SYLLABUS

(With effect from 2024-25)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2024-25)

Bachelor Degree

In

Computer Science &Engineering

V & VI Semester

Out Come Based Education

With

Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka

[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

- *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*
- *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*
- *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*
- *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

Department of Computer Science and Engineering

The Vision of the department is:

"The Department of Computer Science and Engineering shall create professionally competent and socially responsible engineers capable of working in global environment.*"*

The mission of the department is:

DM1: Enforce best practices in teaching-learning, with dedicated faculty and supportive infrastructure to impart the knowledge in emerging technologies.

DM2: Improve Industry-Institute relationship for mutual benefit.

DM3: Inculcate ethical values, communication and entrepreneurial skills.

DM4: Sensitize social, legal, environmental and cultural diversity issues through professional training and balanced curriculum.

Program Educational Objectives (PEO's)

Graduates of the program shall

- Have Successful computer professional career in IT industry and related areas
- Pursue higher education in engineering or management with the focus on intensive research and developmental activities.
- Develop their career as entrepreneurs in a Responsible, Professional and ethical manner to serve the society

The National Board of Accreditation (NBA) has defined twelve Program Outcomes for Under Graduate (UG) engineering programs as listed below.

Program Outcomes (PO's)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problem.
2. **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

The Under Graduate (UG) of B.E Computer Science & Engineering Program has defined **Program Specific Outcomes (PSO**) which are listed below.

PSO-1: Ability to apply problem solving skills in developing solutions through fundamentals of Computer Science and Engineering.

PSO-2: Ability to apply Analytical Skills in the field of Data Processing Systems.

PSO-3: Ability to design and develop applications through Software Engineering methodologies and Networking Principles.

	Bachelor of Engineering (V–Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs/Week**				**Credits**	**Examination Marks**		
				L	**T***	**P**	**PJ**		**CIE**	**SEE**	**Total**
1	P22CS501	Software Engineering and Management	CS	3	-	-	-	3	50	50	100
2	P22CS502	Computer Networks	CS	3	-	-	-	3	50	50	100
3	P22CS503X	Professional Core Course (Elective-I)	CS	3	-	-	-	3	50	50	100
4	P22CS504	Operating System(Integrated)	CS	3	-	2	-	4	50	50	100
5	P22CS505	Cyber Security	CS	3	-	-	-	3	50	50	100
6	P22CSL506	Computer Networks Laboratory	CS	-	-	2	-	1	50	50	100
7	P22INT507	Internship-II	CS	-	-	-	-	2	-	100	100
8	P22HSMC508B	Employability Enhancement Skills–V	HSMC	1	-	-	-	1	50	50	100
9.	P22UHV509	Social Connect and Responsibility	XX	1	-	-	-	1	100	-	100
	Total							**21**			

Professional Elective Course– I(P22CS503X)	
Course Code	**Course Title**
P22CS5031	System Software and Compiler Design
P22CS5032	Computer graphics and visualization
P22CS5033	Cloud Computing Platform
P22CS5034	Artificial Intelligence

	Bachelor of Engineering (VI–Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs/Week**				**Credits**	**Examination Marks**		
				L	**T***	**P**	**PJ**		**CIE**	**SEE**	**Total**
1	P22CS601	Data Analytics	CS	3	-	-	-	3	50	50	100
2	P22CS602X	Professional Core Course (Elective-II)	CS	3	-	-	-	3	50	50	100
3	P22CS603X	Professional Core Course (Elective-III)	CS	3	-	-	-	3	50	50	100
4	P22CS604	Computer Architecture(Integrated)	CS	3	-	2	-	4	50	50	100
5	P22CS605X	Open Elective–I	CS	3	-	-	-	3	50	50	100
6	P22CSL606	Data Analytics Lab	CS	-	-	2	-	1	50	50	100
7	P22CSMP607	Mini–Project	CS	-	-	2	2	2	50	50	100
8	P22HSMC608B	Employability Enhancement Skills-VI	HSMC	1	-	-	-	1	50	50	100
9.	P22UHV609	Universal Human Values and Professional Ethics	XX	1	-	-	-	1	50	50	100
	Total							**21**			

Professional Elective Course – II (P22XX602X)	
Course Code	**Course Title**
P22CS6021	Fundamentals of Block chain
P22CS6022	Network Management
P22CS6023	Service Oriented Architecture
P22CS6024	Software Testing

Professional Elective Course – III (P22XX603X)	
Course Code	**Course Title**
P22CS6031	Decision Support Systems
P22CS6032	Fundamentals of Devop's
P22CS6033	UNIX System programming
P22CS6034	Robotics Process and Automation

Open Elective – I (P22XXO605X)	
Course Code	**Course Title**
P22CSO6051	Introduction to WEB Programming
P22CSO6052	Fundamentals of DBMS
P22CSO6053	Fundamentals of Data Mining
P22CSO6054	Fundamentals of Machine Learning

Software Engineering and Management [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P22CS501**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Introduction to Software Engineering.
- Describe the process of Agile Software Engineering, the technologies used for Software Engineering, and configuration management of Software Engineering.
- Apply Object oriented Design decisions, Patterns and Software testing.
- Understand Software Project management and Configure management.
- Explain Earned Value Management (EVM) and its basics.

UNIT – I	**8 Hours**
Overview: Introduction to Software Engineering, Introduction, Professional software development. **Software processes**: Software process models, Process activities, coping with change, The Rational Unified Process.	
Self-study component:	Software Engineering Ethics

UNIT – II	**Agile and Lean Software development**	**8 Hours**
Agile software development: Agile methods, Plan driven and agile development, Extreme programming, Agile project management, Scaling agile methods. **Lean Software Development (LSD):** Eliminating the waste, Fast Delivery, Amplify Learning, Builds Quality, Respect Teamwork, Delay the commitment, optimizing the whole system, Difference between Lean Development Model and Agile Development Model.		
Self-study component:	EVO function specification using planguage	

UNIT – III	**8 Hours**
Design and Implementation: Object-oriented design using the UML Design patterns, Implementation issues, Open source development. **Software testing**: Development testing, Test-driven development, Release testing, User testing.	
Self-study component:	Control styles in design

UNIT – IV	**8 Hours**
Software Project Management (SPM): Conflict Management, Risk Management, Requirement Management, Managing people, Teamwork. **Configuration management**: Change management, Version management System building ,Release management	
Self-study component:	Software measurements and Metrics

UNIT – V	**8 Hours**
Earned Value Management (EVM): Benefits of EVM, Planned Value (PV), Actual Costs (AC), Earned Value (EV). Variance Analysis, Performance Indexes. **Fundamentals of Earned Value Management:** Organization and Scope of Project, Planning, Scheduling, and Budgeting, Accounting for Actual Costs, Analyzing and Reporting on Project Performance, Revisions and Data Maintenance, Find the Best EVM Solution for Your Projects.	
Self-study component:	Different Earned value formulas

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy**	**Level Indicator**

		Level	
CO1	Show the given project in various phases of a lifecycle	Understand	L2
CO2	Build appropriate process model depending on the user requirements..	Apply	L3
CO3	Make use of various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.	Apply	L3
CO4	Analyze Software project management methods	Analyze	L4
CO5	Apply the knowledge, techniques, and skills to Solve various Earned Value Management techniques	Apply	L3

Text Book(s):

1. **Software Engineering** – Ian Somerville, 10th Edition, *©2016* | ***Pearson*** .
2. **Earned value Project Management by** Quentin W. Fleming PhD MSc and Joel M. Koppelman, fourth Edition 2010, PMI

Reference Book(s):

1. Agile and Iterative Development by Craieg Larman 2003
2. **Software Engineering: A Practitioners Approach -** Roger S. Pressman, 7th Edition, McGraw-Hill, 2007.
3. **Software Engineering Theory and Practice -** Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
4. **Software Engineering Principles and Practice –** Waman S Jawadekar, Tata McGraw Hill, 2004
5. **Software Engineering** – Pankaj Jalote, Tata McGraw Hill

Computer Networks [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P22CS502**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the fundamentals concepts of computer networks.
- Familiarize with the standard models for the layered approach to set the communication between machines in a network using protocols of the various layers.
- Get prepare for advanced courses in computer networking.

UNIT – I	**8 Hours**
Introduction and Physical Layer : Data communication—Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Signals: analog signals, digital signals—Signal impairment—Multiplexing—Transmission media : guided	
Self-study component:	Transmission media : unguided
UNIT – II	**8 Hours**
Data-Link Layer & Media Access : Introduction — Data-Link Control—Media Access Control —Layer Addressing — Ethernet—Cellular telephony.	
Self-study component:	Satellite Network ,Connecting devices
UNIT – III	**8 Hours**
Network Layer : Network Layer Services — Packet switching —Internet protocol version 4: IP addressing, main and auxiliary protocol, options, ICMPv4 — Next Generation IP (IPV6): IPV6 addressing , IPV6 protocol — Transition from IPv4 to IPv6—Routing algorithms: —Unicasting routing protocols: RIP,OSPF—Multicasting Protocol: PIM— IGMP	
Self-study component:	BGP4, Multicasting protocol: DVMRP, MOSPF
UNIT – IV	**8 Hours**
Transport Layer : Transport Layer services— Transport Layer Protocols — User Datagram Protocol — Transmission Control Protocol: TCP services, TCP features, Segment, TCP connection, Windows in TCP, Flow control, Error control ,TCP congestion control— SCTP: Services and features, packet format.	
Self-study component:	Transport layer services: Connectionless and connection oriented protocols
UNIT – V	**8 Hours**
Application Layer : Introduction—Client /Server Paradigm—Standard Applications: World Wide Web and HTTP, FTP, Electronic Mail, Domain Naming Services—Socket interface programming	
Self-study component:	Network management: Introduction

Course Outcomes: On completion of this course, students are able to:			
CO's		**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Recall the basic concepts of Computer network pertaining to each layer of TCP/IP reference model.		
CO2	Understand the different applicability of protocols in various layers.		
CO3	Solve the problem by applying networking techniques for a given scenario.		

Text Book(s):

Behrouz A. Forouzan "Data Communications and Networking with TCP/IP protocol suite" 6th Edition Published by McGraw Hill LLC, 2022.

Reference Book(s): - Computer networks ,Andrew S. Tanenbaum, David J. Wetherall. -- 5th ed, Pearson Education, Inc, 2011.

Web and Video link(s):

- https://www.youtube.com/watch?v=bR3l1L1oCb0&list=PL9P1J9q3_9fNXTTpJ1TM0gJDdjM9HBGxN
- https://www.youtube.com/watch?v=VwN91x5i25g&list=PLBlnK6fEyqRgMCUAG0XRw78UA8qnv6jEx

E-Books/Resources:

- https://drive.google.com/file/d/1BXjlY59ka2gYkxGLVPnSmH8Ew0IBqBLi/view?usp=drive_link

Operating Systems (Integrated)

[As per Choice Based Credit System(CBCS) &OBE Scheme]

SEMESTER –V

Course Code:	**P22CS504**	**Credits:**	**04**
Teaching Hours/Week(L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**
Total Laboratory Hours:	**24**		

Course Learning Objectives: This course will enable the students to:

- Understand the basic functionalities of Operating System, Process and Threads.
- Analyze the usage of different Process and Disk scheduling
- Understand the implementation of memory management and virtual memory.
- Analyze the structure and organization of the file system

UNIT – I	**8 Hours**

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Operating System operations.

