SYLLABUS

(With effect from 2023 -24)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2023-24)

Bachelor Degree

In

Information 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 INFORMATION SCIENCE AND ENGINEERING

About the Department

The Department of Information science and Engineering takes pride in producing quality engineers over the past 19 years. The credit for all the flowery results goes to the highly motivating staff, from whom all students draw inspiration. The Department was started in the year 2000. The present intake of the undergraduate program is 60. The department has well equipped classrooms, computer laboratories with high-end systems, department library. We are proud to produce the first PhD student in our college. Faculty members of the department are involved in research activities in different fields such as Medical Image Processing, Pattern Recognition, and Data Mining etc. The department is using Outcome-based education (OBE), which is a recurring education reform model, and it is affiliated to Visvesvaraya Technological University (VTU). The department has achieved good Placement, conducted International Conferences and other sponsored short-term courses, workshops, National seminars and symposia. The laboratory facilities and the Internet access are available to the staff and students of the Information Science and Engineering

Vision

"The department strives to equip our graduates with Knowledge and Skills to contribute significantly to Information Science & Engineering and enhance quality research for the benefit of society".

Mission

M1: To provide students with state of art facilities and tools of Information Science & Engineering to become productive, global citizens and life-long learners.

M2: To prepare students for careers in IT industry, Higher education and Research.

M3: To inculcate leadership qualities among students to make them competent Information Science & Engineering professionals or entrepreneurs.

1.2. State the Program Educational Objectives (PEOs)

Graduates of the program will be able to

PEO1: Establish a productive Information Science & Engineering career in industry, government or academia.

PEO2: Interact with their peers in other disciplines by exhibiting professionalism and team work to contribute to the economic growth of the country.

PEO3: Promote the development of solutions to the problems in Information Science using hardware and software integration.

PEO4: Pursue higher studies in Engineering, Management or Research.

A. List of Program Outcomes (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

PO12. 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.

B. List of Program Specific Outcomes (PSOs)

Information Science & Engineering Graduates will have

PSO1- The Knowledge to excel in IT profession by utilizing mathematical concepts, programming paradigms and software development practices for successful career.

PSO2- The ability to continuously learn and develop solutions in IT world by applying the emerging technologies in multidisciplinary environment

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	P21IS501	Software Engineering and Project Management	IS	3	-	-	-	3	50	50	100
2	P21IS502	Computer Networks	IS	3	-	-	-	3	50	50	100
3	P21IS503X	Professional Elective Course - I	IS	3	-	-	-	3	50	50	100
4	P21IS504	Machine Learning (Integrated)	IS	3	-	2	-	4	50	50	100
5	P21ISO505X	Open Elective – I	IS	3	-	-	-	3	50	50	100
6	P21ISL506	Computer Networks Laboratory	IS	-	-	2	-	1	50	50	100
7	P21INT507	Internship - II	IS	-	-	-	-	2	-	100	100
8	P21HSMC508	Employability Enhancement Skills – V	HSMC	1	-	-	-	1	50	50	100
9.	P21UHV509	Social Connect and Responsibility	IS	1	-	-	-	1	50	50	100
							Total	21			

Professional Elective Course – I (P21IS503X)	
Course Code	Course Title
P21IS5031	Advanced Java and J2EE
P21IS5032	Robotic Process Automation Design and Development
P21IS5033	Computer Graphics with Open GL
P21IS5034	Information Retrieval

Open Elective – I (P21ISO505X)	
Course Code	Course Title
P21ISO5051	Introduction to Java Programming
P21ISO5052	Web Technologies
P21ISO5053	Fundamentals of Data Structures and Algorithms
P21ISO5054	Fundamentals of DBMS

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	P21IS601	Software Testing	IS	3	-	-	-	3	50	50	100
2	P21IS602X	Professional Elective Course – II	IS	3	-	-	-	3	50	50	100
3	P21IS603X	Professional Elective Course - III	IS	3	-	-	-	3	50	50	100
4	P21IS604	Cryptography and Network Security (Integrated)	IS	3	-	2	-	4	50	50	100
5	P21ISO605X	Open Elective – II	IS	3	-	-	-	3	50	50	100
6	P21ISL606	Software Testing Laboratory	IS	-	-	2	-	1	50	50	100
7	P21ISMP607	Mini – Project	IS	-	-	2	2	2	50	50	100
8	P21HSMC608	Employability Enhancement Skills - VI	HSMC	1	-	-	-	1	50	50	100
9.	P21UHV609	Universal Human Values and Professional Ethics	IS	1	-	-	-	1	50	50	100
	Total							21			

Professional Elective Course – II (P21IS602X)	
Course Code	Course Title
P21IS6021	Advanced Computer Networks
P21IS6022	Object Oriented Modeling and Design
P21IS6023	Storage Area Network
P21IS6024	Augmented and Virtual Reality

Professional Elective Course – III (P21IS603X)	
Course Code	Course Title
P21IS6031	Cloud Computing
P21IS6032	Unix and Shell Programming
P21IS6033	Blockchain Technology
P21IS6034	Introduction to Dot Net Framework for Application Development

Open Elective – II (P21ISO605X)	
Course Code	Course Title
P21ISO6051	Robotic Process Automation
P21ISO6052	Information System Management
P21ISO6053	Software Engineering
P21ISO6054	Operating System

Software Engineering and Project Management [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P21IS501**	**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:

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

UNIT – I	**OVERVIEW**	**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 language

UNIT – III	**Design and Implementation**	**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	**Project and Configuration Management**	**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	**Earned Value Management(EVM)**	**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:	Health and Safety Case Studies

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 concepts of various software process models.	Remember	L1
CO2	**Illustrate** the importance of software design and development activities.	Understanding	L2
CO3	**Extract** the different Software project management methods.	Applying	L3
CO4	**Estimate** the actual budget of various project management techniques.	Applying	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.
3. Bob Hughes, Mike Cotterell, and Rajib Mall "Software Project Management", Fifth Edition,
   Tata McGraw Hill, 2012.

Reference Book(s):

1. Agile and Iterative Development by Craieg Larman 2003
2. **Software Engineering: A Practitioners Approach -** Roger S. Pressman, 7th Edition,
3. McGraw-Hill, 2007.
4. **Software Engineering Theory and Practice -** Shari Lawrence Pfleeger, Joanne M.
5. Atlee, 3rd Edition, Pearson Education, 2006.
6. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
7. Royce, "Software Project Management", Pearson Education,1999.
8. Jalote, "Software Project Management in Practice", Pearson Education,2002

Course Articulation Matrix (CAM)

Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1										2	
CO2	2	2	2										2	
CO3	2	2	2								1		2	
CO4	2	2	2								2		2	

Computer Networks [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21IS502**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Describe the fundamentals of data communications and various application layer protocols used by TCP/IP reference model.
- Illustrate error control and media access control protocols of data link layer
- Discuss different types of data transmission techniques.
- Analyze the various protocols, techniques in TCP/IP network architecture

UNIT – I	**8 Hours**

Introduction: TCP/IP protocol suite: Layered Architecture, Brief Description of layers, Description of each layer, OSI versus TCP/IP, lack of OSI Model's Success.

Physical Layer: Signals: Analog Signals, Digital Signals, Signal Impairment: Attenuation and Amplification, Distortion, Data Rate Limits and Performance, Digital to Digital Conversion, Analog to Digital Conversion, Digital to Analog Conversion, Analog to Analog conversion.

Self-study component:	Multiplexing

UNIT – II	**8 Hours**

Data Link Layer: Introduction, Nodes and links, Two types of links, two sub layers, Framing, Error control, High-Level Data-Link Control, Three types of Addresses, Address Resolution Protocol (ARP)

Self-study component:	DLC protocols

UNIT – III	**8 Hours**

Network Layer1: Packetizing, Routing, Error Control, Flow Control, Congestion Control, Quality of Services, Security. Datagram Approach: Connectionless service, Virtual-Circuit Approach: Connection Oriented Service. Performance: Delay, Throughput, packet loss.IPv4 Addressing.

Self-study component:	ICMPv4

UNIT – IV	**8 Hours**

Network Layer2: Distance-Vector routing Algorithm, Link State routing algorithm, path-vector routing, Routing Information Protocol, Border Gateway Protocol.

Self-study component:	Multicast Routing

UNIT – V	**8 Hours**

Transport Layer: process-to-process communication, Encapsulation and Decapsulation, Multiplexing and Demultiplexing, Flow Control, Error Control, Combination of Flow and Error Control, UDP services, UDP applications, TCP Services.

Application Layer: World Wide Web and HTTP, FTP

Self-study component:	Client/Server Paradigm

Course Outcomes: On completion of this course, students are able to:	
COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Understand the fundamental concepts of Networking
CO2	Illustrate various Data control and Delivery mechanism over network
CO3	Analyze the working of various routing protocols for Network performance

Text Book(s):

1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A.Forouzan, McGraw Hill, 6th Edition, 2021

Reference Book(s):

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach, 8th edition, Addison-Wesley, 2021.
2. Data and Computer Communication, William Stallings, 10th Edition, Pearson Education, 2017
3. Tanenbaum: Computer Networks, 4th Ed, Pearson Education/PHI, 2018.

