook 1: Chapter: 9.1-9.9.

Module-V	**8 Hours**

Recurrent and Recursive Neural Networks: Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short- Term Memory and Other Gated RNNs.

Applications: Large-Scale Deep Learning, Computer, Speech Recognition, Natural Language Processing and Other Applications.

Textbook 1: Chapter: 10.1-10.3, 10.5, 10.6, 10.10, 12.

PRACTICAL COMPONENT OF IPCC: **20Hours**

1. Design and implement a neural based network for generating word embedding for words in a document corpus.
2. Write a program to demonstrate the working of a deep neural network for classification task.
3. Design and implement a Convolutional Neural Network (CNN) for classification of image dataset.
4. Build and demonstrate an autoencoder network using neural layers for data compression on image dataset.
5. Design and implement a deep learning network for classification of textual documents.
6. Design and implement a deep learning network for forecasting time series data.
7. Write a program to enable pre-train models to classify a given image dataset.
8. Write a program to read a dataset of text reviews. Classify the reviews as positive or negative.

Course outcomes:

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

- **CO1:** Realize the fundamental issues and challenges of deep learning data, model selection, model complexity, etc.
- **CO2:** Describe various knowledge on deep learning and algorithms.
- **CO3:** Apply CNN and RNN model for real time applications.
- **CO4:** Identify various challenges involved in designing and implementing deep learning algorithms.
- **CO5:** Relate the deep learning algorithms for the given types of learning tasks in varied domain.

Text Book:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

Reference Books:

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009.
2. N.D.Lewis, “Deep Learning Made Easy with R: A Gentle Introduction for Data Science”, January 2016.
3. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly publications.

E-Resources:

1.https://www.deeplearningbook.org/

COURSE NAME: FULL STACK DEVELOPMENT WITH PYTHON

Course Code	**23CS72**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Python Basics
- Web Technologies

Course Objectives:

This course will enable students to,

1. Introducing Django fundamentals and environment setup.
2. Develop core skills in building models, views, and templates.
3. Construct a dynamic web application with essential CRUD features.
4. Enhance functionality through front-end integration and advanced form handling.
5. Master deployment and optimization techniques for production-ready Django apps.

Module-I **8 Hours**

Django Fundamentals and Environment Setup: Full-Stack Web Development, Overview, Installing Python, Virtual Environments, and Django, Django Project and App Structure, Creating Your First Django Project**,** Understanding the MVT Architecture.

Textbook 1: Chapter:1,2,3

Module-II **8 Hours**

Models, Views, and Templates: Defining Models and Managing Migrations, Creating Views and URL Configuration, Django Template System and Template Inheritance, Managing Static Files and Media, Basic Form Handling

Textbook 1: Chapter:4,5,6

Module-III **8 Hours**

Building a Dynamic Web Application: Developing a Blog Application, Implementing CRUD Operations, Advanced Model Relationships and Querying, User Registration and Authentication, Utilizing the Django Admin Interface

Textbook 1: Chapter:7,8

Module-IV **8 Hours**

Enhancing Functionality and Front-End Integration: Advanced Form Handling and Validation, Integrating Third-Party Packages and Libraries, Styling with CSS Frameworks (e.g., Bootstrap), Adding JavaScript and AJAX for Interactivity, Optional: Introduction to RESTful API Integration

Textbook 1: Chapter:9,10

Module-V **8 Hours**

Deployment, Optimization, and Best Practices: Preparing for Production Deployment, Deployment Strategies (e.g., Heroku, Digital Ocean), Performance Optimization Techniques, Security Best Practices for Django Applications, Continuous Integration and Maintenance.

Textbook 1: Chapter:11,12

Practical Components: **20Hours**

1. **Django Project Setup** – Install Python, set up a virtual environment, and create a Django project.

2. **Understanding MVT Architecture** – Develop a simple Django app demonstrating Model-View-Template interaction.
3. **Working with Models & Migrations** – Define models, apply migrations, and interact with the database using ORM.
4. **Creating Views & URL Routing** – Implement views and configure URL patterns for navigation.
5. **Django Template System** – Use templates, inheritance, and static files to build dynamic web pages.
6. **CRUD Operations in a Blog App** – Develop a blog with Create, Read, Update, and Delete functionalities.
7. **User Authentication** – Implement user registration, login, logout, and authentication-based access control.
8. **Form Handling & Validation** – Work with Django forms, validations, and integrating Bootstrap for styling.
9. **Integrating AJAX & JavaScript** – Enhance interactivity using AJAX for dynamic content updates.
10. **Deploying a Django App** – Deploy a project on a cloud platform like Heroku, optimize performance, and apply security best practices.