Operating System Structures: Operating System Services, System calls; Types of system calls; System programs; Operating System structure

Process Management:

Process: Process concept; Process scheduling; Operations on processes; Inter process communication

Self-study component:	Operating System Debugging; Operating System generation.
Practical topics: (4Hours)	1. Write a program to read data from the standard input device and write it on the screen(using read()/write() system calls) 2. Write a program to print 10 characters starting from the 10th character from a file(lseek() system call) 3. Write a program to implement IPC using shared memory

UNIT – II	**8 Hours**

Threads: Overview; Multithreading models; Thread Libraries; Threading issues

Process Synchronization: Background, The critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization; Monitors.

Self-study component:	Implicit threading, Synchronization hardware, mutex locks
Practical Topics: (6 Hours)	1. Implement the Producer & consumer Problem (Semaphore) 2. Implement the solution to dining philosopher's problem using monitors.

UNIT – III	**8 Hours**

CPU Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling;

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection.

Self-study component:	Thread scheduling, Recovery from deadlock
Practical Topics: (4Hours)	1. Implement the FCFS CPU Scheduling Algorithms 2. Implement Bankers Algorithm for Deadlock Avoidance

UNIT – IV	**8 Hours**

Memory Management:

Main Memory: Background, Swapping; Contiguous Memory allocation; Segmentation; Paging;

Virtual Memory: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

Self-study component:	Structure of page table,I/O Interlock and Page Locking
Practical Topics: (6Hours)	1. Implement the following Memory Allocation Methods for fixed partition a) First Fit b) Worst Fit 2.Implement the following Page Replacement Algorithms a) FIFO b) LRU

UNIT – V	**8 Hours**

Storage Management:
Mass storage structures: Overview of mass storage structure, Disk structure; Disk scheduling;
File System Interface: File concept; Access methods; Directory structure
File System Implementation: File system structure; Directory implementation; Allocation methods;

Self-study component:	Disk Attachment , RAID structure, File system implementation;
Practical Topics:(4Hours)	1.Implement the following Disk Scheduling Algorithms: a) SSTF Scheduling b) SCAN Scheduling 2.Implement the following File Allocation Strategies a) Sequential b) Indexed

Course Outcomes: On completion of this course, students are able to:

CO's	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	**Explain the structure of operating system and its various operations.**	Understand	L2
CO2	**Apply** different techniques for management of resources.	Apply	L3
CO3	**Implement** various algorithm related to operating system concepts.	Apply	L3

Text Book(s):

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne ,9th Edition, Wiley-India-2013

Reference Book(s):

1. Operating Systems: A Concept Based Approach – D.M Dhamdhere, 2nd Edition, Tata McGraw- Hill, 2017.
2. Operating systems internals and design principles 7th edition, , PHI, 2012

Web and Video links:

1. https://nesoacademy.org/cs/03-operating-system
2. https://archive.nptel.ac.in/courses/106/105/106105214/

Cyber Security

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – V

Course Code:	**P22CS505**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- To understand Cyber offenses and various attacks
- To gain knowledge on tools and methods used in cybercrimes
- To understand computer forensics and forensics for handheld devices

UNIT – I	**8 Hours**
Introduction to Cybercrime: Introduction, Cybercrime and information security, who are Cyber criminals? Classification of Cybercrimes, Cybercrime – The Legal Perspectives and Indian Perspective.	
Self-study component:	Case Study : Cybercrimes - Banking frauds, Email-phishing
UNIT – II	**8 Hours**
Cyber Offenses: How Criminals Plan Them: Introduction, Categories of Cybercrime, how criminals plan the attack, classification of social engineering, Cyber stalking, Cybercafé and Cybercrimes.	
Self-study component:	Botnet – The fuel of cybercrimes
UNIT – III	**8 Hours**
Tools and Methods used in Cybercrime: Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and Spywares, virus and worms, Trojan horses and backdoors, SQL injection	
Self-study component:	DoS and DDoS attacks
UNIT – IV	**8 Hours**
Cyber Forensics: Introduction, historical background of Cyber forensics, digital forensic science, the need for computer forensics, cyber forensics and digital evidence, digital forensics life cycle, chain of custody concept, Approaching a computer forensics investigation, Relevance of the OSI 7 Layer model to computer forensics.	
Self-study component:	Setting up a computer forensics laboratory: understanding the requirements
UNIT – V	**8 Hours**
Forensics of Handheld Devices: Introduction, handheld devices and digital forensics, Toolkits for Hand-held device forensics, Mobile phone evidence guidelines, organizational guidelines on cell phone forensics.	
Self-study component:	An Illustration on real life use of forensics

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Explain the fundamentals of cybercrime and cyber forensics	Understanding	L2
CO2	Illustrate the different types of cybercrimes	Apply	L3
CO3	Analyze the various methods associated with cyber forensics	Analyze	L4
CO4	Demonstrate real world scenarios of cybercrimes using forensic tools in a team	Apply	L3

Text Book(s):

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2011, First Edition (Reprinted 2018)

Reference Book(s):

1. Jeetendra Pande "Introduction to cyber security" uttarkand open university ,2017
2. Computer Forensics: Computer Crime Scene Investigation by John R, Vacca, 2nd edition, Charles River Media, Inc, New Delhi, 2017
3. Guide to Computer Forensics and Investigations by Bill Nelson, Amelia Phillips, Christopher Steuart, CENGAGE Learning, 2018.
4. Cybersecurity Essentials by Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short, ISBN: 978-1-119-36239-5, 2018.

Web and Video link(s):

1. https://www.youtube.com/watch?v=KqSqyKwVuA8
2. https://www.youtube.com/watch?v=nzZkKoREEGo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI4

.

System Software and Compiler Design

(Professional Elective Effect from the academic year 2024-2025)

SEMESTER – V

Course Code:	**P22CS5031**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Learn basics of System Software and compilers.
- Familiarize with the approaches of lexical, syntax and syntax directed translations.
- Describe the front-end and back-end phases of compiler and their importance to students

UNIT – I	**8 Hours**

INTRODUCTION TO SYSTEM SOFTWARE: Assemblers: Elements of Assembly Language programming, A Simple Assembly Scheme and Pass Structure of Assemblers. Linkers and Loaders: Relocation, Linking and Loading Concepts. Language processors, The structure of a Compiler, Impacts on Compilers.
LEXICAL ANALYSIS: The Role of Lexical Analyzer, Lexical Analysis Versus Parsing, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors, Input Buffering, Buffer Pairs, Sentinels, Specification of Tokens, Strings and Languages, Operations on Languages, Regular Expressions.

Self-study component:	Compiler tools and applications of the compilers

UNIT – II	**8 Hours**

LEXICAL ANALYSIS: Recognition of Tokens, Transition Diagrams, Architecture of a Transition-Diagram-Based Lexical Analyzer.
SYNTAX ANALYSIS : The role of parser, Representative Grammars, syntax error handling, error recovery strategies, Writing a grammar, lexical versus syntactic analysis, Eliminating ambiguity, Elimination of left-recursion, Left-factoring.

Self-study component:	Recognition of Reserved Words and Identifiers, Completion of the Running Example,

UNIT – III	**8 Hours**

TOP-DOWN PARSING : Introduction, Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) grammars , Constructing a predictive parsing table , Non recursive Predictive Parsing, Error Recovery in Predictive Parsing: Panic mode Error Recovery.

Self-study component:	Phrase level Error Recovery

UNIT – IV	**8 Hours**

BOTTOM-UP PARSING : Reductions, Handle Pruning, Shift-reduce parsing and conflicts during Shift-reduce parsing, Introduction to LR Parsing: Simple LR, Need of LR parsers, Items and LR(0) automaton, Closure of Item Sets, The Function GOTO, LR(0) automaton for the expression grammar, The LR-Parsing Algorithm, Constructing SLR-parsing tables, LALR parsers.

Self-study component:	CLR parsers

UNIT – V	**8 Hours**

SYNTAX-DIRECTED TRANSLATION: Syntax directed definitions, Inherited and synthesized attributes, evaluating an SDD at the nodes of the parse tree.
INTERMEDIATE-CODE GENERATION: Three-address code – Addresses and instructions, Quadruples and Triples.

Self-study component:	S-attributed and L-attributed SDTs, Code optimization techniques,code generation

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Understand** the basics of system software and phases of compiler	Understanding	L2
CO2	**Understand** the concepts of lexical and syntax analysis	Understanding	L2
CO3	**Apply** appropriate parsers using top-down and bottom-up parsing in syntax analysis	Apply	L3
CO4	**Apply** different syntax directed translation schemes with appropriate intermediate code and code generation techniques	Apply	L3

Text Book(s):

1. Compilers- Principles, Techniques and Tools, Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman, Pearson Education, 2nd Edition 2007.
2. System Programming and Operating Systems, D M Dhamdhere , Mcgraw Hill. 2nd Revised Edition.

Reference Book(s):

1. Compiler Construction Principles & Practice, Kenneth C Louden, Thomson Education, 1997.
2. Modern Compiler Implementation in C, Andrew W Appel, First Edition, Cambridge University Press, 2010

Computer Graphics and Visualization

(Professional Elective Effect from the academic year 2024-2025)

SEMESTER – V

Course Code:	**P22CS5032**	**Credits:**	**03**
Teaching hours/week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Teaching hours of Pedagogy:	**40hrs**	**SEE Marks:**	**50**

Course learning Objectives:

- Explain hardware, software and OpenGL Graphics Primitives
- Illustrate interactive computer graphics using OpenGL
- Design and implement algorithms for 2D graphics Primitives and attributes
- Demonstrate Geometric transformations, viewing on both 2D and 3D objects

UNIT – I	**8 Hours**

Computer Graphics Hardware: Video Display Devices: , Raster-Scan Systems, Computer Graphics Software: Coordinate Representations, Graphics Functions, Software Standards, Introduction To OpenGL, Graphics Output Primitives: Coordinate Reference Frames, Specifying A Two Dimensional World-Coordinate Reference Frame In OpenGL, OpenGL Point Functions, OpenGL Line Functions, Opengl Curve Functions, Fill Area Primitives, OpenGL Polygon Fill Area Functions, OpenGL Vertex Arrays, OpenGL Pixel-Array Functions, Character Primitives, OpenGL Character Functions, OpenGL Display Lists, OpenGL Display-Window Reshape Function.

Self-Study Content: Input Devices, Hardcopy devices, Polygon Fill Areas.

UNIT – II	**8 Hours**

Attributes of Graphics Primitives: OpenGL State Variables, Color and Gray Scale, OpenGL Color Functions, Point Attributes, OpenGL Point-Attribute Functions, Line Attributes, OpenGL Line-Attribute Functions, Curve Attributes, Fill Area Attributes, OpenGL Fill-Area Attribute Functions, Open-GL Antialiasing Functions, OpenGL Query Functions.

Implementation Algorithms for Graphics Primitives and Attributes: Line Drawing Algorithms, Circle Generating Algorithms, General Scan-Line Polygon-Fill Algorithm

Self-Study Content: OpenGL Character Attribute Functions, Fill Methods for Areas with Irregular Boundaries.

UNIT – III	**8 Hours**

Two Dimensional Transformations: Basic Two-Dimensional Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two Dimensional Composite Transformations, Other Two Dimensional Transformations, Transformations Between Two Dimensional Coordinate System, OpenGL Functions for Two-Dimensional Geometric Transformations.

Three Dimensional Geometric Transformations: Three-Dimensional Translation, Three-Dimensional Rotation, Three-Dimensional Scaling, Composite Three-Dimensional Transformations, Other Three-Dimensional Transformations, Affine Transformations, OpenGL Geometric-Transformation Functions.

Self-Study Content: Raster Methods for Geometric Transformations, OpenGL Raster Transformations.