Web and Video link(s):

1. https://nptel.ac.in/courses/106105183/
2. https://www.coursera.org/learn/network-protocols-architecture

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												2
CO2	3	1	2	2										2
CO3	3	2	2	2										2

Advanced Java and J2EE [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21IS5031**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Understand the fundamental concepts of Enumerations and Annotations
- Apply the concepts of Generic classes in Java programs
- Demonstrate the fundamental concepts of String operations
- Design and develop web applications using Java servlets and JSP
- Apply database interaction through Java database Connectivity

UNIT – I	8 Hours

Enumerations, Auto boxing and Annotations:
Enumerations, Ednumeration fundamentals, the values() and value of() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers, Autoboxing, Autoboxing methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of warning Annotations, Annotation basics, specifying retention policy, obtaining annotations at run time by use of reflection, Annotated element interface, Using default values, Marker Annotations.

Self-study component:	Single member annotations, Built in annotations

UNIT – II	8 Hours

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

Self-study component:	Erasure, Ambiguity errors, Some Generic Restrictions

UNIT – III	8 Hours

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using value of(), String Buffer, String Builder

Self-study component:	Changing the case of characters within a String

UNIT – IV	8 Hours

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

Self-study component:	Cookies, Session Objects

UNIT – V	8 Hours
The concept of JDBC; JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Exceptions.	
Self-study component:	Metadata, Data Types

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

COs	Course Outcomes with *Action verbs* for the Course topics
CO1	Understand and apply the fundamental concepts of Enumerations and Annotations
CO2	Apply the concepts of String operations and Generic classes in Java programs.
CO3	Create web based applications using Java servlets and JSP
CO4	Illustrate database interaction and transaction processing in Java

Text Book(s):

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

Reference Book(s):

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

Web and Video link(s):

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

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2											2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	

Robotic Process Automation Design and Development [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER -V			
Course Code:	**P21IS5032**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory 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? 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-by-step 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-by-step 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, Terminal plugin, SAP automation, Java plugin, Citrix automation, 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:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Demonstrate Robotic Process Automation & Record and Play feature of UiPath Studio.
CO2	Create different types of variables, control flow and data manipulation techniques.
CO3	Apply various control techniques, plugins and extensions in RPA.
CO4	Illustrate various types and strategies to handle events and exceptions.

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

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				2								1	
CO2	2				2								1	
CO3	2				2								1	
CO4	2				2								1	

Computer Graphics with Open GL [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21IS5033**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Understand the mathematical and theoretical principles of computer graphics.
- Implement algorithms for 2D graphics Primitives and attributes.
- Implement algorithms related to 2D and 3D Geometric transformations of an Object.
- Demonstrate transformations and viewing using different algorithms on 2D and 3D objects.

UNIT – I	**8 Hours**

Computer Graphics Hardware: Video Display Devices, Raster-Scan Systems, Computer Graphics Software: Coordinate Representations, Graphics Functions, Introduction to open GL

Graphics Output Primitives

Coordinate reference frames, Specifying two dimensional world coordinate reference frame in Open GL, Open GL point functions, Open GL line functions, Line drawing algorithms, Circle generation algorithms, Ellipse generation algorithms, Fill area primitives, Polygon fill areas, OpenGL polygon fill area functions, OpenGL Vertex Arrays, OpenGL Pixel-Array Functions, OpenGL Display Lists, OpenGL Display-Window Reshape Function.

Self-study component:	Software Standards, Character primitives

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 Anti-aliasing Functions, OpenGL Query Functions.
Implementation Algorithms for Graphics Primitives and Attributes: Line Drawing Algorithms, Circle Generating Algorithms.

Self-study component:	Parallel line algorithms

UNIT – III	**8 Hours**

Two – Dimensional and Three - Dimensional Geometric 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 Systems, OpenGL Functions for Two-Dimensional Geometric Transformations.

Three dimensional Translation, Rotation, Scaling, Composite three dimensional transformations.

Self-study component:	Raster Methods for Geometric Transformations, OpenGL Raster Transformations. Text clipping

UNIT – IV	8 Hours

Two Dimensional Viewing

The two dimensional viewing pipeline, Clipping window, Normalization and viewport transformations, Clipping algorithms,-Two dimensional point clipping, Two dimensional line clipping algorithms (Cohen-Sutherland and Liang Barsky), Polygon fill area clipping(Sutherland- Hodgeman Polygon Clipping)

Self-study component:	Text clipping, Curve clipping.

UNIT – V	8 Hours

Three Dimensional Viewing

The three dimensional viewing concepts, Three dimensional viewing pipeline, Three dimensional viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformations, Orthogonal projections, Oblique parallel projections, Perspective projections

Self-study component:	Normalized perspective projection transformation coordinates.

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Understand the basic concepts of Computer graphics interfaces and use OpenGL to draw simple objects.
CO2	Identify and implement algorithms for 2D graphics Primitives and attributes
CO3	Analyze line drawing, clipping algorithms and rasterization techniques.
CO4	Apply viewing and clipping techniques on different types of objects.

Text Book(s):

1. Text book: 1. Donald Hearn, M.Pauline Baker, Computer Graphics with Open GL, Pearson (Indian Edition), Fourth Edition.

Reference Book(s):

1. Edward Angel, 'Interactive Computer Graphics' – A top down approach using Open GL, Pearson, Fifth Edition
2. Peter Shirley, Steve Marschner, 'Computer Graphics, Cengage Learning (Indian edition), 2009.

Web and Video link(s):

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

E-Books/Resources:

1. **https://drive.google.com/drive/folders/1WJiTYewbVpfhe8G0IAw7YLR43djW8aIB?usp=drive_link**
2. **https://drive.google.com/file/d/1zMCWWFN9bxtl0mXjRw_o1v-dqjwcv282/view?usp=drive_link**

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1				1							1	1	
CO2	2	2	1									1	1	
CO3	2	2	2									1	1	
CO4	2	2	1									1	1	

Information Retrieval
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER -V

Course Code:	**P21IS5034**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Understand the retrieval of relevant information from a text database.
- Understand the Term Vocabulary and Postings Lists.
- Understand the Index Construction and the Index Compression.
- Understand the Vector Space Model.
- Understand the Evaluation in information retrieval

UNIT - I	**8 Hours**

Boolean retrieval: An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval. The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers.

Self-study component:	Positional postings and phrase queries

UNIT - II	**8 Hours**

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction. Index construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing.

Self-study component:	Other types of indexes

UNIT - III	**8 Hours**

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression. Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring.

Self-study component:	Variant tf-idf functions

UNIT - IV	**8 Hours**

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction (Boolean retrieval).

Self-study component:	Wildcard queries and Phrase queries

UNIT - V	**8 Hours**

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, A broader perspective: System quality and user utility.

Self-study component:	Results snippets

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Demonstrate the retrieval of relevant information from a text database.
CO2	Apply different data/file structures in building computational search engines.
CO3	Illustrate index construction and index compression techniques.
CO4	Demonstrate computing scores in a complete search system.
CO5	Illustrate information retrieval system evaluation.

Text Book(s):

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "An Introduction to Information Retrieval", 1st Edition, Cambridge University Press, 2008.

Reference Book(s):

1. G.G. Chowdhury, "Introduction to Modern Information Retrieval", 3rd Edition, neal-schuman publishers, 2010.
2. Gerald J.Kowalski, Mark T.Maybury, "Information storage and Retrieval systems: theory and implementation", 2nd Edition, kluwer academic publishers, 2009.

Web and Video link(s):

1. **https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf**

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	
CO2	2												1	
CO3	2												1	
CO4	2												1	

Machine Learning [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21IS504**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

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

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

UNIT – I	**8 Hours**

Introduction to Machine Learning, Preparing to Model: Introduction to Machine learning - Human learning, machine learning, types, problems not to be solved using machine learning, Application, Issues Machine learning activities, , Exploring structure of data, Data quality and Remediation, Data Pre-processing.

Self-study component:	Basic type of data in Machine learning
Practical Topics: **(6 Hours)**	1. Demonstrate the following data preprocessing tasks using python libraries. a) Loading the dataset b) Identifying the dependent and independent variables c) Dealing with missing data 2. Demonstrate the following data preprocessing tasks using python library a) Dealing with categorical data b) Scaling the features c) Splitting dataset into Training and Testing Sets

UNIT – II	**8 Hours**

Modeling and Evaluation / Feature Engineering–. Selecting the Model, Training the Model, Model Representation and Interpretability, Evaluating performance of a model, Introduction to Feature Engineering, Feature Transformation.

Self-study component:	Feature Subset Selection
Practical Topics: **(6Hours)**	1. Write Python code to select features in machine learning using Python. 2. Write Python code to load the data from a CSV file and select the top 10 features using the chi-squared test. The selected features are to be printed on the console.

UNIT – III	**8 Hours**

Supervised learning Bayesian Concept – Bayes theorem and concept learning - Brute force Bayesian algorithm, Naïve Base Classifier Classification: Classification Model, Classification learning steps, Classification Algorithms-k-nearest Neighbor (KNN), Decision Tree, Random Forest Model.

Self-study component:	Support Vector Machines
Practical Topics: **(4 Hours)**	1. Build a classification model using Decision Tree algorithm on iris dataset. 2. Apply Naïve Bayes Classification algorithm on any dataset. 3. Apply KNN Classification algorithm on any dataset.