Course Outcomes:

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

CO1: Able to install Django, configure virtual environments, and create their first project.
CO2: Define models, implement views, and design dynamic templates.
CO3: Build a blog application featuring CRUD operations and user authentication.
CO4: Integrate JavaScript, CSS frameworks, and advanced forms to improve interactivity.
CO5: Deploy a secure, optimized Django application using industry best.

Text Books:

1. Django for Beginners, 5th Edition: Build Modern Web Applications with Python *by William S. Vincent.*

References:

1. Django Unleashed: Full-Stack Web Development with Python by Laszlo Bocso.
2. Django for APIs: Build Web APIs with Python & Django by William S. Vincent.
3. Django 3 By Example: Build powerful and reliable Python web applications from scratch by Antonio Mele.

E-References:

1. https://www.fullstackpython.com/
2. https://www.tutorialsteacher.com/python

COURSE NAME: INTERNET OF THINGS AND APPLICATIONS

Course Code	**23CS73**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40+20**	Total Marks	**100**
Credits	**04**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basics of Networking Fundamentals.
- Basics of Programming Knowledge.
- Basics of Embedded Systems.

Course Objectives:

This course will enable students to,

1. Understand IoT Fundamentals.
2. Explore Smart Objects and Connectivity Technologies.
3. Analyze IoT Communication and Network Protocols.
4. Apply Data Analytics and Security in IoT.
5. Work with IoT Physical Devices and Programming, Develop IoT Applications for Smart and Connected Cities.

Module-I **8 Hours**

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Textbook 1: Chapter: 3,4

Module-II **8 Hours**

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Textbook 1: Chapter: 3,4

Module-III **8 Hours**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods

Textbook 1: Chapter: 5,6

Module-IV **8 Hours**

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Textbook 1: Chapter: 7,8

Module-V **8 Hours**

IoT Physical Devices and Endpoints: What is a IoT Device, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Case Studies illustrating IoT design – Home Automation, Cities, Agriculture.

Textbook 1: Chapter: 7.1-7.6,9.2,9.3,9.5

Experimental components:

1. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds.
2. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
3. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
4. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed.
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to things peak cloud.
9. To install MySQL database on Raspberry Pi and perform basic SQL queries.

Course Outcomes:

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

CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO3: Appraise the role of IoT protocols for efficient network communication.
CO4: Elaborate the need for Data Analytics and Security in IoT.
CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry**.**

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743).

References:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT, 2014. (ISBN: 978-8173719547).
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).
3. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017.
4. Arshdeep Bahga, Vijay Madisetti," Internet of Things- A Hands On Approach", Universities press, 2014.

E-References:

1. https://nibmehub.com/opac-service/pdf/read/IoT%20Fundamentals.pdf
2. https://jcer.in/jcer-docs/E-Learning/Digital%20Library%20/E-Books/Internet-of-things-a-hands-on-approach-%20Arshadeep.pdf
3. https://docs.arduino.cc/

COURSE NAME: BLOCKCHAIN TECHNOLOGY

Course Code	**23CS741**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

Student should have the knowledge in the following areas:

1. Basic Computer Science Knowledge.
2. Basic Programming Languages.
3. Web Development Basics (For Dapps).

Course Objectives:

This course will enable students to,

1. Explain the basics of Block chain concepts.
2. Illustrate the working of Block Chain.
3. Explore working of Bitcoin.
4. Exemplify the Ethereum working.
5. Illustrate DApps working.

Module-I	**8 Hours**

Introduction to Block chain: Backstory of Block chain ,What is Block chain?, Centralized vs. Decentralized Systems Centralized Systems, Decentralized Systems, Layers of Block chain, Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer, Why is Block chain Important?, Limitations of Centralized Systems,Block chain Adoption So Far, Block chain Uses and Use Cases

Textbook 1: Chapter: 1

Module-II	**8 Hours**

How Block chain works: Laying the Block chain Foundation, Cryptography Symmetric Key Cryptography: Cryptographic Hash Functions, MAC and HMAC. Asymmetric Key Cryptography, Diffie- Hellman Key exchange, Symmetric vs Asymmetric Key Cryptography, Computer Science Engineering. The Block chain, Merkle Trees