UNIT – IV	**8 Hours**

Two-Dimensional Viewing: The Two-Dimensional Viewing Pipeline, The Clipping Window, Normalization and Viewport, OpenGL Two-Dimensional Viewing Functions, Clipping Algorithms, Two-Dimensional Point Clipping, Two-Dimensional Line Clipping (Cohen-Sutherland Line Clipping and Liang-Barsky Line Clipping), Polygon Fill-Area Clipping (Sutherland-Hodgeman Polygon Clipping), Text Clipping.

Self-Study Content: Curve Clipping, Weiler-Atherson Polygon Clipping.

UNIT – IV	**8 Hours**

Three-Dimensional Viewing: Transformation from World to Viewing Coordinates, Projection Transformations, Orthogonal Projections, Perspective Projections, OpenGL Three-Dimensional Viewing Functions.

Illumination Models and Surface Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models

Self-Study Content: Transparent Surfaces, OpenGL Illumination and Surface Rendering Functions.		
Course Outcomes: At the end of the course students should be able to :		**Expected Bloom's Level**
CO1	Understand graphics hardware and OpenGL Graphics primitive attributes	L2
CO2	Apply algorithms for graphics Primitives and attributes	L3
CO3	Apply various Algorithms of Transformations/Clipping/Viewing on different type of objects	L3
CO4	Design computer graphics programs using OpenGL	L4

Textbooks:

Computer Graphics with OpenGL - Donald Hearn & M Pauline Baker, 2014 , 4th Edition, Pearson Publisher

Reference Books:

1. Computer Graphics using OpenGL - FS Hill & Stephen M Kelley, 2009 , 3rd Edition , Pearson Education.
2. Interactive Computer Graphics – A Top-down Approach using Opengl - Edward Angel , 2012, 6th Edition, Pearson Education.

Web links and Video Lectures (e-resources) :

1. https://www.youtube.com/watch?v=lTN7bDyHrfE
2. https://www.youtube.com/watch?v=XYWjnRV3ty8

Cloud Computing Platform

(Professional Elective Effect from the academic year 2024-2025)
SEMESTER – V

Course Code:	**P22CS5033**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Identify the architecture, infrastructure and delivery models of cloud computing
- Compare and contrast different cloud services.
- Apply suitable virtualization concept.
- Apply Cloud automation and management tools to build your own cloud application in Google Cloud Platform.

UNIT – I	**8 Hours**

Introduction to Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Major Challenges Faced by Cloud Computing, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing.

Self-study component:	Comparative analysis on Services provided by AWS AND GCP

UNIT – II	**8 Hours**

Cloud Computing: Application Paradigms and Concepts : Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep The Web application. Cloud Resource Virtualization-Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and Para virtualization, Hardware support for virtualization.

Self-study component:	Virtualization in AWS and Microsoft Azure

UNIT – III	**8 Hours**

Resource Management and Scheduling : Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling.

Self-study component:	Application of map reduce in AWS and Microsoft Azure

UNIT – IV	**8 Hours**

Google Cloud Platform and Services: Types of Cloud Services, Cloud Computing vs. Data Center Computing. Computing Components of Google Cloud Platform, Storage Components of Google Cloud Platform, Networking Components of Google Cloud Platform, Additional Components of Google Cloud Platform. How GCP Organizes Projects and Accounts, Roles and Identities, Billing, Enabling APIs.

Self-study component:	Projects and Accounts, Roles and Identities, Billing, Enabling APIs in AWS and Microsoft Azure

UNIT – V	**8 Hours**

Computation in Google Cloud: Compute Engine, App Engine, Kubernetes Engine, Cloud Functions, Creating and Configuring Virtual Machines with the console, Creating and Configuring Virtual Machines with Cloud SDK, Basic Virtual Machine Management, Guidelines for planning, Deploying and Managing Virtual Machines, Managing Single Virtual Machine Instances, Introduction to Instance Groups, Guidelines for Managing Virtual Machine.

Self-study component:	Execution of Kubernetes Engine in AWS and Microsoft Azure		
Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with **Action verbs** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Understand** the cloud computing concepts.	Understanding	L2
CO2	**Explain** application paradigm and concepts.	Understanding	L2
CO3	**Apply** different types of virtualization and Resource Management techniques that can be used in designing cloud applications.	Applying	L3
CO4	**Explain** google platform and services.	Understanding	L2
CO5	**Apply** Google Cloud Platform using Qwiklabs to build cloud applications.	Applying	L3

Text Book(s):

1. Dan C Marinescu: Cloud Computing Theory and Practice, 2nd edition. Elsevier(MK) 2013.
2. Dan Sullivan: Official Google Cloud Certified Associate Cloud Engineer Study Guide, 1st edition, SYBEX, 2019

Reference Book(s):

1.John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Web and Video link(s):

1. AWS https://www.youtube.com/watch?v=k1RI5locZE4
2. GCP https://www.youtube.com/watch?v=m6ozQnqit50
3. Aneka https://www.youtube.com/watch?v=8FeysgQLwIo

E-Books/Resources:

1 https://aws.amazon.com/executive-insights/content/data-security-as-business-accelerator/
2 https://cloud.google.com/resources/future-of-cloud-computing-ebook

Artificial intelligence

(Professional Elective Effect from the academic year 2024-2025)
SEMESTER - V

Course Code:	**P22CS5034**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving.
- Get to know approaches of inference, perception, Uncertain Knowledge and Reasoning

UNIT – I	**8 Hours**
Introduction - The Foundations of Artificial Intelligence, The History of Artificial Intelligence. Intelligent Agents - Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	
Self-study component:	AI - State of the Art
UNIT – II	**8 Hours**
Solving Problems by Searching - Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions	
Self-study component:	Problem-solving agents - Example problems
UNIT – III	**8 Hours**
Beyond Classical Search - Local Search Algorithms and Optimization Problems, Example problems, Searching with Nondeterministic Actions, Searching with Partial Observations.	
Self-study component:	Learning in online search.
UNIT – IV	**8 Hours**
Adversarial Search – Games, Optimal Decisions in Games, Alpha–Beta Pruning, Stochastic Games. **Logical Agents** - Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving.	
Self-study component:	State-of-the-Art Game Programs.
UNIT – V	**8 Hours**
First-Order Logic - Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic. **Inference in First-Order Logic** - Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.	
Self-study component:	Knowledge Engineering in First-Order Logic

COs	**Course Outcomes** with ***Action verb*** for the Course topics	**Bloom's Level**	**Level Indicator**
CO1	**Apply** knowledge of agent architecture and searching for different applications.	Apply	L3
CO2	**Analyze** Searching and Inferencing Techniques.	Analyze	L4
CO3	**Develop** knowledge base sentences using propositional logic and first order logic	Develop	L5

Text Book(s):

1. Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015

Reference Book(s):

1. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2013
2. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011

Web and Video link(s):

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/

Computer Networks Laboratory [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P22CSL506**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the fundamentals concepts of computer networks in simulation environment.
- Familiarize with the implement of the standard models to set the communication between machines in a network.

EXPERIMENTS

Part A

1. Simulate a topology with 2 LAN's each having two devices connected to switches. Switches are connected to a common router. Observe the packet flow.
2. Construct simple LAN using n nodes and understand working of Address Resolution Protocol (ARP).
3. Construct a simple LAN by configuring static IP address and observe the routing table at the end of simulation.
4. Perform an experiment to understand the dynamic IP address allocation process observe the routing table at the end of simulation.
5. Simulate a topology where 3 routers are fully connected and each router connected to an end device. Observe the flow of ICMP packets from one network to other using RIP protocol.
6. Simulate a topology where 3 routers are fully connected and each router connected to an end device. Observe the flow of ICMP packets from one network to other using OSPF protocol.
7. Simulate a network for browsing and understand DNS protocol.

Part B

1. Write a program to implement error detection/ error correction using hamming code.
2. Write a program to show working of the Stop and wait protocol.
3. Implementation of CSMA/CD.
4. Write a program to implement Distance Vector Routing algorithm.
5. Write program to create a least cost tree using Link State Routing algorithm.
6. To write a client-server application for chat using TCP.

Course Outcomes: On completion of this course, students are able to:		**Bloom's Level**
Cos	**Course Outcomes with Action verbs for the Course topics**	
CO1	**Understand** the working of various networking components in the simulation environment.	**L1**
CO2	**Analyse** the working principle of the protocols in the TCP/IP protocol suite.	**L2**
CO3	**Implemen**t given networking scenarios and analyse the results.	**L3**

Internship - II [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P22INT507**	**Credits:**	**02**
Teaching Hours/Week (L:T:P)	**0:0:0**	**CIE Marks:**	**-**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**100**

All the students registered to III year of BE shall have to undergo a mandatory internship of 04 weeks during the vacation of IV semesters in industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship/AICTE Intern Shala/College Partnered Industries. A Semester End Examination (Presentation followed by Question Answer session) shall be conducted during V semester and the prescribed credit shall be included in the V semester grade card. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent Semester End Examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

Internship-II: SEE component will be the only seminar/Presentation and question answer session

EMPLOYABILITY ENHANCEMENT SKILLS - V [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V for CSE, ISE, ECE, EEE & CSE(AIML) Branches only			
Course Code:	**P22HSMC508B**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving Time and work, Speed & distance, trains, boats and streams and races.
- Explain concepts behind logical reasoning modules of clocks and calendars.
- Develop problem solving skills through Data structures.

UNIT – I		**06 Hours**
Quantitative Aptitude: Time and Work, Time, Speed and Distance. **Logical Reasoning:** Clocks and Calendars.		
Self-study component:	Decimal fractions	

UNIT – II		**06 Hours**
Quantitative Aptitude: Trains, Boats and Streams, Races. **Verbal Ability:** Reading Comprehension, Critical Reasoning.		
Self-study component:	Game based assessments	

UNIT – III	**ADVANCED DATA STRUCTURES - I**	**06 Hours**
Priority Queues: Introduction to Priority Queues, Ways to implement priority queues, Introduction to heaps, Introduction to Complete Binary Trees and its implementation, Insert and Delete operations in heaps, Implementing priority queues, Heap sort, Inbuilt Priority Queue **Hashmaps:** Introduction to Hashmaps, Inbuilt Hashmap, Hash functions, Collision handling, Insert and Delete operation implementation in hashmap, Load factor, Rehashing		
Self-study component:	Applications of Queues: Josephus Problem	

UNIT – IV	**ADVANCED DATA STRUCTURES - II**	**06 Hours**
Tries: Introduction to Tries, making a Trie Node class, Insert, Search and Remove operation implementation in Tries, Types of Tries, Huffman coding. **Graphs:** Introduction to Graphs, Graph Terminology, Graph implementation, Graph Traversals (DFS and BFS), Weighted and Directed Graphs, Minimum Spanning Trees, Cycle Detection in Graphs, Kruskal's algorithm, Prim's algorithm, Dijkstra's algorithm.		
Self-study component:	Optimal Binary Search Trees.	