UNIT – IV	8 Hours
Regression: Introduction, Examples of Regression, Regression Algorithms- Simple Linear Algorithms, Multiple Linear Regression, Assumption in Regression Analysis, Main Problems in Regression Analysis, Logistic Regression Other types of learning Overview –Representation Learning, Active Learning, Ensemble Learning Algorithm ,	
Self-study component:	Regularization Learning algorithm
Practical Topics: **(4 Hours)**	1.Build a model using linear regression algorithm on any dataset. 2.Build a model using multi linear regression algorithm on any dataset.
UNIT – V	**8 Hours**
Unsupervised learning : Introduction, Unsupervised/s supervised learning, applications of Unsupervised Learning, Clustering- Clustering as a machine learning task, different types of clustering techniques, Partitioning methods, Hierarchical clustering.	
Self-study component:	Density based Methods – DBSCAN
Practical Topics: **(4 Hours)**	1. Apply Hierarchical Clustering algorithm on any dataset. 2. Apply DBSCAN clustering algorithm on any dataset.

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Understand the need of data and pre-processing, machine learning techniques for various Application
CO2	Identify and apply the appropriate techniques to process the data and solve the applications using machine learning techniques
CO3	Apply the concepts of machine learning techniques to a given problem or dataset.
CO4	Evaluate the different data processing and machine learning techniques for various application

Text Book(s):

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 4 th Impression, 2019, Pearson Publications

Reference Book(s):

1. Machine Learning, Tom M Mitchel, McGraw Hill publications, ISBN-0070428077
2. Introduction to Machine Learning with Python: A Guide for Data Scientists. Andreas C. Müller, Sarah Guido, 1st Edition, O'Reilly
3. Introduction to Machine Learning, Ethem Alpaydın, 2 nd Edition, The MIT Press

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1										2	
CO2	2	1	1										2	
CO3	2	1	1										2	
CO4	2	2	2										2	

Introduction to Java Programming

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

SEMESTER - V

Course Code:	**P21ISO5051**	**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:

- Understand fundamental features of object oriented language and JAVA
- Analyze the Java Code & Run simple Java programs by using IDE
- Implement method Overloading concepts using
- Implement packages and exception handling mechanism.

UNIT – I	**8 Hours**

An Overview of Java:

Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays,

Self-study component:	A Few Words About Strings

UNIT – II	**8 Hours**

Operators:

Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements.

Self-study component:	**Jump Statements**

UNIT – III	**8 Hours**

Introducing Classes:

Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion,

Self-study component:	**Dynamic Method Dispatch,**

UNIT – IV	**8 Hours**

Introducing Access Control, Understanding static, Introducing final, Arrays, Revisited, and Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Using Abstract Classes, Using final with Inheritance, The Object Class.

Self-study component:	Chained Exceptions, Using Exceptions.

UNIT – V	8 Hours
Packages **and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Enumerations, Type Wrappers, I/O, Applets.	
Self-study component:	Additional String Methods, String Buffer, String Builder.
Text Books	1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
Reference Book	1. Programming with Java A Primer E. Bala Guru Swamy 5th Edition McGraw Hill Education 2014. 2. The Complete Reference - Java , Herbert Schildt , 11th Edition, 2019, McGraw Hill Education

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				1								1	
CO2		1	1		2									
CO3			1										2	
CO4		1	1										2	

Web Technologies [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21ISO5052**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives:

This course will enable the students to:

1. Learn the principles of creating an effective web page.
2. Develop the ability to logically plan and create web pages.

UNIT – I	**8 Hours**

Fundamentals: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol.

Introduction to HTML/XHTML: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard HTML Document Structure, Basic Text Markup.

Self-study component:	Security and The Web Programmer's Toolbox.

UNIT – II	**8 Hours**

HTML/XHTML: Images, Hypertext Links, Lists, Tables, Forms.

Self-study component:	Frames

UNIT – III	**8 Hours**

Cascading Style Sheets: Introduction, Levels of Style Sheets, Style specification format, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Back ground Images**.**

Self-study component:	The and Tags, Conflict Resolution

UNIT – IV	**8 Hours**

The Basics 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.

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, Elements Access in JavaScript, Events and Event Handling, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements.

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility

Self-study component:	Changing Colors and Fonts
Course Outcomes: On completion of this course, students are able to:	
CO1	Understand the basic concepts used to develop web pages.
CO2	Create web pages using XHTML and CSS.
CO3	Develop web pages using Java script(Client side programming).

Text Book(s):

1. Robert W. Sebesta: Programming the World Wide Web, Seventh Edition, Pearson Education, 2014.

Reference Book(s):

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5th Edition, 2011.
2. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2											2	
CO2	3	2	2										2	
CO3	3	2	1										2	

Fundamentals of Data Structures and Algorithms

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

SEMESTER – V

Course Code:	**P21ISO5053**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- To become familiar with the concept of pointers and its usage in data structure.
- To study and understand the representation and implementation of linear & non-linear data structures.
- To identify the appropriate data structure while solving real-time applications.

UNIT – I	**8 Hours**

Introduction to data Structures- Definition, Classification of Data Structures. **Stacks:** Representing stack in C- Implementation of Push, Pop and display operations using arrays and pointers. Example of Stacks: Infix, Postfix, Prefix, Infix to postfix, evaluation of postfix expression.

Self-study component:	Prefix to postfix.

UNIT – II	**8 Hours**

Recursion: Definition, Writing Recursive Programs-Factorial Numbers, Fibonacci Numbers and Tower of Hanoi Problem. **Queues:** Definition, Representation, operations, implementation using arrays. Different types of queues, Basic operations on - Linear queue, Circular queue.

Self-study component:	Priority Queue and Double ended Queue.

UNIT – III	**8 Hours**

Linked Lists: Static Memory Allocation and Dynamic Memory Allocation, Basic operations on SLL, DLL, Circular SLL and Circular DLL: insertion, deletion and display.

Self-study component:	Linked list with header nodes.

UNIT – IV	**8 Hours**

Applications of Linked Lists: Merging, Reversing, Searching, Addition of two polynomials using SLL, evaluation of polynomial.

Self-study component:	Addition of two long integers.

UNIT – V	8 Hours

Trees: Introduction-Definition, Tree Representation, Properties of Trees, Binary Search Tree [BST] - Definition, searching BST, Insertion to BST, Display BST; Tree and their Applications- Tree Traversal, General Expression as a tree, evaluating an Expression Tree.

Self-study component:	Deletion from BST.

Course Outcomes: On completion of this course, students are able to:	
COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Apply** the concepts of data structures to solve some problems.
CO2	**Analyze** and represent various data structures and its operations.
CO3	**Design** algorithms using different data structures like List, Stack, Queue and Trees.
CO4	**Develop** programs with suitable data structure based on the requirements of the real-time applications.

Text Book(s):

1. "Data Structures using C and C++ ", Yedidyah Langsam and Moshe J. Augenstein andAaron M.Tenanbaum , 2nd Edition , PHI.
2. "Data Structures – A pseudo code Approach with C ", Richard F Gilberg and Behrouz Aforouzan, 2nd Edition .

Reference Book(s):

1. "Fundamentals of Data Structures in C ", Horowitz, Sahani, Anderson-Freed , SecondEdition, University Press .

Web and Video link(s):

1. Data Structures and algorithms offered by NPTEL: https://nptel.ac.in/courses/106102064/

E-Books/Resources:

1. **https://www.academia.edu/28758384/**

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	
CO2	2	3											2	
CO3	2	3	3										1	1
CO4	1	1	2									1	1	1

Fundamentals of Database Management System

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

SEMESTER –V

Course Code:	**P21ISO5054**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

1. To learn the basic knowledge of Database Management System and various types of data Models.
2. To learn the concept and syntax of ER Diagram, relational data model and relational algebra.
3. To learn and write various SQL queries.
4. To learn the concept of Normalization.
5. To learn the various issues in Transaction processing.

UNIT – I	**8 Hours**

Introduction to Databases: Introduction, Characteristics of the database approach, Advantages of using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence.

Introduction to ER model: Entity Types, Entity Sets, attributes and keys, Relation Types, Relationship Sets, roles, and structural constraints, Weak Entity Types, ER Diagrams.

Self-study component:	Actors on the scene, Workers behind the scene, Database Languages and Interfaces, Relationship Types of Degree Higher Than Two.

UNIT – II	**8 Hours**

Relational Model: Relational Model Concepts, Relational Model Constraints, update operations dealing with constraint violations, Relational Database Design using ER-to-Relational mapping.

Relational Algebra: Unary and Binary relational operations, Examples of simple queries in relational algebra.

Self-study component:	Additional relational operations.

UNIT – III	**8 Hours**

Creation of table in SQL: SQL Data Definition and Data types. **SQL:** Specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL.

Self-study component:	More Complex SQL Retrieval Queries.

UNIT – IV	**8 Hours**

Basics of Functional Dependencies and Normalization for Relational Databases: Informal design guidelines for relation schema, Functional Dependencies: Inference rules, Normal Forms based on Primary Keys: First, Second and Third Normal Forms.

Self-study component:	Boyce–Codd Normal Form.

UNIT – V	**8 Hours**

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions.

Self-study component:	characterizing schedules based on Serializability: Serial, Non-serial and conflict-serializable
NOTE	

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Apply** the database concepts to create the relations by specifying various constraints.
CO2	**Desi**gn ER diagrams for given scenario.
CO3	**Apply** suitable normalization technique to improve database design.
CO4	**Conduct** experiments on given database using modern tools: Draw io,MySQL.