Textbook 1: Chapter: 2

Module-III	**8 Hours**

How Bitcoin Works: The History of Money,, Dawn of Bitcoin, What Is Bitcoin?, Working with Bitcoins The Bitcoin Blockchain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Black Propagation

Textbook 1: Chapter: 3

Module-IV	**8 Hours**

How Ethereum Works: From Bitcoin to Ethereum, Ethereum as a Next-Gen Blockchain, Design Philosophy of Ethereum, Enter the Ethereum Blockchain, Ethereum Blockchain, Ethereum Accounts, Trie Usage Merkle Patricia Tree, RLP Encoding, Ethereum 'Transaction and Message Structure, Ethereum State Transaction Function, Gas and Transaction Cost, Ethereum Smart Contracts, Contract Creation, Ethereum Virtual Machine and Code Execution, Ethereum Ecosystem, Swarm, Whisper, DApp, Development Components

Textbook 1: Chapter: 4.1-4.8

Module-V	8 Hours

Building an Ethereum DApp: The DApp, Setting Up a Private Ethereum Network, Install go-Ethereum [geth).Create geth Data Directory, Create a geth Account, Create genesis.json Configuration File, Run the First Node of the Private Network, Run the Second Node of the Network, Creating the Smart Contract Deploying the Smart Contract
Setting up web3 Library and Connection, Deploy the Contract to the Private Network, Client Application

Textbook 1: Chapter:4.9-4.16

Course Outcomes:

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

- **CO1:** Demonstrate the basics of Block chain concepts using modern tools technologies.
- **CO2:** Analyze the role of block chain applications in different domains including cyber.
- **CO3:** Explore the Bitcoin working with Consensus.
- **CO4:** Exemplify the usage of Ethereum and its impact on the economy.
- **CO5:** Demonstrate building an Ethereum Dapp.

Text Books:

1. Beginning Block chain: A Beginner's Guide to Building Block chain Solutions by Arshdeep Bikramaditya Signal.Gautam Dhameija (Priyaanshu Sekhar Panda... Press.) 2018.

References:

1. Bitcoin and Cryptocurrency Technologies by Aravind Narayan, Joseph Bonneau, princton.
2. Bitcoin and Block chain Basics: A non-technical introduction tor beginners by Arthu.T Books.
3. Block chain Applications: A Hands-On Approach by Bahga, Vijay Madisetti 2017.
4. Block chain by Melanie Swan. O Reilly 2015.

E-References:

1. https://www.youtube.com/watch?v=SyVMma1IkXM&t=3s

COURSE NAME: SOFTWARE DEFINED NETWORKS

Course Code	**23CS742**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

Student should have the knowledge in the following areas:

- Basic understanding of business concepts and general management principles.
- Knowledge of entrepreneurship is beneficial but not mandatory.

Course Objectives:

This course will enable students to,

1. Understand the need for SDN and its data plane operations.
2. Understand the functions of control plane.
3. Comprehend the migration of networking functions to SDN environment.
4. Explore various techniques of network function virtualization.
5. Comprehend the concepts behind network virtualization.

Module-I	**8 Hours**
Introduction: Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane,Control plane and Application Plane **Textbook 1: Chapter-3**	
Module-II	**8 Hours**
Data Plane functions and protocols : OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, Open Daylight, ONOS - Distributed Controllers **Textbook 1: Chapter-4, 5**	
Module-III	**8 Hours**
SDN Application Plane Architecture : Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking **Textbook 1: Chapter-6**	
Module-IV	**8 Hours**
Network Virtualization: Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture **Textbook 1: Chapter-7**	
Module-V	**8 Hours**
NFV Infrastructure : Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV **Textbook 1: Chapter-8**	

Course Outcomes:

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

CO1: Describe the motivation behind SDN.
CO2: Identify the functions of the data plane and control plane.
CO3: Design and develop network applications using SDN.
CO4: Orchestrate network services using NFV.
CO5: Explain various use cases of SDN and NFV.

Text Books:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud",Pearson Education, 1st Edition, 2015.

References:

1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRC Press, 2014.
4. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

E-References:

http://ptgmedia.pearsoncmg.com/images/9780134175393/samplepages/9780134175393.pdf

COURSE NAME: INTRODUCTION TO DEVOPS PRACTICES

Course Code	**23CS743**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

Student should have the knowledge in the following areas:

- Basic Knowledge of Operating Systems and Computer Networks.
- UNIX Commands with shell scripting.
- Knowledge of Programming languages such as Python, Java.
- Familiarity with SQL and NoSQL databases.