UNIT – V	**ADVANCED DATA STRUCTURES - III**	**06 Hours**
Introduction to Dynamic Programming: Introduction to Memoization, Introduction to Dynamic Programming, Fibonacci numbers using recursion, memoization and dynamic programming **Applications of Dynamic Programming:** Longest Common Subsequence (LCS) using recursion,		

memorization and dynamic programming, Edit distance using recursion, memorization and dynamic programming, Knapsack problem using recursion, memorization and dynamic programming			
Self-study component:	Lower Bound Arguments, Decision trees.		
Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Solve the problems based on Time and work, Speed & distance, trains, boats and streams and races.	Applying	L3
CO2	Solve logical reasoning problems based on Clocks and calendars and verbal ability skills of reading comprehension and critical reasoning.	Applying	L3
CO3	Analyze and represent various data structures and its operations.	Analyzing	L4
CO4	Develop programs with suitable data structure based on the requirements of the real-time applications	Applying	L3

Text Book(s):

1. Data Structures and Algorithms Made Easy by Narasimha Karumanchi
2. Data Structures through C in Depth by by S K Srivastava and Deepali Srivastava
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, "Data Structures using C", 2014, low price edition ,Pearson education.
2. Seymour Lipschutz, Data Structures with C (Schaum's Outline Series) , July 2017, McGraw Hill Education.
3. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Data Structures and algorithms offered by NPTEL: https://nptel.ac.in/courses/106102064/
2. https://www.youtube.com/watch?v=CBYHwZcbD-s
3. https://www.youtube.com/watch?v=2ZLl8GAk1X4
4. https://www.youtube.com/watch?v=MdG0Vw9f1A4

COURSE ARTICULATION MATRIX (EMPLOYABILITY ENHANCEMENT SKILLS - V – P22HSMC508B)												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										
CO4	1	1	2									1

Social Connect and Responsibility [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P22UHV509**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**1:0:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**25+5**	**SEE Marks:**	**--**

Course Outcomes: This course will enable the students to:

- **Identify** the needs of the community and involve them in problem solving.
- **Demonstrate** the knowledge about the culture and societal realities.
- **Develop** sense of responsibilities and bond with the local community.
- **Make use** of the Knowledge gained towards significant contributions to the local community and the society at large.
- **Develop** among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions for individual and community problems.

PART-I

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excpert either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature – Objectives, Visit, case study, report, outcomes.

PART-II

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.

PART-III

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

PART-IV

Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

PART-V

Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Identify** the needs of the community and involve them in problem **solving.**	**Knowledge / Apply**	**L1 & L3**
CO2	**Demonstrate** the knowledge about the culture and societal realities.	**Understand**	**L2**
CO3	**Develop** sense of responsibilities and bond with the local community	**Apply**	**L4**
CO4	**Make use** of the Knowledge gained towards significant contributions to the local community and the society at large.	**Apply**	**L4**
CO5	**Develop** among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions for individual and community problems.	**Create**	**L6**

Course Articulation Matrix

Mapping of Course Outcomes (CO) with Program Outcomes (POs) and Program Specific Outcomes(PSOs)

Sl. No.	**Course Outcome**	**Programme Outcomes**												**Programme Specific outcomes**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	**Identify** the needs of the community and involve them in problem **solving.**	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-
2	**Demonstrate** the knowledge about the culture and societal realities.	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-
3	**Develop** sense of responsibilities and bond with the local community.	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-
4	**Make use** of the Knowledge gained towards significant contributions to thelocal community and the society at large.	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-
5	**Develop** among themselves a sense ofsocial & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE) :

After completion of the social connect and responsibility course, the student shall prepare, with daily diary/ report as reference and a comprehensive report in consultation with the faculty/mentor to indicate what he has observed and learned in the social connect period. The report shall be evaluated on the basis of the following below criteria's or other relevant criteria pertaining to the activity completed.

- Planning and scheduling the social connect.
- Information/Data collected during the social connect.
- Analysis of the information/data and report writing.
- Presentation and interaction.

CIE Rubrics for Evaluation.

Report	Video presentation	Interaction	Total
10	05	05	20

Note:

- Video presentation of **4 to 5 min** in a team to be presented and the same to be uploaded in the department YouTube channel.
- The number of students in each team can be from **4 to 5** members.
- Each activities has to be evaluated on above basis that is [20 * 5 = 100 marks] for final total marks.

Duration : A total of 25 – 30 hours engagement per semester is required for the 5th semester of the B.E./B.Tech. program. The students will be divided into groups and each group will be handled by faculty mentor.

Pedagogy – Guidelines:

Special Note: NO SEE – Semester End Exam – Completely Practical and activities based evaluation

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	**Group size**	Location	**Activity execution**	**Reporting**	**Evaluation Of the Topic**
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Data Analytics

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS601**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40 Hours**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Apply quantitative modeling and data analysis techniques to draw conclusion regarding the dataset.
- Employ predictive modeling techniques.
- Identify, assess, and select appropriate data analytics methods and models for solving a particular real-world problem, weighing their advantages and disadvantages.

UNIT – I	**8 Hours**

Introduction to Data Science: Data Analysis Life Cycle Overview. Data analysis Discovery, Framing Problem, Developing Initial Hypothesis, Sources of Data, Process for Making Sense of Data, Data Preparation, Performing ETLT, Data Conditioning, Survey and Visualize, Common tools for Data Preparation Phase, Data Exploration and Variable Selection, Common tools for the Model Planning and Building Phase, Communicate Results, Operationalize.

Self-study component:	The KDD Process, The CRISP-DM Methodology.

UNIT – II	**8 Hours**

Descriptive Statistics: Scale Types, Descriptive Univariate Analysis, Descriptive bivariate Analysis.

Multivariate Analysis: Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics.

Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II Errors, Power and Sample Size, ANOVA.

Self-study component:	Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation.

UNIT – III	**8 Hours**

Data Quality and Pre-processing: Data Quality, Missing Values, Redundant Data, Inconsistent Data, Noisy Data Outliers, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction: Attribute Aggregation: Principal Component Analysis. Attribute selection: filters, wrappers.

Self-study component:	Introduction to R, Exploratory Data Analysis.

UNIT – IV	**8 Hours**

Clustering : Distance Measures, Difference between Values of Common Attribute Types, Distance Measures for Objects with Quantitative Attributes, Distance Measures for Non-conventional Attributes, Clustering Validation, Clustering Techniques, K-means, Centroids and Distance Measures, How K-means Works, Density-based spatial clustering of applications with noise (DBSCAN).

Frequent Pattern Mining: Frequent Item sets, Setting the min_sup Threshold, Apriori – a Join-based Method, Eclat**, FP-Growth**, Maximal and Closed Frequent Item sets, Association Rules.

Self-study component:	Agglomerative Hierarchical Clustering Technique.

UNIT – V	**8 Hours**

Regression: Predictive Performance Estimation, Generalization, Model Validation, Predictive Performance Measures for Regression, Finding the Parameters of the Model, Linear Regression.
Classification : Binary Classification , Predictive Performance Measures for Classification, Distance-based Learning Algorithms ,K-nearest Neighbor Algorithms, Case-based Reasoning, Logistic Regression Algorithm, Naive Bayes Algorithm.

Self-study component:	Search-based Algorithms, Decision Tree Induction Algorithms, Decision Trees for Regression.

Course Outcomes: On completion of this course, students are able to:

CO's	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Describe the basic tenets of Data Analysis.	Understand	L2
CO2	Utilize the statistical and computational methods to understand the relationship among data.	Apply	L3
CO3	Apply data pre processing methods on raw data set.	Apply	L3
CO4	Apply unsupervised and supervised learning methods to analyze the datasets.	Apply	L3

Text Book(s):

1. A General Introduction to Data Analytics, João Mendes Moreira, André C.P.L.F. de Carvalho, © 2019 John Wiley & Sons, Inc.
2. Data Science & Big Data Analytics, Discovering, Analyzing, Visualizing and Presenting Data, Published by EMC Education services, 2015.

Reference Book(s):

1. Big Data and Data Analytics by Seema Acharya & Subhashini Chellappan by Wiley India Pvt Ltd.
2. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt, 2nd Edition, Wiley, 2014.
3. Data Mining by Jiawei Han, Micheline Kamber & Jian Pei, 3rd Edition, Morgan Kaufmann, 2012.

Web and Video link(s):

1. Foundations of Data Science: https://www.edx.org/course/foundationsof-data-science
2. Data Preprocessing: https://www.youtube.com/watch?v=CaqJ65CIoMw
3. Unsupervised learning algorithms: https://www.youtube.com/watch?v=D6gtZrsYi6c
4. Supervised learning algorithms: https://www.youtube.com/watch?v=QeKshry8pWQ&pp=ygUSc3VwZXJ2aXNlZCBsZWFybmln

E-Books/Resources:

1. https://careerfoundry.com/en/blog/data-analytics/what-is-data-analytics/
2. https://www.geeksforgeeks.org/supervised-unsupervised-learning/

Computer Architecture and Parallel Programming(Integrated)

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS604**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the Architecture of computer systems, measure the performance of architectures.
- Understand the pipelining concept and deal with different types of hazards.
- Understand the concept of Instruction level Parallelism.
- Understand the concept of parallel Processes and threads and OpenMP.

UNIT – I	**8 Hours**

Fundamentals of Computer Design : Introduction, Classes of Computers, Defining Computer Architecture, Trends in Technology, Dependability, Measuring, Reporting and Summarizing Performance, Quantitative Principles of Computer Design.

Self-study component:	Trends in Power in Integrated Circuit, Trends in Cost.
Practical Topics:	Familiarization with OpenMP interface.

UNIT – II	**8 Hours**

Pipelining: Basic and Intermediate Concepts : Introduction, How is pipelining implemented, The major hurdle of Pipeling – pipeline hazards, Data Hazards, Branch Hazards, Reducing the Cost of Branches Through Prediction, Static Branch Prediction.

Self-study component:	Extending the RISC V Integer pipeline to handle Multicycle operations.
Practical Topics:	1. Write a OpenMp program to illustrate a) Data hazard b) Eliminating data hazard 2. Write a OpenMp program to illustrate data dependency.

UNIT – III	**8 Hours**

Instruction-Level parallelism and its Exploitation: Instruction –Level Parallelism: Concepts and Challenges, Basic Complier Techniques for Exposing ILP, Reducing Branch costs with Prediction, Overcome Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Examples and the Algorithm.

Self-study component:	Hardware based Speculation, Studies of the Limitations of ILP.
Practical Topics:	**1.** Write a OpenMp program to explore Loop Unrolling mechanism. **2.** Write a OpenMp program to illustrate tomasulo's algorithm

UNIT – IV	**8 Hours**

System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created.

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns.

Self-study component:	Application Programming Models and Threading, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm.
Practical Topics:	1. Write an OpenMp program which performs C=A+B & D=A-B in separate blocks/sections where A,B,C& D are arrays. 2. Write an OpenMp program to add all the elements of two arrays A & B each of size 1000 and

	store their sum in a variable using reduction clause. 3. Write an OpenMp program to multiply two matrices A & B and find the resultant matrix C.

UNIT – V	**8 Hours**

Open MP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Compilation, Debugging, performance.

Self-study component:	Open MP Library Functions, Open MP Environment Variables
Practical Topics:	1. Write an OpenMp program to show how thread private clause works. 2. Write an OpenMp program to show how first private clause works (Factorial program). 3. Write an OpenMP program to find prime numbers (split)

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	**Understand** the basic/performance characteristics of Computer Architecture.	Understand	L2
CO2	**Understand** the Instruction Level Parallelism.	Understand	L2
CO3	**Analyze** the various types of pipeline hazards.	Analyze	L3
CO4	**Understand** the salient features of threads and parallel programming.	Understand	L2
CO5	**Apply** OpenMP programming concept**.**	Apply	L3

Text Book(s):

1. John L. Hennessy and David A. Patterson : Computer Architecture, A quantitative approach, Sixth Edition, Morgan Kaufmann Publishers, Elsevier 2019
2. Multicore Programming, Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Reference Book(s):

1. Kai Hwang & Naresh Jotwani," Advanced Computer Architecture", Parallelism, scalability, Programmability 3rd edition McGraw Hill 2017.
2. John P Hayes, Computer Architecture & Organization 3rd Ed. McGraw Hill 2017.
3. Thomas Rauber and Gudula Runger Parallel Programming for Multicore and cluster systems, Springer International Edition, 2009.