Text Book(s):

1. Fundamentals of Database Systems – Elmasri and Navathe, 6th Edition, Addison-Wesle 2011.

Reference Book(s):

1. Data Base System Concepts – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-Graw Hill, 2006 .
2. An Introduction to Database Systems – C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_cs91/
2. https://youtu.be/c5HAwKX-suM

E-Books/Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs15/preview
2. http://nptel.ac.in/courses/106106093/
3. http://nptel.ac.in/courses/106106095/

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	2
CO2	2	2	3									1	2	2
CO3	3	1	2										2	2
CO4	2	2	2	1	3				1			1	2	2

Computer Networks Laboratory [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – V**			
Course Code:	**P21ISL506**	**Credits:**	**1**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Laboratory Hours:	**24**	**SEE Marks:**	**50**

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

1. Analyze the performance of various network topologies
2. Design and demonstrate various data flow control and routing algorithms
3. Explore the concept of error detection and routing mechanism
4. Explore various Networking tools

Instructions: Students has to attend one Question from each part in SEE

COURSE CONTENT

PART-A

1. Create a Scenario of Star, Ring and Bus topologies through simulation.
2. Simulate a stop and wait protocol and sliding window protocol
3. Create a Scenario to study the high-level data link control protocol (HDLC) through simulation
4. Simulate go back n protocol
5. Simulate Selective Repeat protocol

PART-B

1. Write a C program for error detection using CRC-CCITT (16-bits).
2. Write a C program to generate Hamming Code for error detection and correction.
3. Write a C program to implement Distance vector Routing algorithm
4. Write a C program to implement Open Shortest Path First Routing Algorithm
5. Write a C Program to implement Border Gateway Protocol (BGP)

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Illustrate networking concepts using C programming language
CO2	Demonstrate networking concepts using NS2 simulator

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	2
CO2	3	2	2	2	2								2	2

Internship - II [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21INT507**	**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

Social Connect and Responsibility [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – V			
Course Code:	**P21UHV509**	**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 the local community and the society at large.	-	-	-	-	-	2	2	3	3	3	-	3	-	-	-
5	**Develop** among themselves a sense of social & 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

Employability Enhancement Skills (EES) - V
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – V

Course Code:	**P21HSMC508**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable students to:

- Apply programming constructs of C language to solve the real-world problem.
- Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems.
- Design and Develop solutions to problems using functions.

UNIT – I	**10 Hours**

Problem solving through C -

Flow Control: If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs.
Functions: Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs
Arrays: Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.

Self-Study: Variables and constants

UNIT – II	**10 Hours**

Problem solving through C -

Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples.
Strings: String Functions, String Examples, Programs.
Self-Study: Evaluation of Expression.

UNIT – III	**08 Hours**

Problem solving through C -

Structure and Union: Structure, Struct & Pointers, Struct & Function, Unions, Programs.
Programming Files: Files Input/output

Self-Study: Error handling during I/O operations.

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

CO – 1:	Apply suitable programming constructs of C language to solve the given problem.
CO – 2:	Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting.
CO – 3:	Design and Develop solutions to problems using functions.

Text Book(s):

1. The C Programming Language (2nd edition) by Brian Kernighan and Dennis Ritchie.
2. C in Depth by S K Srivastava and Deepali Srivastava.
3. Computer fundamentals and programming in c, "Reema Thareja", Oxford University, Second edition, 2017.

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.

Web and Video link(s):

1. Problem Solving through Programming in C - https://archive.nptel.ac.in/courses/106/105/106105171/

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - V**]**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2	2	-	-	-	-	-	-	-	-	-
CO-2	2	2	2	-	-	-	-	-	-	-	-	-
CO-3	2	2	1	-	-	-	-	-	-	-	-	-

Software Testing

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

SEMESTER – VI

Course Code:	**P21IS601**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Understand the basics of Software Testing
- Recognize various types of Software Testing Techniques
- Analyze various levels of software testing
- Explore software test automation process

UNIT – I	**8 Hours**

Basics of software testing - Basic Definitions, Test Cases, Insights from a Venn Diagram, Identifying Test Cases, Fault Taxonomies, Levels of Testing; Examples: Generalized Pseudo code, The Triangle Problem, The Next Date Function, The Commission Problem

Self-study component:	The SATM System

UNIT – II	**8 Hours**

Boundary value testing, Equivalence class testing, Decision table based testing-Normal, Robust and Worst-case Boundary value testing, special value testing, Examples, Random testing, Traditional and Improved Equivalence class testing, Equivalence class test cases for triangle problem, NextDate function and commission problem, Decision tables, Decision Table Techniques.

Self-study component:	Decision Table Test cases for triangle problem

UNIT – III	**8 Hours**

Path Testing, Data flow testing, Life Cycle–Based Testing-Program Graphs, DD Paths, Test coverage metrics, Basis path testing, Define/Use Testing, Slice-Based Testing, Program Slicing Tools, Traditional Waterfall Testing, Testing in Iterative Life Cycles

Self-study component:	Agile Testing, Agile Model–Driven Development

UNIT – IV	**8 Hours**

Integration Testing, System testing-Decomposition-Based Integration, Path-Based Integration Example: integration Next Date; Threads, Basis Concepts for Requirements Specification, Model-Based Threads, Use Case–Based Threads, Coverage Metrics for System Testing, Non-functional System Testing

Self-study component:	Atomic System Function Testing Example

UNIT – V	**8 Hours**

Test Management and Automation-Preparing a Test Plan, Scope Management, Deciding Test Approach, Setting up Criteria for testing; Test Automation and terms used, Skills needed for Automation, Scope of Automation, Process Model for Automation, Selecting a Test tool

Introduction to Selenium- Overview and working with Selenium IDE, Selenium Web Driver

Self-study component:	Challenges in Automation

COs	Course Outcomes with *Action verbs* for the Course topics
CO1	**Demonstrate** the fundamentals of software testing using real world examples
CO2	**Identify** and apply relevant testing techniques suitable for a real world scenario
CO3	**Apply** the different levels in testing
CO4	**Implement** Test Automation process and experiment with testing tools

Text Book(s):

1 Paul C. Jorgensen, "Software Testing, A Craftsman's Approach", Auerbach Publications, 3rd Edition, First Indian Reprint, 2014, ISBN-13:9781466560680

2 Srinivasan Desikan Gopalaswamy, "Software Testing Principles and Practices", Pearson Education, 5th Edition, 2008 , ISBN: 9788177581218

Reference Book(s):

1. Unmesh Gunecha, "Learning Selenium Testing Tools with Python", PACKT Publishing, 2014,ISBN: ISBN 9781783983506

Web and Video link(s):

1. https://artoftesting.com/selenium-tutorial
2. https://katalon.com/resources-center/blog/software-testing
3. https://www.tutorialspoint.com/software_testing/index.htm

E-Books/Resources:

1. https://books.google.mn/books?id=Yt2yRW6du9wC&printsec=copyright&source=gbs_pub_info_r#v=onepage&q&f=false
2. https://www.tutorialspoint.com/selenium/selenium_pdf_version.htm

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1	1									2	
CO2	2	2	2	1									2	
CO3	2	2	2	1									2	
CO4	2	2	2	2	2								2	

Advanced Computer Networks

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

SEMESTER – VI

Course Code:	**P21IS6021**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

1. Describe a variety of network concepts and protocols.
2. Analyze the interoperability of networking protocols
3. Analyze network traffic, congestion and Congestion controlling mechanism

UNIT – I	**8 Hours**

Foundation: Applications, Classes of Applications, Requirements, Scalable Connectivity, Cost-Effective Resource Sharing, Architecture, Layering and Protocols, Encapsulation, Multiplexing and Demultiplexing, Internet Architecture, Performance, Bandwidth and Latency, Delay × Bandwidth Product, High-Speed Networks, Application Performance Needs, Direct Links: Technology Landscape, Encoding, Reliable Transmission.

Self-study component:	Framing, Error Detection

UNIT – II	**8 Hours**

Internetworking: Switching Basics, Datagrams, Virtual circuit switching, Asynchronous Transfer Mode (ATM), Source Routing, Switched Ethernet, Learning Bridges, Spanning Tree Algorithm, Virtual LANs (VLANs),Internet (IP), What Is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, Sub netting and Classless Addressing, Classless Addressing, IP Forwarding Revisited, Address Translation (ARP), Host Configuration (DHCP).

Self-study component:	Network as a Graph

UNIT – III	**8 Hours**

Advanced Internetworking: Global Internet, Routing Areas, Interdomain Routing (BGP), Challenges in Interdomain Routing, IP Version 6, Addresses and Routing, Address Space Allocation, Address Notation, Global Unicast Addresses, Packet Format, Advanced Capabilities, Multicast, Multicast Addresses, Multicast Routing (DVMRP, PIM, MSDP), Multiprotocol Label Switching, Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels.