Course Objectives:

This course will enable students to,

1. Understand DevOps Principles and Practices.
2. Master Version Control and Collaboration.
3. Implement Continuous Integration and Continuous Delivery (CI/CD).
4. Work with Containerization and Orchestration.
5. Automate Configuration Management.

Module-I	**8 Hours**

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

Textbook 1: Chapter 1, 2

Module-II	**8 Hours**

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, Themonolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

Textbook 1: Chapter 3

Module-III	**8 Hours**

Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab**.**

Textbook 1: Chapter 4

Module-IV	**8 Hours**

Integrating the system: Build systems, Jenkins build server, managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host,

Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order. Build phases, Alternative build servers, Collating quality measures.
Textbook 1: Chapter 5

Module-V **8 Hours**

Testing Tools and automation: Various types of testing. Automation of testing Pros and cons, Selenium Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker.
Textbook 1: Chapter 6

Course Outcomes:

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

CO1: Comprehend the core principles of DevOps and its role in the software development lifecycle.

CO2: Set up and configure CI pipelines using tools like Jenkins, Travis CI, or Git Lab CI.

CO3: Design and implement CD pipelines to automate the deployment of applications to different environments.

CO4: Manage infrastructure changes using version control and automated workflows.

CO5: Configure Kubernetes clusters, including Pods, Services, Deployments, and Stateful Sets.

Text Books and References:

1. Practical Devops, Joakim Verona PACKT Open Publisher 2016.

References:

1. DevOps Tools from Practitioner's Viewpoint Deepak Gaikwad, Viral Thakkar Wiley publications.
2. Building a DevOps culture Mandi Walls O' Reilly Publications 1st Edition, 2013.
3. DevOps: A Software Architect's Perspective Len Bass, Ingo Weber, Liming Zhu Addison Wesley 2015.

E-References:

1. DevOps Roadmap: https://roadmap.sh/devops
2. Git Docs: https://git-scm.com/doc
3. Jenkins Docs: https://www.jenkins.io/doc/
4. Docker Docs: https://docs.docker.com/
5. Ansible Docs: https://docs.ansible.com/
6. KodeKloud DevOps Courses: https://kodekloud.com/

COURSE NAME: DATA WAREHOUSE AND DATA MINING

Course Code	**23CS744**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Database Management Systems (DBMS).
- Statistics and Probability.
- Programming Skills
- Mathematics for Data Mining
- Basic Knowledge of OLAP

Course Objectives:

This course will enable students to

1. Understanding Data Warehousing Concepts.
2. Mastering OLAP Data Models and Operations.
3. Exploring Data Mining Fundamentals.
4. Applying Classification Techniques.
5. Implementing Clustering Algorithms

Module-I	**8 Hours**

Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations

Textbook 2: Ch.4.1,4.2

Module-II	**8 Hours**

Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.

Textbook 1: Ch.1.1,1.2,1.4, 2.1 to 2.4

Textbook 2: Ch.4.4

Module-III	**8 Hours**

Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

Textbook 1: Ch 4.3,4.6,5.1,5.2,5.3

Module-IV	**8 Hours**

Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns. **Textbook 1: Ch 6.1 to 6.7 (Excluding 6.4)**
Module-V **8 Hours**
Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. **Textbook 1: Chapter 8.1 to 8.5, 9.3 to 9.5**
Course Outcomes: The students should be able to: **CO1:** Design and Implement Data Warehouses. **CO2:** Proficiency in OLAP Operations. **CO3:** Implement Data Mining Algorithms **CO4:** Data Preprocessing and Quality Management **CO5:** Apply Clustering and Classification to Real-World Problems
Suggested Learning Resources: **Text Books:** 1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014. 2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.
1. Arun K Pujari: Data Mining Techniques 2nd Edition, UniversitiesPress, 2009. 2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006. 3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining,and OLAP Computing, Mc GrawHill Publisher, 1997.
E-References: 1. NOC | Data Mining

B.Tech– VIII Semester

Computer Science & Engg.

(2023 Syllabus)

COURSE NAME: ADVANCE CYBER SECURITY

Course Code	**23CS81**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Familiarity with networking concepts, operating systems, and system administration.
- Basic coding skills in languages like **Python** or **C** for automation and security analysis.