Web and Video link(s):

1. https://people.math.sc.edu/Burkardt/c_src/openmp/openmp.html
2. https://www.openmp.org/wp-content/uploads/openmp-examples-4.5.0.pdf
3. https://www.youtube.com/results?search_query=openmp+parallel+programming

E-Books/Resources:

1. http://archive.nitjsr.ac.in/course_assignment/CS01CS6021.BookwithcommentComputerarchitecture AQuantitativeApproachbyJohnL.HennesseyandDavidA.Patterson,6thEdition.pdf
2. https://dl.acm.org/doi/book/10.5555/2821564
3. http://grsotudeh.ir/pardazeshmovazi/%DA%A9%D8%AA%D8%A7%D8%A8%D9%87%D8%A7%DB%8C%20%D9%BE%D8%B1%D8%AF%D8%A7%D8%B2%D8%B4%20%D9%85%D9%88%D8%A7%D8%B2%DB%8C/Multi-Core_Programming_Digital_Edition_(06-29-06).pdf

Fundamentals of Block Chain

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Subject Code:	**P22CS6021**	**Credits:**	**03**
Number of Contact Hours/Week:	**3:0:0**	**CIE Marks:**	**50**
Total Number of Contact Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable students to:

- To enable the student to understand and appreciate, the importance of fundamentals of block chain technology and application of cryptography in block chain.
- To gain the awareness about the concepts of various implementations of block chain technology such as bit coin, Ethereum, and Hyper ledger.

UNIT- I — **8 Hours**

Introduction to Blockchain Technology: Distributed systems – The history of blockchain – Introduction to blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization.

Self-study component: Benefits and limitations of blockchain

UNIT- II — **8 Hours**

Cryptography in Blockchain: Introduction – cryptographic primitives – Assymetric cryptography – public and private keys -line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms.

Self-study component: Bitcoin improvement proposals (BIPs)

UNIT- III — **8 Hours**

Bit Coin : Introduction – Transactions – Structure - Transactions types – The structure of a block– The genesis block – The bitcoin network– Wallets and its types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface.

Self-study component: Bitcoin installation – Bitcoin programming and the command-line interface

UNIT- IV — **8 Hours**

Ethereum: Ethereum block chain- Elements of the Ethereum block chain– Precompiled contracts –Accounts and its types – Block header- Ether – Messages – Mining - Clients and wallets – Trading and investment – The yellow paper - The Ethereum network - Applications developed on Ethereum – Scalability and security issues.

Self-study component: Scalability and security issues of Ethereum

UNIT- V — **8 Hours**

Smart Contract and Hyper ledger: History of Smart Contract – Ricardian contracts - The DAO. Hyper ledger projects – Hyperledger as a protocol – Fabric - Hyperledger Fabric - Sawtooth lake – Corda Architecture.

Self-study component: Corda Architecture

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Student will be able to understand the fundamentals of blockchain technology.	Understanding	L2
CO2	To use the working of an immutable distributed ledger and trust model that defines blockchain.	Understanding	L2
CO3	To illustrate the essential components of a blockchain platform.	Understanding	L2
CO4	Apply knowledge of implementations of Bitcoin, Ethereum and Hyperledger to develop solutions in the appropriate domains.	Understanding	L2

Textbooks:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018.

Reference Books:

1. A. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O'Reilly,2015.
2. Z. Zheng, S. Xie, H. Dai, X. Chen, andH. Wang, ―An Overviewof Blockchain Technology Architecture,Consensus, and Future Trends,‖ in 2017 IEEE International Congress on Big Data (BigData Congress), 2017.

Web and Video link(s):

1. https://www.coursera.org/specializations/blockchain .
2. https://nptel.ac.in/courses/106105184/
3. Introduction to Blockchain Technology and Application
4. https://swayam.gov.in/nd1_noc20_cs01/preview

Network Management [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P22CS6022**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the principles of network management
- Understand different standards and protocols used in managing networks
- Understanding the Automation of network management
- Understand remote monitoring of network statistics for Ethernet networks.

UNIT – I	**8 Hours**
Introduction: Common Network Problems, Challenges of Information Technology Managers, Network Management: Goals, Organization and Functions: Goal of Network Management, Network Provisioning, Network Operations and NOC. Network Management, Architecture and Organization. Network Management Perspectives, Service Management Perspectives	
Self-study component: Network Node Components	
UNIT – II	**8 Hours**
Basic Foundations: Network Management Standards, Network Management Models, Organization Model, Information Model – Management Information Trees, Managed Object Perspective. Communication Model; ASN.1-(Abstract syntax notation) Terminology, Symbols, and Conventions, Objects and Data Types, Object Names. Functional Models	
Self-study component: Object Perspectives, An Example of ASN.1 ISO 8824	
UNIT – III	**8 Hours**
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information Management Information Base (MIB)- Object group, System group, IP group and TCP group.	
Self-study component: Case Histories and Examples of Managed Network	
UNIT – IV	**8 Hours**
SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Protocol specification, SNMP operation- PDU operations, SNMP MIB groups, Functional Models. **SNMP Management–RMON:** Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups.	
Self-study component: RMON2 – The RMON2 Management Information Base.	
UNIT – V	**8 Hours**

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, **Performance** Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Security Management – Policies and Procedures, Resources to prevent Security Breaches, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems.

Self-study component:	Event correlation Techniques: Rule based and Model based

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Enumerate the applications of NM and challenges pertaining to security management of an IT Manager	Remember	L1
CO2	Articulate network management standards and models	Remember	L1
CO3	Develop insight knowledge about SNMP network management	Understand	L2
CO4	Identify various network management applications to monitor a network	Apply	L3

Text Book(s):

- Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

Text Book Link: https://taufikcool.files.wordpress.com/2015/11/network-management-principles-and-practices-2nd-edition.pdf

Reference Book(s):

- J. Richard Burke: Network management Concepts and Practices: Hands-On Approach, PHI, 2008.

Web and Video link(s):

- https://www.youtube.com/watch?v=liBB_Q7Go5k
- https://www.youtube.com/watch?v=FmKbxjUZhmk&t=10s
- https://www.youtube.com/watch?v=J_Z1BsfB1gM
- https://www.youtube.com/watch?v=Lq7j-QipNrI&t=36s
- https://www.youtube.com/watch?v=o6rtuFcYofo

E-Books/Resources:

- Network Management Fundamentals, Alexander Clemm, Cisco Press, 1st Edition.

Service Oriented Architecture

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6023**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: Students will be able to:

- Comprehend the need for SOA and its evolution.
- Explore various patterns of service design and techniques.
- Formulate experiments with various levels and factors.
- Demonstrate applicability of SOA in various domains.
- Understand PoC-Requirements Architectures of LMS SOA based integration

UNIT – I	**8 Hours**

SOA BASICS: Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise-Wide SOA, Straw man Architecture For Enterprise-Wide-SOA-Enterprise, SOA Layers, Application Development Process.

Self-study component:	SOA Methodology For Enterprise

UNIT – II	**8 Hours**

Enterprise Applications; Architecture Considerations, Solution Architecture for enterprise application, Software platforms for enterprise Applications; Package Application Platforms, Enterprise Application Platforms, Service-oriented-Enterprise Applications; Considerations for Service-Oriented Enterprise Applications, Patterns for SOA, Pattern-Based Architecture for Service-Oriented Enterprise Application(java reference model only).Composite Applications.

Self-study component:	SOA programming models

UNIT – III	**8 Hours**

SOA ANALYSIS AND DESIGN: Need For Models, Principles of Service Design, Design of Activity Services, Design of Data services, Design of Client services and Design of business process services, Technologies of SOA; Technologies For Service Enablement, Technologies For Service Integration.

Self-study component:	Technologies for Service orchestration

UNIT – IV	**8 Hours**

Business case for SOA: Stakeholder OBJECTIVES, Benefits of SOA, Cost Savings, Return on Investment, SOA Governance, Security and implementation; SOA Governance, SOA Security, approach for enterprise wide SOA implementation, Trends in SOA; Technologies in Relation to SOA.

Self-study component:	Advances in SOA

UNIT – V	**8 Hours**

SOA Technologies-PoC; Loan Management System(LMS), PoC-Requirements Architectures of LMS SOA based integration; integrating existing application, SOA best practices, Basic SOA using REST.

Self-study component:	Role of WSDL,SOAP and JAVA/XML Mapping in SOA

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Explore** the different IT architectures	Remember	L1
CO2	**Elaborate** SOA based applications.	Understanding	L2
CO3	**Asses** web service and realization of SOA	Understanding	L2
CO4	**Derive** restful services	Applying	L3
CO5	**Understand** SOA Technologies-PoC	Understanding	L2

Text Book(s):

1. **Shankar Kambhampaly**, "Service–Oriented Architecture for Enterprise Applications",Wiley Second Edition, 2014.
2. **Mark D. Hansen**, "SOA using Java Web Services", Practice Hall, 2007

Reference Book(s):

1. **WaseemRoshen**, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009, 2004

Software Testing

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6024**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Differentiate the various testing techniques
- Analyze the problem and derive suitable test cases.
- Apply suitable technique for designing of flow graph and tool support for model-based testing.

UNIT – I	**8 Hours**

Basics of Software Testing and Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudo code, the triangle problem, The Next Date function, The commission problem.

Self-study component:	Currency converter.

UNIT – II	**8 Hours**

Software Testing, Decision Table-Based Testing: SATM problem, Decision tables, Test cases for the triangle problem, Test cases for the Next Date function. Data Flow Testing: Definition-Use testing, Slice-based testing. Levels of Testing: Traditional view of testing levels, Alternative life-cycle models.

Self-study component:	The SATM system, separating integration and system testing, case study.

UNIT – III	**8 Hours**

System Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines. Interaction Testing: Context of interaction, taxonomy of interactions, Client/Server Testing.

Self-study component:	Interaction, composition, and determinism

UNIT – IV	**8 Hours**

Object-Oriented Integration Testing: UML support for integration testing, MM-paths for object-oriented software, A framework for object-oriented dataflow integration testing.GUI Testing: The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program. Object-Oriented System Testing: Currency converter UML description, UML-based system testing.

Self-study component:	State chart-based system testing.

UNIT – V	**8 Hours**

Exploratory Testing: The context-driven school, Exploring exploratory testing, Exploring a familiar example, Exploratory and context-driven testing observations. Model-Based Testing: Testing based on models, Appropriate models, Use case-based testing, Commercial tool support for model-based testing.

Test-Driven Development: Test-then-code cycles, Automated test execution, Java and JUnit example, Pros, cons, and open questions of TDD.

Self-study component:	Retrospective on MDD versus TDD.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Understand the perspective and need for software testing.	understand	L2
CO2	Apply the test cases for given problem.	Applying	L3
CO3	Understand the strategies for thread testing and issues raised by Object Oriented Software.	understand	L2
CO4	Understand the appropriate technique for the design of the flow graph and tool support for model-based testing.	understand	L2

Text Book(s):

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 4rd Edition, Auerbach Publications, 2014.

Reference Book(s):

1. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, John Wiley & Sons, 2008.

Decision Support System

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6031**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Explore the historical context and identify key components of decision support systems.
- Understand the impact of organizational culture on decision making.
- Describe how DSS can support and improve decision making in organizations.
- Understand how to manage multiple decision-maker (MDM) activities and facilitate Collaboration.
- Understand the concept of creativity and implement a decision support system.

UNIT – I	**8 Hours**

Introduction to decision support systems: DSS Defined, History of decision support systems, Ingredients of a DSS, Data and model management, DSS Knowledge base, User interfaces. The DSS user, Categories and classes of DSSs.
Decisions and Decision makers: who are they, Decision styles, why are decision so hard? , A Typology of decisions.

Self-study component:	Decision effectiveness, How can a DSS help?