Self-study component:	Routing Among Mobile Devices

UNIT – IV	**8 Hours**

End-to-End Protocols: Simple Demultiplexor (UDP), Reliable Byte Stream (TCP), End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Remote Procedure Call, RPC Fundamentals, RPC Implementations (SunRPC, DCE, gRPC)

Self-study component:	Transport for Real-Time (RTP)

UNIT – V	**8 Hours**

Congestion Control: Issues in Resource Allocation, Network Model, Queuing Disciplines, TCP Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery, Advanced Congestion Control, Active Queue Management (DECbit, RED, ECN), Source-Based Approaches (Vegas, BBR, DCTCP)

Self-study component:	Quality of Service
Course Outcomes: On completion of this course, students are able to:	
COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Understand fundamental concepts in network and IP addressing
CO2	Analyze the working of various routing protocols for network performance
CO3	Apply the algorithms/techniques of congestion control to solve problems related to computer Networks

Text Book(s):

1. Larry Peterson and Bruce S Davis "Computer Networks: A System Approach" 6th Edition, Elsevier.2019

Reference Book(s):

1. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI
2. Uyless Black, "Computer Networks, Protocols, standards and Interface" 2nd Edition-PHI
3. Behrouz A Forouzan, "TCP/IP Protocol Suite" 4th Edition-Tata McGraw-Hill

Web and Video link(s):

1. https://www.youtube.com/watch?v=K5SvnM3goxg&list=PLRvnry7Sqkdjys3j-hUn1-D6jTr6fctVH
2. https://www.youtube.com/watch?v=YdkksvhkQGQ

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2									2	1
CO2	3	2	2	2									2	2
CO3	3	3	2	2									2	2

Object Oriented Modeling and Design [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21IS6022**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

1. Analyze and identify the modelling design techniques.
2. Understanding of Class Models, State and Interaction Models with diagrams with advanced notations.
3. Acquire the knowledge and understanding of the process of System Conception, Domain and Application Analysis.
4. Improve the creativity in developing a overall Class Design and fine tuning of classes and relationships.

UNIT – I	**8 Hours**

INTRODUCTION: Object Orientation, OO development, OO themes; Evidence for usefulness of OO development; OO modeling history. **INTRODUCING THE UML:** An Overview of the UML, A Conceptual Model of the UML, Architecture, and Software Development Life Cycle. **MODEL:** The Importance of Modeling, Principles of Modeling, Object-Oriented Modeling. **MODELING CONCEPTS:** Modeling as Design Technique; Modeling; abstraction; The three models. **DIAGRAMS:** Terms and Concepts, Common Modeling Techniques- Modeling different views of a system, modeling different levels of abstraction, Modeling complex views.

Self-study component:	**MODEL:** The Importance of Modeling, Principles of Modeling, Object-Oriented Modeling.

UNIT – II	**8 Hours**

CLASS MODELING: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. **ADVANCED CLASS MODELING:** Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages.

Self-study component:	Constraints; Derived data; Packages.

UNIT – III	**8 Hours**

STATE MODELING: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. **ADVANCED STATE MODELING:** Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models. **INTERACTION MODELING:** Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models

Self-study component:	A sample state model; Relation of class and state models

UNIT – IV	**8 Hours**

PROCESS OVERVIEW: Development stages; Development life cycle. **SYSTEM CONCEPTION:** Devising a system concept; Elaborating a concept; Preparing a problem statement. **DOMAIN ANALYSIS**: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. **APPLICATION ANALYSIS**: Application interaction model; Application class model; Application state model; Adding operations

Self-study component:	Application state model; Adding operations

UNIT – V	**8 Hours**
CLASS DESIGN: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. **IMPLEMENTATION MODELING:** Overview of Implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.	

Self-study component:	Realizing associations; Testing

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Realize** the concepts of Object-Oriented Analysis and Design, UML Architecture, Notations and Diagrams and also demonstrate an understanding of modeling as a design technique
CO2	**Construct** advanced Class, State and Interaction models and know their importance in realistic situations
CO3	**Apply** the process of System Conception for any given problem and understand the process of Domain and Application analysis with respect to its Class, State and Interaction model
CO4	**Create** a Class model and enhance its design and associated relationships

Text Book(s):

1. **Object-Oriented Modeling and Design with UML** – Michael Blaha, James Rumbaugh, 2nd Edition, Pearson , 2012 First Impression.
   (**Chapters 1,2,3,4,5,6,7,10,11,12,13,15,17&23**).

Reference Book(s):

Object-Oriented Analysis and Design with Applications – Grady Booch et al, 3rd Edition, Pearson Education, 2007

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2											2	
CO2	2	2	2										2	
CO3	2	2	2										2	
CO4	2	2	2										2	

Storage Area Network

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

SEMESTER – VI

Course Code:	**P21IS6023**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Define a storage system and data center environment, review the evolution of storage technology, and introduce intelligent storage systems.
- Understand about storage area networks like FC-SAN, IPSAN, FCoE.
- Exploration on information availability and business continuity solutions in both virtualized and non-virtualized environments
- Understand on the business drivers, definition, essential characteristics, and phases of journey to the Cloud.
- Discussion on framework and domains of storage security along with covering security. implementation at storage networking

UNIT – I	**8 Hours**

Storage System Introduction to evolution of storage architecture, key data center elements, virtualization, and cloud computing. Key data center elements – Host (or compute), connectivity, storage. RAID implementations, techniques, and levels along with the impact of RAID on application performance. Components of intelligent storage systems and virtual storage provisioning.

Self-study component:	Disk Drive Components, RAID Impact on Disk Performance.

UNIT – II	**8 Hours**

Storage Networking Technologies and Virtualization Fibre Channel SAN components, connectivity options, and topologies including access protection mechanism 'zoning", FC protocol stack, addressing and operations, SAN-based virtualization and VSAN technology, iSCSI and FCIP protocols for storage access over IP network, Converged protocol FCoE and its components.

Self-study component:	Fibre Channel Architecture, Fabric Services.

UNIT – III	**8 Hours**

Backup, Archive, and Replication Information, Business continuity terminologies, planning and solutions, Failure Analysis. Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup.

Self-study component:	Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.

UNIT – IV	**8 Hours**

Local Replication and Remote Replication Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Modes of Remote Replication, Remote Replication Technologies, Three-Site Replication, Data Migration Solutions, Remote Replication and Migration in a Virtualized Environment. **Cloud Computing** Cloud Enabling Technologies, Characteristics of

Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure.	
Self-study component:	Restore and Restart Considerations, Local Replication in a Virtualized Environment, Cloud Challenges.
UNIT – V	**8 Hours**
Securing and Managing Storage Infrastructure Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution.	
Self-study component:	Concepts in Practice: RSA and VMware Security Products, Information Lifecycle Management, Storage Tiering.
NOTE	

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Identify** key challenges in managing information and analyze different storage networking technologies and virtualization
CO2	**Describe** components and the implementation of Storage areas.
CO3	**Analyze** types of archives and forms of virtualization.
CO4	**Illustrate** the storage infrastructure and management activities.

Text Book(s):

1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839

Reference Book(s):

1. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

Web and Video link(s):

1. **https://nptel.ac.in/courses/106108058**

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1										2	2
CO2	1	1	1										1	2
CO3	1	1	1										1	2
CO4	2	1	1										2	2

Augmented and Virtual Reality [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER –VI**			
Course Code:	**P21IS6024**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

1. Understand the system of human vision and its implication on perception and rendering
2. Explain the concepts of motion and tracking in VR systems
3. Analyse and understand the working of various state of the art AR devices
4. To study about Virtual Hardware and Software

UNIT – I	**8 Hours**
INTRODUCTION: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Input Devices: Trackers, Navigation, and Gesture Interfaces, Three-Dimensional Position Trackers, Tracker Performance Parameters, Mechanical Trackers, Magnetic Trackers, Ultrasonic Trackers, Optical Trackers, Hybrid Inertial Trackers.	
Self-study component:	Navigation and Manipulation Interfaces Tracker-Based Navigation/Manipulation Interfaces, Trackballs
UNIT – II	**8 Hours**
OUTPUT DEVICES: Graphics, Three-Dimensional Sound, and Haptic Displays: Graphics Displays, The Human Visual System, Personal Graphics Displays, Large-Volume Displays, Sound Displays, The Human Auditory System, The Convolvotron, Speaker-Based Three-Dimensional Sound.	
Self-study component:	Tactile Feedback Interfaces, Force Feedback Interfaces
UNIT – III	**8 Hours**
COMPUTING ARCHITECTURES FOR VR: The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures	
Self-study component:	MODELING
UNIT – IV	**8 Hours**
What Is Augmented Reality?, where did Augmented Reality come from?, Why Digital Enhancement of the Real World Rather Than Physical Enhancement?, The Physical World Is Augmented by Digital Information That Is Superimposed on a View of the Physical World, The Physical World Is Augmented by Digital Information That Is Superimposed on a View of the Physical World, The Relationship Between Augmented Reality and Other technologies.	
Self-study component:	Communication augmented reality applications
UNIT – V	**8 Hours**
MAJOR HARDWARE COMPONENTS FOR AUGMENTED REALITY SYSTEMS, Sensors, Roles of Sensors, Tracking, Optical Tracking, Acoustical Tracking, Electromagnetic Tracking, Mechanical Tracking Depth Sensors for Tracking, Processors, Roles of Processors, Handheld, Laptop or Desktop Computer with Server, Application Run as a Web Application, Displays, Visual Displays, Stationary Visual Displays, Visual Displays That Move with the Participant's Head.	

Self-study component:	Computer vision system
Course Outcomes: On completion of this course, students are able to:	
COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Interpret the concepts and principles of virtual reality and its application
CO2	Illustrate the contextual knowledge of Generic VR system and Computing Architectures for VR/AR applications.
CO3	Analyze the various hardware requirements of AR.

Text Book(s):

1. Virtual Reality Technology, Gregory C. Burdea& Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc., ISBN: 978-0-471-36089-6
2. Alan B. Craig, "Understanding Augmented Reality", Concepts and Applications, Morgan Kaufmann,1st Edition, 2013 ISBN: 9780240824086

Reference Book(s):

1. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005.ISBN 1-56881-230-2
2. Computer Graphics, second Edition in C, James. D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Kindle edition.