Course Objectives:

This course will enable students to:

1. Understand the incident response process and its key stages.
2. Develop a comprehensive cyber strategy using Red and Blue Team tactics.
3. Perform external reconnaissance to gather target system information.
4. Implement active sensors for intrusion detection and prevention.
5. Develop a comprehensive disaster recovery plan to ensure business continuity.

Module-I **8 Hours**

Security Posture: The current threat landscape, cyber security challenges, enhancing your security posture, the red and blue teams. The Incident response process, handling an incident, post-incident activity

Textbook1: Chapter:1,2

Module-II **8 Hours**

Cyber Strategy: why do we need to build a cyber strategy? How to build a cyber strategy, best cyber-attack strategies (Red Team), cyber-attack defense strategies (blue Team). Introducing the cyber-Kill chain, reconnaissance, weaponization, privilege Escalation, Threat Life cycle management, Tools used: Nmap, Zen map, Metasploit, Wireshark

Textbook1: Chapter:3,4

Module-III **8 Hours**

Reconnaissance: External reconnaissance, web browser enumeration tools,

Compromising the system: Analyzing current trends, phishing, performing the steps to comprise a system

Textbook1: Chapter: 4, 5, 6

Module-IV **8 Hours**

Security Policy: Educating the end user, policy enforcement, Monitoring for compliance

Active sensors: Detection capabilities, Intrusion detection system, intrusion prevention system, Behavior analytics on-premises

Introduction to Threat Intelligence, open-source tools for threat intelligence

Textbook1: Chapter:10,12, 13

Module-V **8 Hours**

Investigating an Incident: Scoping the issue, Investigating a compromised system on-premises, proactive investigation (Threat hunting), Disaster recovery plan.

Textbook1: Chapter:14,15

Course Outcomes:

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

CO1: Identify cybersecurity threats and enhance security posture.

CO2: Develop and apply Red and Blue Team strategies.

CO3: Perform reconnaissance and analyze system compromise techniques.

CO4: Implement security policies and threat detection tools.

CO5: Investigate incidents and create disaster recovery plans.

Suggested Learning Resources:

Text Books and References:

1. **Cybersecurity – Attack and Defense Strategie** by Yuri Diogenes, Dr. Erdal Ozkaya, 2nd edition, Packt Publishing.

References:

1. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" (2nd Edition) by Dafydd Stuttard, Marcus Pinto, wiley publisher.
2. "Blue Team Handbook: Incident Response Edition – A condensed field guide for the Cyber Security Incident Responder" (2nd Edition) by Don Murdoch GSE

E-References:

1. https://www.youtube.com/watch?v=MsGl6lX-YaI

COURSE NAME: NATURAL LANGUAGE PROCESSING

Course Code	**23CS821**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Programming Skills
- Discrete Mathematics
- Data Structures & Algorithms
- Machine Learning Basics

Course Objectives:

This course will enable students to,

1. Understand NLP Fundamentals
2. Model Morphological and Syntactic Analysis
3. Implement Naive Bayes Classifiers
4. Explore Information Retrieval and Lexical Resources
5. Learn Machine Translation Techniques

Module-I	**8 Hours**

Introduction: What is Natural Language Processing? Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications.

Language Modeling: Statistical Language Model - N-gram model (unigram, bigram), Paninion Framework, Karaka theory.

Textbook 1: Ch. 1, Ch. 2.

Module-II	**8 Hours**

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of Speech Tagging.

Syntactic Analysis: Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.

Textbook 1: Ch. 3, Ch. 4.

Module-III	**8 Hours**

Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.

Textbook 2: Ch. 4.

Module-IV	**8 Hours**

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model,

Fuzzy model, LSTM model**,** Major Issues in Information Retrieval.

Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

Textbook 1: Ch. 9, Ch. 12.

Module-V	**8 Hours**

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder- Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.

Textbook 2: Ch. 13.

Course outcomes (Course Skill Set)

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

CO1: Apply the fundamental concept of NLP, grammar-based language model and statistical-based language model.

CO2: Model morphological analysis using Finite State Transducers and parsing using context-free grammar and different parsing approaches.

CO3: Develop the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications.

CO4: Apply the concepts of information retrieval, lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, distributional word similarity.

CO5: Identify the Machine Translation applications of NLP using Encode and Decoder.