UNIT – II	**8 Hours**

Decisions and Decision makers (contd.): Decision theory and Simon's model of problem solving Decisions in the organization, Bounded decision making, The process of choice, Cognitive processes, Biases and heuristics in decision making.
Decisions in the organization: Understanding the organization, Organizational culture, Power and politics, supporting organizational decision making.

Self-study component:	Rational decision making, Effectiveness and efficiency.

UNIT – III	**8 Hours**

Modeling decision processes: Defining the problem and its structures, Decision models, Types of probability, Techniques for forecasting probabilities.
Group decision support and groupware technologies: Group Decision making, MDM support technologies, Managing MDM activity.

Self-study component:	Calibration and sensitivity, The problem with groups,

UNIT – IV	**8 Hours**

Designing and building decision support systems: Strategies for DSS analysis and design, The DSS developer, Tools for DSS development.
Implementing and integrating decision support systems: DSS implementation, System evaluation, The importance of integration.

Self-study component:	Development Tools Classification.

UNIT – V	**8 Hours**

Creative decision making and problem solving: What is creativity?, Creativity defined, The occurrence of creativity, Creative problem solving techniques.

Self-study component:	Creativity and the role of technology.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**

CO1	Understand the relationship between business information needs and decision making.	Understand	L2
CO2	Analyze the Problem solving Decisions in the organization and organizational culture on decision making.	Analyze	L4
CO3	Analyze the Issues related to development of DSS and select appropriate a modeling technique.	Analyze	L4
CO4	Design and implement a Decision Support System.	Apply	L3

Textbooks:

Decision support system- George M. Marakas , 2nd Edition, Pearson publisher, 2011.

Reference Book(s):

Decision support system- George M. Marakas , 2nd Edition, Pearson publisher, 2015.

Fundamentals of DevOp's

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6032**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- The objective of the course is to acquaint students with the principles and philosophies of DevOps and to explain the foundational material for DevOps.
- It also introduces students to basic DevOps tools used in the industry for DevOps Engineering.
- Students will have a hands-on experience of building a CI/CD pipeline for continuous Integration, continuous delivery from start to finish.
- It also introduces students to Docker and its details.
- It also introduces students to Kubernetes and its details.

UNIT – I **8 Hours**

DevOps Culture and Practices,Getting started with DevOps,Implementing CI/CD and continuous deployment, Continuous integration(CI), Implementing CI,Continuous delivery(CD),Continuous deployment,Understanding IaC practices,The benefits of IaC, IaC languages and tools,Scripting types, Declarative types,The IaC topology, The deployment and provisioning of the infrastructure, Server configuration, Immutable infrastructure with containers, Configuration and deployment in Kubernetes, IaC best practices

Optimizing Infrastructure Deployment with Packer:

Technical requirements,An overview of Packer, Installing Packer,Installing manually, Installing by script, Installing Packer by script on Linux,Installing Packer by script on Windows, Integrating Packer with Azure Cloud Shell, Checking the Packer installation, Creating Packer templates for Azure VMs with scripts,The structure of the Packer template, The builders section, The provisioners section, The variables section,Building an Azure image with the Packer template,Using Ansible in a Packer template,Writing the Ansible playbook,Integrating an Ansible playbook in a Packer template,Executing Packer,Configuring Packer to authenticate to Azure,Checking the validity of the Packer template,Running Packer to generate our VM image

Self-study component:	Practically implement the above concepts

UNIT – II **8 Hours**

DevOps CI/CD Pipeline I : Managing Your Source Code with Git,Technical requirements,Over viewing Git and its command lines, Git installation, Configuration Git, Git vocabulary, Git command lines, Retrieving a remote repository, Initializing a local repository, Configuring a local repository, Adding a file for the next commit, Creating a commit, Updating the remote repository, Synchronizing the local repository from the remote, Managing branches,Understanding the Git process and GitFlow pattern,Starting with the Git process,Creating and configuring a Git repository, Committing the code, Archiving on the remote repository, Cloning the repository, The code update, Retrieving updates,Isolating your code with branches, Branching strategy with GitFlow, The GitFlow pattern, GitFlow tools.

Self-study component:	Practically implement the above concepts

UNIT – III **8 Hours**

DevOps CI/CD Pipeline II : Continuous Integration and Continuous Delivery, Technical requirements, The CI/CD principles, Continuous integration(CI) ,Continuous delivery(CD),Using a package manager,Private NuGet and npm repository, Nexus Repository OSS,Azure Artifacts,Using Jenkins,Installing and configuring Jenkins, Configuring a GitHub webhook, Configuring a Jenkins CI job,Executing the Jenkins job,Using Azure Pipelines, Versioning of the code with Git in Azure Repos,Creating the CI pipeline,Creating the CD pipeline :the release, Using GitLab CI, Authentication at GitLab, Creating a new project and managing your code source, Creating the CI pipeline,Accessing the CI pipeline

execution details.	
Self-study component:	Practically implement the above concepts

UNIT – IV	**8 Hours**
Containerizing Your Application with Docker: Technical requirements, Installing Docker, Registering on Docker Hub, Docker installation, An overview of Docker's elements, Creating a Dockerfile , Writing a Dockerfile, Dockerfile instructions overview, Building and running a container on a local machine,Building a Docker image,Instantiating a new container of an image, Testing a container locally, Pushing an image to Docker Hub, Deploying a container to ACI with a CI/CD pipeline, The Terraform code for ACI, Creating a CI/CD pipeline for the container.	
Self-study component:	Practically implement the above concepts

UNIT – V	**8 Hours**
Containerized Applications with Kubernetes : Managing Containers Effectively with Kubernetes, Technical requirements, Installing Kubernetes, Kubernetes architecture overview, Installing Kubernetes on a local machine, Installing the Kubernetes dashboard, First example of Kubernetes application deployment, Using HELM as a package manager, Using Azure Kubernetes service, Configuring kubectl for Azure Kubernetes services Advantages of Azure Kubernetes Service, Creating a CI/CD pipeline for Kuberrnetes with Azure Pipelines, The build and push of the image in the Decker Hub , Automatic deployment of the application in Kubermetes	
Self-study component:	Practically implement the above concepts

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** wit ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Apply** various **Concepts** and **Principles** used in the topics to understand the theory related to DevOps.	Remember	L1
CO2	**Discuss** the fundamental **Definitions** of DevOps &Github relevant to Software development and deployment.	Understanding	L2
CO3	**Assess** the CI/CD **problems** by applying proper solutions to verify the theoretical concepts.	Understanding	L2
CO4	**Understand** the various **Properties** and **Applications** pertaining **to Dockers.**	Applying	L3
CO5	**Understand** the various **Properties** and **Applications** pertaining to Kubernetes.	Applying	L3

Text Book(s):

1. Mikel Krief: Learning DevOps, Published by Packt Publishing Ltd, October 2019.
2. Mitesh Soni: DevOps Bootcamp, Published by Packt Publishing Ltd, May 2017.

Reference Book(s):

1. Michael Duffy: DevOps Automation Cookbook,Published by Packt Publishing Ltd, Nov 2015.
2. Jennifer Davis: Effective DevOps,Published by O'Reilly Media,in. June 2016
3. David Gonzalez: implementing Modern DevOps,Published by Packt Publishing Ltd,Oct 2017

Web and Video link(s):

1. https://learn.microsoft.com/en-us/azure/devops
2. https://www.guvi.in/devops
3. https://www.youtube.com/watch?v=hQcFE0RD0cQ

UNIX System Programming

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6033**	**Credits:**	**03**
Teaching hours/week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Teaching hours of Pedagogy:	**40**	**SEE Marks:**	**50**

Course learning Objectives: Students will be able to :

- Analyze the UNIX kernel structure
- Use the UNIX commands and system calls for Input/output, disk access, file systems facilities, Semaphores/monitors, mutual exclusion and Process scheduling for the UNIX system programs
- Use UNIX inter-process communication facilities
- Use UNIX signals and signal handlers.
- Identify important UNIX system calls and invoke them using C/C++ programs.

UNIT- I — **8 Hours**

The UNIX architecture and command usage: UNIX Architecture, Features of UNIX, POSIX and Single UNIX specification. Locating commands, internal and external commands, understanding the man documentation, Basic Unix commands: cal, date, echo, printf, bc, script, email basics, mailx, passwd, who, uname, tty, stty.

The File system: The File, What's in a (File)name?, The Parent-Child Relationship, The HOME variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, ls, The UNIX File System, File related commands – cat, cp, rm, mv, more, file, wc, od, cmp, comm, diff, gzip, gunzip, tar, zip, unzip, ls, chmod commands.

Self-Study Content: Pattern matching, escaping and quoting, redirection, /dev/null and /dev/tty, tee

UNIT- II — **8 Hours**

The vi Editor: vi basics, input mode, ex mode, navigation, editing text.

Simple Filters: The sample database, pr, head, tail, cut, paste, sort, An example: displaying a word count list

Filters using Regular Expressions: grep, BRE introduction, ERE and egrep, sed

Self-Study Content: Undoing last editing instructions, repeating last command, searching for a pattern

UNIT- III — **8 Hours**

Essential Shell programming:

Shell Scripts, read, exit and exit status of command, the logical operators && and || - conditional execution, the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift, the here document(<<) ,trap, debugging shell scripts with set –x

UNIX File APIs:

General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs

Self-Study Content: uniq, tr, using command line arguments

UNIT- IV — **8 Hours**

Process environment: 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, UNIX Kernel Support for Processes.

Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions

Self-Study Content: changing user IDs and Group IDs, process scheduling, process times

UNIT- V	8 Hours
Signals: Introduction, signals function, unreliable signals, interrupted system calls, kill, raise, alarm, pause, signal sets , abort, system and sleep functions. **Interprocess Communication:** Pipes, popen and pclose Functions, Co-processes, FIFOs, XSI IPC, Message Queues, Semaphores. shared memory, client server properties	
Self-Study Content: Job control signals, signal names and numbers, POSIX Semaphores	

Course Outcomes: At the end of the course students should be able to :	**Expected Bloom's Level**
CO1: Understand Unix Architecture, File system and use of Basic Commands	**L2**
CO2: Select commands related to Shell basics, vi editor and regular expression commands.	**L2**
CO3: Apply UNIX / LINUX commands for process control , Signal and IPC	**L3**
CO4: Analyze the given commands & shell programs, to identify the errors and generate the desired outputs	**L4**

Textbooks:

1. Unix Concepts and Applications - Sumitabha Das, 4thEdition **(Latest)** , Tata McGraw Hill Publisher.
2. Advanced Programming in the UNIX Environment - W. Richard Stevens , 3rd Edition, 2016 , Pearson Publisher.
3. Unix System Programming Using C++ - Terrence Chan, 2015 , PHI Publisher.

Reference Books:

1. UNIX & Shell Programming- M.G. Venkatesh Murthy, Pearson Education
2. Linux Command Line and Shell Scripting Bible - Richard Blum , Christine Bresnahan , 2ndEdition,2014 , Wiley Publishing.
3. Linux Shell Scripting Cookbook - Clif Flynt, Sarath Lakshman, Shantanu Tushar , Third Edition, 2017 , Packt Publishing.

Web links and Video Lectures (e-resources)

Linux Shell Scripting: A Project-Based Approach to Learning

https://www.udemy.com/course/linux-shell-scripting-projects/?couponCode=NVDPRODIN35

E-Books/Resources:

1. https://xesoa.com/wp-content/uploads/2014/04/APUE-3rd.pdf
2. https://github.com/ccceye/computerbook/blob/master/Shell%20Programming%20in%20Unix%2C%20Linux%20and%20OS%20X%2C%204th%20Edition.pdf

Robotic Process Automation

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CS6034**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the basic concepts of RPA platform.
- Describe the different types of variables, control flow and data manipulation techniques.
- Understand various control techniques, plugins and extensions in RPA.
- Describe various types and strategies to handle events and exceptions.