Web and Video link(s):

1. https://www.coursera.org/learn/ar
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	2											2	
CO3	3	2	2	2	1								2	

Cloud Computing [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER - VI			
Course Code:	**P21IS6031**	**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:

- Understand Cloud Computing Fundamentals & Virtualization.
- Identify the Cloud Types and Services, Technologies and Applications.
- Analyze the Data-Intensive Technologies for Cloud Computing.
- Explore and Scheduling Service Oriented Workflows Inside Clouds & Data Security in the Cloud

UNIT – I	**8 Hours**

Cloud Computing Fundamentals: Introduction, Types of Cloud Computing, Cloud Computing Versus Cloud Services Enabling Technologies, Virtualization, Web Service and Service Oriented Architecture, Web 2.0 and Mashup, Cloud Computing Features, Cloud Computing Standards, Cloud Computing Security, Cloud Computing Platforms, Example of Web Application Deployment, Cloud Computing Challenges.

Self-study component:	Cloud Computing in the Future

UNIT – II	**8 Hours**

Cloud Types and Services: Cloud Types, Cloud Services and Cloud Roles, Platform as a Service, Software as a Service,

Cloud Computing Technologies and Applications: Cloud Computing: IT as a Service, Cloud Computing Security, Cloud Computing Model Application Methodology, Cloud Computing Tactics Planning Phase, Cloud Computing Deployment Phase, Cloud Computing in Development/Test, Cloud-Based High Performance Computing Clusters.

Self-study component:	Use Cases of Cloud Computing

UNIT – III	**8 Hours**

Data-Intensive Technologies for Cloud Computing: Data-Intensive Computing Applications, Data-Parallelism, Characteristics of Data-Intensive Computing Systems, Data-Intensive System Architectures, Hadoop vs. HPCC Comparison.

Self-study component:	Architecture Comparison

UNIT – IV	**8 Hours**

Scheduling Service Oriented Workflows Inside Clouds Using an Adaptive Agent Based Approach: Related Work on DS Scheduling, Scheduling Issues Inside Service Oriented Environments, Workflow Scheduling, Distributed Agent Based Scheduling Platform Inside Clouds.

Self-study component:	Prototype Implementation Details

UNIT – V	8 Hours
Data Security in the Cloud: The Current State of Data Security in the Cloud, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security—Pros and Cons Legal Issues in Cloud Computing: Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location	
Self-study component:	Commercial and Business Considerations—A Cloud
Text Books	1) Handbook of Cloud Computing, Borko Furht, Armando Escalante, Editors, Springer Science+Business Media, LLC. 2) Computing Principles and Paradigms, Rajkumar Buyya , James Broberg, Andrzej Goscinsk,i Willey, 2014.
Reference Book	1) Cloud Computing For Dummies ®, Published by Wiley Publishing, Inc. 111 River Street Hoboken, NJ 07030-5774 www.wiley.com Copyright © 2010 by Wiley Publishing, Inc., Indianapolis, Indiana

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				1	1							1	
CO2	2	1	1								1		2	
CO3		1	1										1	
CO4						2	1				1	1	2	

Unix and Shell Programming [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21IS6032**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- To teach principles of UNIX operating system including File handling utilities, Process utilities, Disk utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of the Bourne again shell (bash), shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.

UNIT – I	**8 Hours**

Introduction to the Unix Operating System: The operating system, The UNIX operating system, knowing your machine, System Administrator, logging in and out, POSIX and the Single UNIX specification, The Linux and GNU, The UNIX Architecture, Features of UNIX. **Becoming Familiar with UNIX Commands:** Command basics, command structure, flexibility of command usage, man, the man documentation, echo, printf, script, using Email with mails, password, username, who, date, stty, the X window system.

Self-study component:	A Hands-On Session, How It All Clicked

UNIT – II	**8 Hours**

The File System: The file, what in a file name? the file system hierarchy, the unix file system, Using Absolute Pathnames with Commands, The HOME Variable and ~: The Home Directory, pwd and cd, Relative Pathnames, mkdir, rmdir, ls, cp, mv, rm, cat, more, pico, wc, lp, od, tar, gzip, zip.**File Attributes:** *ls* Revisited, File Permissions, chmod, the directory, umask, File Systems and Inodes, ln, ln Again, File Ownership, Modification and Access Times, find.

Self-study component:	dos2unix, unix2dos

UNIT – III	**8 Hours**

The vi/vim Editor: Vi basics, input mode, Saving Text and Quitting, recovering from a Crash, Navigation, Editing Text without Operators, correcting a C Program, Editing Text with Operators, Copying and Moving Text from One File to Another, Undoing Last Editing Instructions, searching for a Pattern, Repeating the Last Command, Substitution, set, map, abbr. **The Shell:** The Shell as Command Processor, Shell Offerings, Pattern Matching, Escaping and Quoting Redirection, Collective Manipulation, /dev/null and /dev/tty, Pipes, tee: Creating a Tee, Command Substitution, Shell Variables, Shell Scripts, The Shell's Treatment of the Command Line, More Wild Cards.

Self-study component:	xargs: Building a Dynamic Command Line

UNIT – IV	**8 Hours**

The Process: Process Basics, The Shell and init, ps: Displaying Process Attributes, The Process Creation Mechanism, Inherited Process Attributes, When You Can't Use a Separate Process, Process States and Zombies, Signal Handling, Running Jobs in Background, Job Control, at and batch: Execute Later. **Simple Filters:** pr, comparing files, cmp, comm, diff, head, tail, cut, paste, sort, uniq, tr, applying filters, Filters Using Regular Expressions—grep and sed.

Self-study component:	cron and crontab: Running Jobs Periodically.

UNIT – V	**8 Hours**

Filtering and Programming with awk: awk preliminaries, using print and printf, number processing, variables and expressions, the comparison and logical operators, the –f option, BEGIN and END section, positional parameters, arrays, built-in variables, Functions, control flow, looping with for and while.

Shell Programming: Shell Scripts, read: Making Scripts Interactive, Using Command-Line Arguments,

exit and $?: Exit Status of a Command, The Logical Operators && and ||—Conditional Execution, The if Conditional, Using test and [ ] to Evaluate Expressions, Two Important Programming Idioms, The case Conditional, expr, bc and base name: Computation and String Handling, for: Looping with a List, while: Looping, break and continue, Manipulating Positional Parameters with set and shift, The Here Document (<<), Shell Functions, trap, eval, exec.

Self-study component:	Sample Program 1: Automatically Selects Last C Program, Sample Script 2: Providing Numeric Extensions to Backup Files, Sample Script 3: A Table of Contents for Downloaded Files.

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Analyze** the role of various components in the architecture of Unix Operating System and use the various UNIX commands to interact with the operating system.
CO2	**Interpret** and **manipulate** file attributes and execute the programs using vi editor.
CO3	**Demonstrate** the importance of process, shell and essential shell programming
CO4	**Develop** shell scripts involving regular expressions.
CO5	**Design** Report generation language using awk

Text Book(s):

1. Your UNIX-The Ultimate Guide, Sumitabha Das, Tata McGraw Hill, 3rd edition.

Reference Book(s):

1. UNIX: Concepts and Applications, Sumitabha Das, Tata McGraw Hill
2. "Beginning Shell Scripting", Eric Foster-Johnson, John C Welch, Micah Anderson, Wrox publication

Web and Video link(s):

1. https://www.youtube.com/@TechArkit
2. https://www.youtube.com/@ampcode

E-Books/Resources:

1. https://usermanual.wiki/Document/YourUNIXtheultimateguideSumitabhaDas.1387537707.pdf

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2										2	1
CO2	2	2	3										2	1
CO3	3	2	2						1				2	1
CO4	2	3	2						2				2	1

Blockchain Technology [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21IS6033**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Be Able to explain concepts related to BlockChain
- Be able to explain the need for BlockChain and the real world problems that BlockChain is trying to solve.
- Understand and describe how BlockChain works
- Explain the underlying technology of transactions, blocks, proof-of-work, and consensus building
- How does BlockChain exist in the public domain (decentralized, distributed) yet maintain transparency, privacy, anonymity, security, immutability, history

UNIT – I	**8 Hours**

Introduction to Block chain: Backstory of Block chain, what is Block chain? Centralized vs. Decentralized Systems, Layers of Block chain, why is BlockChain Important?, BlockChain Uses and Use Cases How BlockChain Works-1: Laying the BlockChain Foundation, Cryptography, Symmetric Key Cryptography, Cryptographic Hash Functions.

Self-study component:	Limitations of Centralized Systems

UNIT – II	**8 Hours**

How BlockChain Works-2: Asymmetric Key Cryptography, Diffie-Hellman Key Exchange, Symmetric vs. Asymmetric Key Cryptography, Nash Equilibrium, Prisoner's Dilemma, Byzantine Generals' Problem, Zero-Sum Games, Why to Study Game Theory, Computer Science Engineering, The BlockChain, Merkle Trees, BlockChain Transactions, Distributed Consensus Mechanisms, Scaling BlockChain, Off-Chain Computation, Sharding BlockChain State

Self-study component:	Game Theory

UNIT – III	**8 Hours**

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

Self-study component:	Putting it All Together

UNIT – IV	**8 Hours**

How Ethereum Works: From Bitcoin to Ethereum, Ethereum as a Next-Gen Blockchain, Design Philosophy of Ethereum, Enter the Ethereum Blockchain, Ethereum Blockchain, Ethereum Accounts, Trie Usage, Merkle Patricia Tree, RLP Encoding, Ethereum Transaction and Message Structure, Ethereum State Transaction Function, Gas and Transaction Cost, Ethereum Smart Contracts, Contract Creation.