Suggested Learning Resources:

Text Book:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press.
2. Daniel Jurafsky, James H. Martin, “Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2023

References:

1. Akshay Kulkarni, Adarsha Shivananda, “Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python”, Apress, 2019.
2. T V Geetha, “Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives”, Pearson, 2024.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”,
4. Kluwer Academic Publishers.

COURSE NAME: AR / VR (PEC)

Course Code	**23CS822**	CIE Marks	**50**
Teaching Hours/Week(L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type(SEE)	**Theory**		

Prerequisites:
- Basic Computer Science and Programming Skills.
- 3D Graphics and Computer Vision.

Course Objectives:

This course will enable students to:

1. Explain key interactions to manipulate, navigate and interact in a Virtual World.
2. Identify the role of immersion in VR.
3. Develop an application with VR experience.
4. Distinguish between Augmented Reality (AR) and Virtual Reality (VR).
5. Understand and analyze motor programs and remapping in human interaction.

Module-I	**8 Hours**

INTRODUCTION TO VIRTUAL REALITY (VR): Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality. Telepresence, Augmented Reality and Cyberspace.

Bird's-Eye View: Hardware. Software. Human Physiology and Perception.

Textbook 2, Chapter 1, Chapter 2

Module-II	**8 Hours**

Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.

Output Devices: Graphics displays, sound displays & haptic feedback.

Textbook 1, Chapter 2, Chapter 3, Chapter 4

Module-III	**8 Hours**

Modeling: Geometric modeling. Kinematics modeling, Physical modeling. Behaviour modeling, Model management.

Textbook 1, Chapter 6

Module-IV	**8 Hours**

Augmented Reality (AR): Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems

AR software development: AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

Textbook 3: chapter 1, chapter 2

Module-V	**8 Hours**

Interaction & Audio: Interaction - Motor Programs and Remapping. Locomotion, Manipulation, Social Interaction, Audio-The Physics of Sound. The Physiology of Human Hearing. Auditory Perception, Auditory Rendering.

Textbook 2: Chapter 10, Chapter 11

Course Outcomes:

At the end of the Course the student will be able to:

CO1: Describe the concept of virtual reality and Communication Media.
CO2: Explore current virtual reality hardware and software.
CO3: Understand various modeling approaches.
CO4: Illustrate the concepts of Human Factors and Applications of VR.
CO5: Build a Virtual Reality Application.

Text Books:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017.
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
3. P. Kaliraj and T. Devi, "Innovating with Augmented Reality Applications in Education and Industry", First Edition , 2022, CRC Press

Reference Books:

1. Rajesh K. Maurya, Computer Graphics with Virtual Reality System, 3rd Edition. Wiley Publication, 2018.
2. William R. Sherman and Alan B. Craig. Understanding Virtual Reality Interface Application, and
3. Design, 2nd Edition, Morgan Kautmann Publishers, Elsevier, 2019.
4. Grigore C. Burdea, Philippe Coiffet. Virtual Reality Technology, 2 Edition, Wiley 2017.

E-References:

1. http://vr.cs.uiuc.edu/vrbook.pdf
2. https://nptel.ac.in/courses/106/106/106106138/

COURSE NAME: COMPUTER VISION & IMAGE PROCESSING

Course Code	**23CS823**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

- Basic Programming Skills
- Linear Algebra and Matrix Operations
- Basics of Image processing

Course Objectives:

This course will enable students to:

1. Understand basic principles and applications of computer vision.
2. Apply techniques for smoothing and sharpening images.
3. Compare various restoration and segmentation methods.
4. Demonstrate smoothing and sharpening techniques for color images.
5. Explain morphological operations, feature extraction, and pattern classification techniques.

Module-I	**8 Hours**

Introduction: What is computer vision? A brief history. Image Formation: Photometric image formation, The digital camera. Image processing: Point operators, Linear filtering.

Textbook-1: Chap-1 (1.1, 1.2), Chap-2 (2.2, 2.3), Chap-3 (3.1, 3.2)

Module-II	**8 Hours**

Image processing: More neighborhood operators, Fourier transforms, Pyramids and wavelets, and Geometric transformations.

Textbook-1: Chap- 3 (3.3 - 3.6)

Module-III	**8 Hours**

Image Restoration and Reconstruction: A model of Image degradation/restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering. Image Segmentation: Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only), Segmentation by region growing & region splitting & merging.