UNIT – I	**8 Hours**

What is Robotic Process Automation? Scope and techniques of automation Robotic process automation, About UiPath, The future of automation.

Record and Play: Record and Play, UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder.

Self-study component:	Step-by-step examples using the recorder.

UNIT – II	**8 Hours**

Sequence, Flowchart, and Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-bystep example using Sequence and Flowchart.

Data Manipulation: Data Manipulation, Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-bystep example

Self-study component:	Step-by-step example, using Sequence and Control flow.

UNIT – III	**8 Hours**

Taking Control of the Controls: 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, Avoiding typical failure points.

Self-study component:	How to use OCR

UNIT – IV	**8 Hours**

Tame that Application with Plugins and Extensions: Tame that Application with Plugins and Extensions, Java plugin, Mail plugin, PDF plugin, Excel and Word plugins.

Handling User Events and Assistant Bots: Handling User Events and Assistant Bots, What are assistant bots? Monitoring system event triggers, monitoring image and element triggers, Launching an assistant bot on a keyboard event.

Self-study component:	Credential management

UNIT – V	**8 Hours**

Exception Handling, Debugging, and Logging: Exception Handling, Debugging, and Logging, Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, Collecting crash dumps.

Self-study component:	Error reporting.

Course Outcomes: On completion of this course, students are able to:			
CO's	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Demonstrate Robotic Process Automation & Record and Play feature of UiPath Studio.	Understand	L2
CO2	Create different types of variables, control flow and data manipulation techniques.	Apply	L3
CO3	Apply various control techniques, plugins and extensions in RPA	Apply	L3
CO4	Illustrate various types and strategies to handle events and exceptions	Apply	L3

Text Book(s):

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath by Alok Mani Tripathi, Packtpub, March 2018.

Reference Book(s):

1. Learning ServiceNow by Tim Woodruff, Packtpub, March 2017.
2. ServiceNow Automation by Ashish Rudra Srivastava, Packtpub.

Web and Video link(s):

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

Introduction to Web Programming

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CSO6051**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Learn the principles of creating an effective web page.
- Develop the ability to logically plan and create web pages
- Construct basic websites using HTML and CSS.

UNIT – I	**8 Hours**
Fundamentals of Web: Internet, WWW, Web Browsers and Web Servers, URLs, DOM, MIME, HTTP, Security, Origins and evolution of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup.	
Self-study component:	The Web Programmers Toolbox

UNIT – II	**8 Hours**
Introduction to HTML/XHTML:, Images, Hypertext Links.Lists, Tables, Forms, Syntactic differences between HTML and XHTML.	
Self-study component:	Frames

UNIT – III	**8 Hours**
Cascading Style Sheets: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box model, Background images.	
Self-study component:	The and tags.

UNIT – IV	**8 Hours**
The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, General syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructor.	
Self-study component:	Pattern matching using regular expressions, Errors in scripts.

UNIT – V	**8 Hours**
JavaScript and HTML documents: The JavaScript execution environment; The Document Object Model; Element access in JavaScript, Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements. **Dynamic documents with javascript:** Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content	
Self-study component:	Stacking elements, Slow movement of elements, Dragging and dropping elements.

CO's	**Course Outcomes** with ***Action verb*** for the Course topics
CO1	Understand the basic concepts used to develop web pages.
CO2	Develop web pages using HTML and CSS features with different layouts as per need of application.
CO3	Develop web pages using Java script

Text Book(s):

1. Programming the World Wide Web –Robert W. Sebesta, 8th Ed., Pearson Ed., 2015.

Reference Book(s):

1. Internet & World Wide Web How to program – M. Deitel, P.J Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
2. Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley, India, 2006.
3. The Web Warrior Guide to Web Programming – XueBai et al.

Web and Video link(s):

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

E-Books/Resources:

1. https://www.amazon.in/Programming-World-Wide-Robert-Sebesta/dp/0133775984
2. https://www.amazon.in/Web-Development-jQuery-Richard-York/dp/111886607X
3. https://www.teamwerx.org/wp-content/uploads/2017/10/Web-Development-with-jQuery.pdf

Fundamentals of DBMS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CSO6052**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- To learn the basic knowledge of Database Management System and various types of data models.
- To learn the concept and syntax of ER Diagram, relational data model and relational algebra.
- To learn and write various SQL queries.
- To learn the concept of Normalization.

UNIT – I	**8 Hours**
Introduction: An example: Characteristics of Database approach; Advantages of using DBMS approach; A brief history of database applications; Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment.	
Self-study component:	Actors on the scene, workers behind the scene.

UNIT – II	**8 Hours**
Entity-Relationship Model : Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues..	
Self-study component:	Relationship types of degree higher than two.

UNIT – III	**8 Hours**
Relational Model And Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database .	
Self-study component:	Rename and Division operation.

UNIT – IV	**8 Hours**
Structured Query Langauge: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL.	
Self-study component:	Specifying constraints as assertions and triggers.

UNIT – V	**8 Hours**
Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form;	
Self-study component:	Definitions of Multi valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form.

Course Outcomes: On completion of this course, students are able to:

CO's	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Understand** the database concepts to create the relations by specifying various constraints.	Understand	L2
CO2	**Design** an ER diagram for given scenario.	Design	L3
CO3	**Develop** SQL commands for a given queries.	Develop	L3
CO4	**Apply** suitable normalization technique to improve database design	Apply	L3

Text Book(s):

1. Fundamentals of Database Systems – Elmasri and Navathe, 7 th Edition, Addison-Wesley, 2011

Reference Book(s):

2. **Data Base System Concepts –** Silberschatz, Korth and Sudharshan, 5th Edition, Mc-GrawHill, 2006.
3. **An Introduction to Database Systems –** C.J. Date, A. Kannan, S.Swamynatham, 8th Edition, Pearson Education, 2006.
4. **Database Management Systems –** Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, McGraw-Hill, 2003.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_cs91/

2. https://youtu.be/c5HAwKX-suM

E-Books/Resources:

1. https://www.ebooks-for-all.com/bookmarks/detail/Database-Management-Systems/onecat/0.html
2. https://ebooks.lpude.in/management/mba/term_3/DCAP204_MANAGING_DATABASE_DCAP402_DATABASE_MANAGEMENT_SYSTEMS.pdf

Fundamentals of Data Mining

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CSO6053**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Define the fundamental concepts of data and data processing techniques.
- Explain the concepts and theories of data mining techniques.
- Build a foundation in classifying and clustering different types of data.

UNIT – I	**8 Hours**

Introduction: What is data mining?; Data mining: an essential step in knowledge discovery; Diversity of data types for data mining; Mining various kinds of knowledge – Multidimensional data summarization, Mining frequent patterns, associations, and correlations, Classification and regression for predictive analysis, Cluster analysis, Deep learning, Outlier analysis, Are all mining results interesting?; Data mining: confluence of multiple disciplines – Statistics and data mining, Machine learning and data mining, Data base technology and data mining, Data mining and data science, Data mining and other disciplines; Data mining and applications; Summary.

Self-study component:	Data mining and society

UNIT – II	**8 Hours**

Data, measurements, and data pre-processing: Data types – Nominal attributes, Binary attributes, Ordinal attributes, Numeric attributes, Discrete vs. continuous attributes; Statistics of data – Measuring the central tendency, Measuring the dispersion of data; Similarity and distance measures- Data matrix vs. dissimilarity matrix, Proximity measures for nominal attributes, Proximity measures for binary attributes, Dissimilarity of numeric data : Minkowski distance; Data quality, data cleaning, and data integration – Data quality measures, Data cleaning, Data integration; Data transformation – Normalization, Discretization; Summary.

Self-study component:	Data Compression, Sampling.

UNIT – III	**8 Hours**

Pattern mining: basic concepts and methods: Basic concepts- Market basket analysis: a motivating example, Frequent item sets, closed item sets, and association rules; Frequent item set mining methods – Apriori algorithm: finding frequent item sets by confined candidate Generation, Generating association rules from frequent item sets, Improving the efficiency of Apriori, A pattern-growth approach for mining frequent item sets, Mining frequent item sets using the vertical data format; Which patterns are interesting?- Pattern evaluation methods, strong rules are not necessarily interesting, From association analysis to correlation analysis, A comparison of pattern evaluation measures, Summary

Self-study component:	Mining closed and max patterns

UNIT – IV	**8 Hours**

Classification: basic concepts and methods: Basic concepts – What is classification, General approach to classification; Decision tree induction – Decision tree induction, Attribute selection measures, Tree pruning; Bayes classification methods - Bayes' theorem, Naïve Bayesian classification; Lazy learners (or learning from your neighbors) - k-nearest-neighbor classifiers; Linear classifiers; Model evaluation and selection; Techniques to improve classification accuracy, Summary

Self-study component:	Case-based reasoning

UNIT – V	**8 Hours**

Cluster analysis: basic concepts and methods: Cluster analysis – What is cluster analysis?, Requirements for cluster analysis, Overview of basic clustering methods; Partitioning methods - k-Means: a centroid-based technique, Variations of k-means; Hierarchical methods – Basic concepts of hierarchical clustering, Agglomerative hierarchical clustering, Divisive hierarchical clustering; Density-based and grid-based methods - DBSCAN: density –based clustering based on connected regions with High density; Evaluation of clustering, Summary

Self-study component:	Grid-based methods

Course Outcomes: On completion of this course, students are able to:			
CO's	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Understand** the fundamental concept of different types of data used in data mining.	Remember	L1
CO2	**Apply** different preprocessing techniques for different data types.	Apply	L3
CO3	**Generate** different frequent item sets using mining methods.	Apply	L3
CO4	**Apply** suitable classification or clustering technique to classify the given data set.	Apply	L3

Text Book(s):

1. Jiawei Han, Jian Pei, Hanghang Tong , "Data Mining Concepts and Techniques", 4th Edition, 2022, Elsevier, MK Publishers.

Reference Book(s):

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, 2012, Elsevier, MK Publishers.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, "Introduction to Data Mining", 2nd Edition, 2021, Pearson Publishers.

Web and Video links:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs12/preview
3. https://nptel.ac.in/courses/106105174
4. https://onlinecourses.swayam2.ac.in/cec20_cs12/preview

E-Books/Resources:

1. https://link.springer.com/book/10.1007/978-3-540-34351-6

Fundamentals of Machine Learning

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CSO6054**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Understand the basic theory on machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Understand the basic concepts of learning and decision trees.
- Understand Bayesian techniques for solving machine learning problems
- Understand the basic design of learning system (or intelligent system).

UNIT – I	**8 Hours**

Introduction: What is Machine Learning? Why Use Machine Learning? Types of Machine Learning Systems: Supervised/Unsupervised Learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning. Main Challenges of Machine Learning: Insufficient Quantity of Training Data, Non-representative Training Data, Poor-Quality Data, Irrelevant Features, Overfitting the Training Data, Under fitting the Training Data, Testing and Validating: Hyper parameter Tuning and Model Selection , Data Mismatch.

Self-study component:	Training and running a linear model using Scikit-Learn

UNIT – II	**8 Hours**

The Machine Learning Toolbox: Data, Infrastructures, Algorithms, Visualization, DATA Scrubbing: Feature selection, Row Compression, One-hot Encoding, Binning, Normalization, Standardization, Missing Data, Setting up your Data: Cross validation.

Self-study component:	Needs of data to train the model

UNIT – III	**8 Hours**

Concept learning and Learning Problems: Introduction, A Concept learning task, Concept Learning as search **:** General-to-Specific Ordering of Hypothesis, FIND-S algorithm, Version Spaces and The CANDIDATE-ELIMINATION algorithm.