Self-study component:	Ethereum Ecosystem
UNIT – V	**8 Hours**
BlockChain Application Development: Libraries and Tools, interacting with the Bitcoin BlockChain, Setup and Initialize the bitcoin js Library in a node.js Application, Create Key pairs for the Sender and Receiver, Get Test Bitcoins in the Sender's Wallet, Get the Sender's Unspent Outputs, Prepare Bitcoin Transaction, Sign Transaction Inputs, Create Transaction Hex, Broadcast Transaction to the Network, Interacting Programmatically with Ethereum—Sending Transactions, Set Up Library and Connection, Set Up Ethereum Accounts, Get Test Ether in Sender's Account, Prepare Ethereum Transaction, Sign Transaction, Send Transaction to the Ethereum Network.	
Self-study component:	Public Nodes vs. Self-Hosted Nodes

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	**Understand** the structure of a BlockChain and why/when it is better than a simple distributed database
CO2	**Explain** the significance of cryptographic algorithms in BlockChain
CO3	**Describe** the features and importance of Bitcoin
CO4	**Explain** about the principles of Ethereum Virtual Machine
CO5	**Design**, **build**, and **deploy** smart contracts and distributed applications.

Text Book(s):

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by BikramadityaSinghal, GautamDhameja and PriyansuSekhar Panda.

Reference Book(s):

1. Blockchain Technology: Cryptocurrency and Applications by S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press 2019.
2. Bitcoin and cryptocurrency technologies: a comprehensive introduction by Arvind Narayanan et. Al, Princeton University Press 2016

Web and Video link(s):

1. https://www.coursera.org/specializations/introduction-to-blockchain
2. https://nptel.ac.in/courses/106/104/106104220/

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1			1							2	
CO2	1	2	2	1		1							2	
CO3	2	2	2			2							2	
CO4	2	1	2			1							2	

Introduction to Dot Net Framework for Application Development [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER -VI**			
Course Code:	**P21IS6034**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows.
- Understand Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#.
- Construct events and query data using query expressions.

UNIT - I	**8 Hours**
Introducing Microsoft Visual C# and Microsoft Visual Studio: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions.	
Self-study component:	Installing Microsoft Visual Studio and building a simple C# application

UNIT - II	**8 Hours**
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays.	
Self-study component:	Using the methods and properties of the *System. Array* class in Microsoft Visual Studio

UNIT - III	**8 Hours**
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management.	
Self-study component:	Using the methods and properties of the *System. GC* class in Microsoft Visual Studio

UNIT - IV	**8 Hours**
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, introducing generics, Using collections.	
Self-study component:	Implementing extensible types with C# using Microsoft Visual Studio

UNIT - V	**8 Hours**
Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading.	
Self-study component:	Demonstrating operator overloading using Microsoft Visual Studio

Course Outcomes: On completion of this course, students are able to:	
COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Build applications on Visual Studio .NET platform by understanding the syntax & semantics of C#.
CO2	Demonstrate Object Oriented Programming concepts in C# programming language.
CO3	Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.
CO4	Illustrate the use of generics and collections in C#.
CO5	Compose queries to query in-memory data and define own operator behavior.

Text Book(s):

1.John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

Reference Book(s):

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellmanand Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and DreamtechPress, 2012.

Web and Video link(s):

1. https://ict.iitk.ac.in/courses/introduction-to-c-sharp/

Course Articulation Matrix (CAM)														
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	
CO2	3												1	
CO3			2										1	
CO4	2												1	
CO5	2												1	

Cryptography & Network Security [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21IS604**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

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

- To provide a practical survey of both the principles and practice of cryptography and network security.
- The basic issues to be addressed by a network security capability are explored by providing a tutorial and survey of cryptography and network security technology.
- Practice of network security and Practical applications that have been implemented and are in use to provide network security.

UNIT – I	**8 Hours**

Computer & Network security Concepts: Computer Security concepts, security attacks, security services, Security Mechanisms **Classical Encryption Techniques** Symmetric Cipher Model, substitution Techniques, Transposition Techniques, Rotor Machine, Steganography, **Block Ciphers and the data encryption standard**: Traditional block Cipher structure, The data encryption standard, A DES example, The strength of DES, Black cipher design Principals.

Self-study component:	A model for Network security.
Practical Topics: **(4 Hours)**	1) Write and Implement Program to Encrypt as well as Decrypt the given Plain Text message. 2) Write a Program to Encrypt the Chosen Plain Text by using Caser Cipher.

UNIT – II	**8 Hours**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems**: Diffie-hellman key exchange, Elgalmal Caryptographic System, Psedorandom Number generation Based on asymmetric cipher.

Self-study component:	Elliptic Curve Arithmetic, Elliptic curve Cryptography.
Practical Topics: **(6 Hours)**	1) To write a program to implement Data Encryption Standard (DES). 2) Write a Program to Implement the RSA Algorithm.

UNIT – III	**8 Hours**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, Symmetric key distribution using Asymmetric encryption, Distribution of Public Keys,X-509 certificates, Public Key Infrastructure, **User Authentication**: Remote user Authentication principles, Remote user Authentication Using Symmetric Encryption, Kerberos, Federated Identity Management.

Self-study component:	Personal Identity Verification, Remote user Authentication using Asymmetric encryption.
Practical Topics: **(6 Hours)**	1) Write and Implement Deffi-hellman Key-Exchange Algorithm.

UNIT – IV	8 Hours
Network Access Control & Cloud Security: Network Access Control, Extensible Authentication Protocol, Cloud Security Risk and Countermeasures, Cloud Computing, Cloud Security Risks and Counter measures, Data Protection in the Cloud. Transport Level Security: Web Security Consideration, Transport Layer security, HTTPS, Secure shell(SSH).	
Self-study component:	Cloud Security as a Service.
Practical Topics: (4 Hours)	**1)** Write a program to Implement SSH to Execute Remote Commands.
UNIT – V	**8 Hours**
Electronic Mail Security: Internet Mail Architecture, Email Formats, Email threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy. **IP Security**: IP Security overview, IP Security Policy, Encapsulating Security payload, Combining Security Associations.	
Self-study component:	DNSSEC, Internet Key Exchange.
Practical Topics: (4 Hours)	1) Case study on Types of Email Security Threats and Best Practices to Ensure Email Security.
NOTE	

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

COs	Course Outcomes with *Action verbs* for the Course topics
CO1	**Analyze** and **design** classical encryption techniques, block ciphers and data encryption standard.
CO2	***Identify*** *the security issues in the network.*
CO3	***Understand*** *the most common type of cryptographic algorithm.*
CO4	***Implementing*** *various encryption techniques.*

Text Book(s):

1. William Stallings: Cryptography and Network Security, Pearson 7th edition.

Reference Book(s):

1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition.

Web and Video link(s):

1. **https://www.youtube.com/watch?v=C7vmouDOJYM**
2. **https://youtu.be/Hm35SS_PY5g**
3. https://youtu.be/jSsehESW37c

E-Books/Resources:

1. **https://archive.nptel.ac.in/courses/106/105/106105162/#**

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2		1								2	2
CO2	2	2	2	2									1	2
CO3	2	2	2										1	2
CO4	2	2	2		1								2	2

Robotic Process Automation [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER -VI			
Course Code:	**P21ISO6051**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory 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-by-step 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-by-step 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:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Demonstrate Robotic Process Automation & Record and Play feature of UiPath Studio.
CO2	Create different types of variables, control flow and data manipulation techniques.
CO3	Apply various control techniques, plugins and extensions in RPA.
CO4	Illustrate various types and strategies to handle events and exceptions.

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

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				2								1	
CO2	2				2								1	
CO3	2				2								1	
CO4	2				2								1	
CO5	2				2								1	

Information System Management [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21ISO6052**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

- Enable students to understand how systems, such as decision support systems and expert systems aid in the decision making process.
- Enable students to understand the use of information systems to gain competitive advantage with management of information as an organizational resource.
- Provide an overview of the uses of organizational systems, such as operations, finance, marketing, and human resources

UNIT – I	**8 Hours**

Foundations of Information Systems in Business: The Real World of Information Systems, The Fundamental Roles of IS in Business, Types of Information Systems, Managerial Challenges of Information Technology, **System Concepts:** A Foundation, Components of Information Systems, Information System Resources, Information System Activities.

Self-study component:	Trends in Information Systems.

UNIT – II	**8 Hours**

Competing with Information Technology: Competing with Information Technology: Strategic IT, Strategic Uses of Information Technology, building a Customer-Focused Business, The Value Chain and Strategic IS, Reengineering Business Processes, creating a Virtual Company, building a Knowledge-Creating Company.

Self-study component:	Agile company

UNIT – III	**8 Hours**

E-Business Systems: Introduction, Cross-Functional Enterprise Applications, Enterprise Application Integration, Transaction Processing Systems, Enterprise Collaboration Systems. **Functional Business Systems:** Introduction, Marketing Systems, Targeted Marketing, Manufacturing Systems, Human Resource Systems, Accounting Systems.

Self-study component:	Financial system

UNIT – IV	**8 Hours**

Enterprise Business Systems: Introduction, what is CRM? The Three Phases of CRM, Benefits and Challenges of CRM. **Enterprise Resource Planning:** Introduction, what is ERP? Benefits and Challenges of ERP. **Supply Chain Management:** introduction, what is SCM? Benefits and Challenges of SCM.

Self-study component:	Trends in CRM, ERP and SCM.

UNIT – V	**8 Hours**

E-Commerce Fundamentals: Introduction to e-Commerce, Scope of E-commerce, Essential E-commerce Processes, Electronic Payment Processes, e-Commerce Success Factors, Web Store Requirements. **Decision Support in Business:** Introduction, Decision Support Trends, Decision Support Systems, Management Information Systems, Online Analytical Processing.

Self-study component:	Using Design Support Systems, Executive Information Systems.

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

COs	Course Outcomes with *Action verbs* for the Course topics
CO1	**Understand** the current generation of computing and information technologies for business and **Apply** the concepts of Management Information Systems to enhance business processes and support decision making.
CO2	**Develop** a strategy to gain a competitive advantage using information technology.
CO3	**Interpret** and **recommend** the use information technology to solve business problems.
CO4	**Apply** a framework and process for aligning organization's IT objectives with business strategy

Text Book(s):

1. James A. O' Brien, George M. Marakas: "Management Information Systems", 7th Edition, Tata McGraw Hill, Reprint 2013.

Reference Book(s):

1. Kenneth C. Laudon Jone and P. Laudon, "Management Information Systems", 13th Edition, Pearson Education Limited2014.
2. Ralph M. Stair and George W. Reynolds, "Principles of Information Systems - A Managerial Approach", 9th edition, Course Technology2013.
3. W.S. Jawadekar: Management Information Systems, Tata McGraw Hill 2008.

Web and Video link(s):

1. https://youtu.be/5JMkdGQCm4k?list=PLE04B26C87FB0C0C6
2. https://youtu.be/-18Py3sX5sM

E-Books/Resources:

1. https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/186-Management-Information-Systems-James-A.-O%E2%80%99Brien-George-M.-Marakas-Edisi-10-2010.pdf

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3		1				1			1		1	
CO2	1	2		1				1			1		1	
CO3			3	2	2			1		1	1		1	
CO4			2	1				1		1	1		1	

Software Engineering [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21ISO6053**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours:	**40**	**SEE Marks:**	**50**

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

1. Gain the knowledge relating to Software Engineering, Software reengineering and maintenance. Understand the principles of large scale software systems.
2. Apply the process of analysis and design using object oriented approach.
3. Identify the importance of testing in assuring the quality of software.
4. Acquire and develop many valuable skills such as the ability to use developed software by Communicating with working group.
5. Evaluate requirements for a software system.

UNIT – I	8 Hours

Overview and Requirements

Introduction to Software engineering, Professional and ethical responsibility; software process models, process iteration, software specification, software design and implementation, software validation, software evaluation; Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; the software requirements document; requirements engineering processes: feasibility studies, requirements elicitation and analysis, requirement validation.

Self-study component:	Functional and Non-functional requirements.

UNIT – II	8 Hours

Software Design

Architectural Design: system structuring, control models, modular decomposition, object oriented design: Objects and Object Classes, An Object-Oriented design process. Design evolution

Self-study component:	Design evolution

UNIT – III	8 Hours

Verification and Validation

Verification and Validation (V & V): Planning; Software inspections; Automated static analysis, clean room software development; software testing: defect testing, integration testing, object oriented testing, Testing workbenches.

Self-study component:	Testing Workbenches

UNIT – IV	8 Hours

Management

Managing People: limits to thinking, group working, choosing and keeping people, the people capability maturity model; software cost estimation: productivity, estimation techniques, algorithmic cost modeling, project duration and staffing.

Self-study component:	Software Cost Estimation.

UNIT – V	8 Hours

Evolution

Software change: program evolution dynamics, software maintenance, architectural evolution; Software Re-engineering: source code translation, reverse engineering process, program modularization, data re-engineering.

Self-study component:	Reverse Engineering Process

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

COs	Course Outcomes with *Action verbs* for the Course topics
CO1	**Apply** the principles and techniques of Software Engineering
CO2	**Analyze** the various steps involved in the design process and the different design approaches which include function-oriented design and object-oriented design.
CO3	**Acknowledge** the activities in project management, requirement engineering process and to identify the different types of system models.
CO4	**Acquire** the knowledge of design engineering in software development activities.

Text Book(s):

1. Software Engineering– Ian Somerville, 8th Edition, Pearson Education, 2007.

Reference Book(s):

1. Software Engineering: A Practitioners Approach - Roger S. Pressman, 7th Edition, McGraw-Hill, 2007.
2. Software Engineering Theory and Practice -Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
3. Software Engineering Principles and Practice –Waman S Jawadekar, Tata McGraw Hill, 2004
4. Software Engineering – Pankaj Jalote, Tata Mc Graw Hill.

Web and Video link(s):

E-Books/Resources:

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	2					2					2	
CO2	2	1	2										2	
CO3	2	1	2										2	
CO4	2	2	2										2	

Operating System [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21ISO6054**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **-**	**SEE Marks:**	**50**

Course Learning Objectives:

This course will enable the students to:

- Familiarize the operations performed by OS as a resource Manager.
- Impart various scheduling and Memory Management techniques of OS.

UNIT – I	8 Hours
Introduction: Role of operating systems, Computer System Architecture, Operating System Structure, Operating System Operations, Computing Environments, Open Source Operating Systems.	
Self-study component:	Activities of Process, Storage and Memory Management.

UNIT – II	8 Hours
System Structures: Operating System Services, System Calls, System Programs, Operating System Structures. **Process Management:** Process Concept, Process Scheduling, Inter-process Communication.	
Self-study component:	Operations on Processes.

UNIT – III	8 Hours
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF & Round Robin only), Algorithm Evaluation. **Synchronization:** Back ground, The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, The Dining Philosopher's Problem.	
Self-study component:	Multiple-Processor Scheduling.

UNIT – IV	8 Hours
Deadlock: Deadlock Characterization, Methods Handling Deadlocks, Recovery from Deadlock. **Memory Management Strategies:** Background, Contiguous Memory Allocation, Segmentation, Paging.	
Self-study component:	Swapping.

UNIT – V	8 Hours
Virtual Memory: Demand Paging, Page Replacement. **File System Structure:** Directory and Disk Structure. **File-System Implementation:** Allocation Methods. **Mass Storage Structure**: Disk Scheduling.	
Self-study component:	Copy-on-Write.

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

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Understand the fundamental concepts of services provided by operating system.
CO2	Apply different Process Scheduling, Disk Scheduling and page replacement algorithms to explore Operating System functionalities.
CO3	Analyze concepts of operating system to acquire knowledge about the course.

Text Book(s):

1. Operating Systems Concepts- Abraham Silberschatz, Peter B Galvin, Gerg Gagne, Ninth Edition, Wiley.

Reference Book(s):

1. The Minix Book Operating Systems Design and Implementation, Third Edition, Andrew S. Tanenbaum and Albert S Woodhull, Pearson.

Web and Video link(s):

1. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O.
2. https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f

E-Books/Resources:

1. https://www.researchgate.net/publication/354665053_Operating_System_Concepts_9th 2012.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	
CO2	2	1	1										2	
CO3	2	1	1										1	

Software Testing Laboratory
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – VI

Course Code:	**P21ISL606**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Lab Hours:	**24**	**SEE Marks:**	**50**

Part – A

Design and write a program to implement the following

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

Design, develop, code and run the program in any suitable language to implement the Next Date function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.

Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.

Design, develop, code and run the program in any suitable language to implement the triangle problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

Part – B

Write a script to login a specific web page.

Write a script to count number of items present on a desktop.

Write a script to update 06 student records into table into Excel file.

Write a script to provide total number of objects present / available on the page.

Write a script to get the number of items in a list / combo box.

COs	**Course Outcomes** with ***Action verbs*** for the Course topics
CO1	Apply the appropriate test cases for any given problem
CO2	Implement Test Automation process and experiment with testing tools

Course Articulation Matrix (CAM)

Course Outcomes	**Program Outcomes (PO's)**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2									2	
CO2	2	2	2	2	2								2	

Mini - Project [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – VI			
Course Code:	**P21ISMP607**	**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 (EES) - VI
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – VI

Course Code:	**P21HSMC608**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable students to:

- Explain the basic concepts in Race and games, Linear equations, mensuration, height and distance.
- Apply the logical skills in decoding Number, letter series and Game based assessments.
- Calculations involving Time, Speed and distance, HCF & LCM, Averages and Partnerships

UNIT – I	**10 Hours**

Quantitative Aptitude: Race and games, Linear equations

Logical Reasoning: Number and letter series

Self-Study: Types of cryptarithm.

UNIT – II	**10 Hours**

Quantitative Aptitude: Mensuration, Height & distance.

Logical Reasoning: Game based assessments.

Self-Study: Inferred meaning, Chain rule.

UNIT – III	**08 Hours**

Quantitative Aptitude: Time, Speed and distance, HCF & LCM, Averages and Partnerships

Self-Study: Decimal fractions

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

CO – 1:	Solve the problems based on Race and games, Linear equations, mensuration, height and distance.
CO – 2:	Solve logical reasoning problems based on Number, letter series and Game based assessments.
CO – 3:	Solve the problems based on HCF & LCM, averages and partnerships.

Text Book(s):

1. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
2. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd
2. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal.
3. CAT Mathematics by Abhijith Guha, PHI learning private limited.

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - VI**]**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2	-	-	-	-	-	-	-	-	-	2
CO-2	2	2	-	-	-	-	-	-	-	-	-	2
CO-3	2	2	-	-	-	-	-	-	-	-	-	2

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

Course Code:	**P21UHV609**	**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