Textbook-2: Chap-5 (5.1 to 5.4), Chap-10 (10.1 to 10.3.2, 10.4)

Module-IV	**8 Hours**

Color Image Processing: Color fundamentals, color models, Pseudocolor image processing, full color image processing, color transformations, color image smoothing and sharpening, Using color in image segmentation, Noise in color images.

Module-V	**8 Hours**

Morphological Image Processing: Preliminaries, Erosion and Dilation, opening and closing, Hit-or-miss transform, some basic morphological algorithms.

Feature Extraction: Background, Boundary preprocessing (Boundary following & Chain codes only).

Image pattern Classification: Background, Patterns and classes, Pattern classification by prototype matching (Minimum distance classifier only).

Textbook-2: Chap -9 (9.1-9.5), Chap-11(11.1-11.2.2), Chap-12 (12.1-12.3.1)

Course outcomes:

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

CO1: Explain the fundamentals of computer vision and its applications.

CO2: Apply the image enhancement techniques for smoothing and sharpening of images.

CO3: Compare the different image restoration and segmentation techniques.

CO4: Demonstrate the smoothing and sharpening techniques for color images.

CO5: Explain morphological, feature extraction, and pattern classification techniques for object recognition.

Textbooks:

1. Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2nd Edition, 2022, Springer.
2. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Pearson, 4th edition, 2019.

Reference books

1. David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.
2. Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

Web links and Video Lectures (e-Resources):

1. Virtual Labs: https://cse19-iiith.vlabs.ac.in/
2. https://onlinecourses.nptel.ac.in/noc21_ee78/preview
3. Introduction to Machine Vision: https://www.youtube.com/watch?v=tY2gczObpfU
4. https://coral.ise.lehigh.edu/optml/files/2019/10/OptML_CV_tutorial_1_compressed.pdf

COURSE NAME: GENERATIVE AI

Course Code	**23CS824**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**
Examination type (SEE)	**Theory**		

Prerequisites:

Student should have the knowledge in the following areas:

- Prior knowledge of Calculus, Linear Algebra, Probability Theory.
- Python programming.
- Basic knowledge about AI and deep learning.

Course Objectives:

This course will enable students to,

1. Introduce the concept of generative AI and its applications.
2. Provide hands-on experience in building generative models using Tensor Flow and Keras.
3. Explore various generative model architectures (RBMs, VAEs, GANs, LSTMs, Transformers).
4. Understand the challenges and limitations of generative models.
5. Develop skills in applying generative models to real-world problems.

Module-I	**8 Hours**

An Introduction to Generative AI: "Drawing" Data from Models, Applications of AI, the rules of probability, why use generative models? Style transfer and image transformation, Unique challenges of generative models.

Setting Up a Tensor Flow Lab: Deep neural network development and Tensor Flow, VS Code Docker: A lightweight virtualization solution, Kubernetes: Robust management of multi-container applications, Kube flow: an end-to-end machine learning lab, A brief tour of Kube flow's components, Kube flow pipelines Using Kube flow Katib to optimize model hyper parameters.

Textbook 1: Chapter:1&2

Module-II	**8 Hours**

Building Blocks of Deep Neural Networks: Perceptrons – a brain in a function, Multi-layer perceptrons and backpropagation, Varieties of networks: Convolution and recursive, Networks for sequence data, Building a better optimizer.

Teaching Networks to Generate Digits: The MNIST database, Restricted Boltzmann Machines-generating pixels with statistical mechanics, Stacking Restricted Boltzmann Machines to generate images: the Deep Belief Network, Creating an RBM using the Tensor Flow Keras layers API, Creating a DBN with the Keras Model API.

Textbook 1: Chapter:3&4

Module-III	**8 Hours**

Painting Pictures with Neural Networks Using VAEs (variational autoencoders): Painting Pictures with Neural Networks Using VAEs Creating separable encodings of images The variational objective, Inverse Autoregressive Flow, Importing CIFAR, Creating the network from Tensor Flow.

Image Generation with GANs: The taxonomy of generative models **Generative adversarial**

networks, Vanilla GAN Improved GANs, Progressive GAN, and Challenges.
Textbook 1: Chapter:5&6

Module-IV **8 Hours**

The Rise of Methods for Text Generation: Representing text, Text generation and the magic of LSTMs, LSTM variants and convolutions for text NLP 2.0.
Using Transformers to Generate Text: Attention, Contextual embedding's, Self-attention, Transformers, GPT 1, 2, 3.
Textbook 1: Chapter:9&10

Module-V **8 Hours**

Composing Music with Generative Models: Getting started with music generation, Music generation using LSTMs, Music generation using GANs, Muse GAN– polyphonic music generation.
Emerging Applications in Generative AI: Introduction Finding new drugs with generative models, Solving partial differential equations with generative modeling Few shot learning for creating videos from images Generating recipes with deep learning.
Textbook 1: Chapter:11&12

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

CO1: Explain the underlying principles of generative AI.
CO2: Implement various generative models using Tensor Flow and Keras.
CO3: Evaluate and compare the performance of different generative models.
CO4: Apply generative models to image generation, text generation, and music composition.
CO5: Analyze the potential and limitations of generative AI in various applications.

Text Book:

1. Generative AI with Python and TensorFlow2 Joseph Babcock Raghav Bali Packt Publishing Ltd.

References:

1. "GANs in Action: Deep Learning with Generative Adversarial Networks" – Jakub Langr, Vladimir Bok.
2. "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" – David Foster, O'Reilly Media.

E-References:

1. https://youtube.com/playlist?list=PLeo1K3hjS3uu7CxAacxVndI4bE_o3BDtO&feature=shared
2. https://youtube.com/playlist?list=PLPTV0NXA_ZSh_HfFtLf5p8hPAW8a7Tr2a&feature=shared
3. https://www.analyticsvidhya.com/blog/2024/01/ultimate-list-of-generative-ai-resources/

Assessment Details

1. Integrated professional Core Courses (IPCC):

I. CIE for IPCC

CIE for the Theory component of IPCC: 30 Marks

	Components	Number	Weightage	Max. Marks
1	Tests (A)	3	60%	18
2	Alternate Assessment Tools(AAT) (B)	3	40%	12
	Total Marks for theory component A+B			30

CIE for the LAB component of IPCC: 20 Marks

	Components	Weightage	Max. Marks
1	Lab Work: Conduction of Experiments (A)	40%	08
2	Lab Journal Writing & Submission (B)	10%	02
3	Lab Test (C)	30%	06
4	Open-Ended Experiments / Course Projects (D)	20%	04
	Total Marks		20

Final Marks for IPCC Courses = X + Y = 30 + 20 = 50

II. SEE for IPCC Theory for 3 hours' duration

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module. The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall

include questions from the practical component)

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However,in SEE, the questions from the laboratory component shall be included. The maximum of04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

2. Professional Core / Basic Science /ESC/ETC/PLC

I. Courses (Theory): Continuous Internal Evaluation CIE:

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools(AAT) (B)	3	40%	20
	Total Marks			**50**

Final CIE Marks = (A) + (B) = 30 + 20 = 50

II. Semester End Examination (SEE)Question paper pattern:

- The question paper will have ten full questions carryingequal marks. Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from eachmodule.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks toqualify in the SEE.
- Marks secured will be scaled down to 50.

3. Ability Enhancement course (Lab):

I. Continuous Internal Evaluation (CIE):

	Components	Weightage	Max. Marks
(i)	Lab Work: Conduction of Experiments (A)	40%	20
(ii)	Lab Journal Writing & Submission (B)	10%	05
(iii)	Lab Test (C)	30%	15
(iv)	Open-Ended Experiments (D)	20%	10
	Total Marks:		**50**

II. Semester End Evaluation (SEE):

1. All laboratory experiments are to be included for practical examination
2. Students can pick one experiment from the lot with equal choice to all the students in a batch.
3. Change of experiment is allowed only once and 15% marks allotted to the procedure part to bemade zero.
4. Marks distribution: Procedure (15%) + Execution (70%) + Viva Voce (15%)

4. Ability Enhancement Course (AEC)/Skill Enhancement course (SEC) (Theory), Universalhuman values Course :

Assessment Details of CIE

	Components	Number	Weightage	Max. Marks
(i)	Tests (A)	3	60%	30
(ii)	Alternate Assessment Tools (AAT) (B)	3	40%	20
	Total Marks			50

Final CIE Marks = (A) + (B) SEE Guidelines for the Courses

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper isMCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure aminimum of 35% of the maximum marks meant for SEE.

No SEE for the courses: Social Connect and Responsibility (22SC37), NSS, YOGA, Sports andAthletics.