Self-study component:	Model complexity based on prediction error

UNIT – IV	**8 Hours**

Supervised & Un-Supervised Learning Techniques: Regression Analysis, Logistic regression, SVM classifier, Clustering: Overview on K-means clustering, Problems on K- means clustering. Overview on K-Nearest Neighbor (KNN), Problems on KNN, Bias and Variance.

Self-study component:	Problems on Bayes Optimal Classifier

UNIT – V	**8 Hours**

Introduction to Bayesian learning: Bayesian learning, Bayes theorem, Example on Bayes theorem, Overview Naïve Bayesian classifier, Problems on Naïve Bayesian classifier**,** Decision Trees, Example of building a Decision Tree.

Self-study component:	Examples on Version spaces and Candidate elimination

Course Outcomes: On completion of this course, students are able to:

CO's	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	**Understand** the basic concept of Machine Learning	Understand	L2
CO2	**Apply** various machine learning tools for visualization and validation	Apply	L3

CO3	**Apply** Concept Learning System for building intelligence system	Apply	L3
CO4	**Apply** various classification and clustering methods in applications.	Apply	L3

Text Book(s):

1. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors Pvt. Ltd 2019.
2. Machine Learning For Absolute Beginners: A Plain English Introduction, Third Edition by Oliver Theobald**,** 2017.
3. "Machine Learning: An Artificial Intelligence Approach" by Tom M. Mitchell

Reference Book(s):

1. Machine Learning, Step-by-Step Guide to Implement Machine Learning Algorithms with Python by Rudolph Russell.
2. Machine Learning A Probabilistic Perspective Kevin P. Murphy, The MIT Press Cambridge, Massachusetts, London, England.
3. Introduction to Machine Learning, 3rd edition, Ethem Alpaydın, The MIT Press Cambridge, Massachusetts, London, England

Web and Video link(s):

1. https://www.youtube.com/playlist?list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
2. https://nptel.ac.in/courses/106/106/106106139/

E-Books/Resources:

1. https://www.analyticsvidhya.com/machine-learning/
2. https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/ml-decision-tree/tutorial/

DATA ANALYTICS LABORATORY

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI

Course Code:	**P22CSL606**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**24**	**SEE Marks:**	**50**

SI.No.	Experiment Name
1	**Demonstrate the Negative (–ve) and Positive (+ve) Correlation between twoattributes of Women data set & mtcars dataset**
2	**Create box plot** for the two Variables group of LungCapData dataset. having 6 variables each signifying lung capacity, age, height, smoke('yes' for a smoker and 'no' for a non-smoker), gender(male/female), and Caesarean(yes/no) of a person divide the ages into groups and then try to plot stratified box plots for the lung capacity of smokers vs non-smokers with age strata.
3	**Perform Data Cleaning on Air Quality data set** Load Air Quality dataset and also perform the followings. a. Check all the observations with missing values b. Check the outliers with box plot c. Clean the data by removing outliers and treat missing values. d. Impute the missing values in the original dataset with "mean" of the respectivevariables
4	**Principal Component Analysis** Perform Multivariate Analysis using PCA on IRIS data set for developing a predictivemodel.
5	**Similarity Measure with Data Normalization:** Three friends with age and education isgiven in the table below Name / Age(in years) / Education: Bala 43 2.0; Ganesh 38 4.2; Jeevan 42 4.1 Compute the following a Calculate the Euclidean distance between these friends to find the most similar friends b Do the same calculation measuring the ages in decades(Divide the age by 10) c Normalize the data using min-max method and find the most similar friends d Compare the results with normalized and without normalized data
6	**Data Conversion from Qualitative to Quantitative** Dimensionality Reduction: Attribute Selection – Filters In the given table, name of the contact, the maximum temperature registered last week in their town, their weight, height, year of experience and gender, together with the information on how good their company is given. Show how similar the behavior of eachpredictive attribute is to the target attribute Company and rank the attributes according to Pearson correlation and filter the predictive attribute with correlation below the given threshold

Contact	Max temp	Weight	Height	Years	Gender	Company
Andrew	25	77	175	10	M	Good
Bernhard	31	110	195	12	M	Good
Carolina	15	70	172	2	F	Bad
Dennis	20	85	180	16	M	Good
Eve	10	65	168	0	F	Bad
Fred	12	75	173	6	M	Good

Gwyneth	16	75	180	3	F	Bad
Hayden	26	63	165	2	F	Bad
Irene	15	55	158	5	F	Bad
James	21	66	163	14	M	Good
Kevin	30	95	190	1	M	Bad
Lea	13	72	172	11	F	Good
Marcus	8	83	185	3	F	Bad
Nigel	12	115	192	15	M	Good

7 **K-Means Clustering in R Programming:** Perform K means Clustering with three different cluster sizes. And Display the Cluster Vector and Perform Sum of squares within clusters.

8 Find the **frequent item sets** and generate **association rules for the following given transaction dataset**. Assume that minimum support threshold (support = 50%) and minimum confident threshold (confidence = 80%).

Transaction ID	Items
T1	Hot Dogs, Buns, Ketchup
T2	Hot Dogs, Buns
T3	Hot Dogs, Coke, Chips
T4	Chips, Coke
T5	Chips, Ketchup
T6	Hot Dogs, Coke, Chips

9 Implement K Nearest Neighbor algorithm to classifies iris data set and classify the dataset to new data point into the target class, depending on the features of its neighboring data points.

10 **Implement Simple Linear Regression algorithm for** predictive analysis and performthe following.

a. Visualize the Data
b. Perform Simple Linear Regression
c. Create Residual Plots
d. Predict the value for new sample.

Course Outcomes: On completion of this course, students are able to:

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Apply statistical and computational methods to **solve** problems and clearly communicate the results.	Apply	L3
CO2	Apply data pre-processing methods on the given data set.	Apply	L3
CO3	Implement classification and regression algorithms for given dataset.	Apply	L3

Mini - Project [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P22ISMP607**	**Credits:**	**02**
Teaching Hours/Week (L:T:P)	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**26**	**SEE Marks:**	**50**

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. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications)

CIE procedure for Mini-project:

(i) 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 Mini-project work shall be based on the evaluation of 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 batch mates.**

(ii) **Interdisciplinary**: CIE shall be group-wise at the college level with the participation of all the guides of the college through Dean (III). The CIE marks awarded for the Mini-project, shall be based on the evaluation of project 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 for Mini-project:

- **Single discipline**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department through Viva-Voce examination.
- **Interdisciplinary**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) through Viva-Voce examination conducted separately at the departments to which the student/s belongs to.

EMPLOYABILITY ENHANCEMENT SKILLS - VI

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – VI for CSE, ISE, ECE, EEE & CSE(AIML) Branches only

Course Code:	**P22HSMC608B**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving permutations and combinations, probability, ages and data interpretation.
- Explain concepts behind logical reasoning modules of syllogisms and data sufficiency.
- Prepare students for Job recruitment process and competitive exams.
- Develop problem solving skills through various programming language.

UNIT – I		**06 Hours**
Quantitative Aptitude: Permutation and Combination, Probability, Ages.		
Self-study component:	Inferred meaning	
UNIT – II		**06 Hours**
Quantitative Aptitude: Data Interpretation. **Logical Reasoning:** Syllogisms, Data Sufficiency.		
Self-study component:	Chain rule	
UNIT – III		**06 Hours**
Soft skills: Group Discussions, Resume Writing, LinkedIn Profiling, Interview Skills. **Interview Preparation:** Mock GDs, Resume Validation and Personal Interviews.		
Self-study component:	Interpersonal communication	
UNIT – IV	**COMPETITIVE CODING - I**	**06 Hours**

Arrays: Find a peak element which is not smaller than its neighbors, K^{th} Smallest largest element, Kadane's Algorithm, Missing number in array, Rearrange Array Alternately, Sort 0s, 1s and 2s, Trapping Rain Water, Chocolate Distribution Problem, Array Leaders, Minimum Number of Platforms Required for a Railway/Bus Station, Rotate a matrix by 90 degree without using any extra space, Find maximum element of each row in a matrix, Print matrix in snake pattern.

Strings: Reverse words in a given string, Converting Roman Numerals to Integer, Find the minimum distance between the given two words, Check whether two Strings are anagram of each other, Remove duplicates from a given string, Multiply Strings, Find largest word in dictionary, Longest Common Prefix, Reduce the string by removing K consecutive identical characters, Check if given

String is Pangram or not, Compare Version Numbers.		
Self-study component:	Logarithmic Complexity with Binary Search	
UNIT – V	**COMPETITIVE CODING - II**	**06 Hours**

Linked List: Print the Middle of a given linked list, Reverse a Linked List, Reverse a Doubly Linked List, Rotate a Linked List, Delete middle of linked list, Pairwise Swap Nodes of a given Linked List, Remove duplicates from a sorted linked list, Convert singly linked list into circular linked list, Merge two sorted linked lists, check if a singly linked list is palindrome, Insert a node in the 5^{th} position in a singly linked list.

Stacks and Queues: Parenthesis Checker, Reverse a String using Stack, Reverse an array using Stack, Delete Middle element from stack, Find Next Greater Element using Stack, The Stock Span Problem, Reverse First k Elements of Queue, insert one element at front using queue, Implement a Queue using an Array, Maximum number of diamonds that can be gained in K minutes, Sorting a Queue without extra space.

Database: Introduction to database, Types of SQL statements, MySQL commands.

Self-study component:	Schema change statements in SQL.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Solve the problems based on Permutation and combination, Probability, ages and data interpretation.	Applying	L3
CO2	Solve logical reasoning problems based on Syllogisms and Data Sufficiency.	Applying	L3
CO3	Apply suitable programming language and / or suitable data structures to solve the given problem.	Applying	L3

Text Book(s):

1. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests by Antti Laaksonen
2. Cracking the Coding Interview by Gayle Laakmann McDowell
3. Fundamentals of Database Systems – Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011.
4. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
5. How to sharpen your interview skills by Prem Vas

Reference Book(s):

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Data Base System Concepts – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-Graw Hill, 2006
3. An Introduction to Database Systems – C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.
4. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Problem Solving through Programming in C - https://archive.nptel.ac.in/courses/106/105/106105171/
2. https://onlinecourses.nptel.ac.in/noc22_cs91/
3. https://youtu.be/c5HAwKX-suM
4. https://onlinecourses.nptel.ac.in/noc18_cs15/preview
5. http://nptel.ac.in/courses/106106093/
6. http://nptel.ac.in/courses/106106095/

COURSE ARTICULATION MATRIX
(EMPLOYABILITY ENHANCEMENT SKILLS - VI – P22HSMC608B)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2	1									1

Universal Human Values and Professional Ethics
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – VI

Course Code:	**P22UHV609**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**1 : 0 : 0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**25 + 5**	**SEE Marks:**	**50**

Course objectives:
This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous selfevolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Module - 1

Introduction to Value Education **(3 hours)**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module - 2

Harmony in the Human Being : **(3 hours)**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module - 3

Harmony in the Family and Society : **(3 hours)**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module - 4

Harmony in the Nature/Existence : **(3 hours)**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module - 5

Implications of the Holistic Understanding – a Look at Professional Ethics : **(3 hours)**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course outcome (Course Skill Set)

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the

sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- CIE paper shall be set for 25 questions, each of the 02 marks. The pattern of the question paper is MCQ (multiple choice question). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

The sum of two tests, will be out of 100 marks and will be scaled down to 50 marks
Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

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

Suggested Learning Resources:

Books for READING:

Text Book and Teachers Manual

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
- The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

Value Education websites,

- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM