

**MALNAD COLLEGE OF ENGINEERING,
HASAN**

(An Autonomous Institution Affiliated to VTU, Belagavi)



**Autonomous Programme
Bachelor of Engineering**

**DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING**

SYLLABUS

**V Semester & VI Semester
(2022-23 Admitted Batch)**

Academic Year 2024-2025

VISION

To become a prominent department of Computer Science & Engineering producing competent professionals with research and innovation skills, inculcating moral values and societal concerns.

MISSION

1. Impart world class engineering education to produce technically competent engineers.
2. Provide facilities and expertise in advanced computer technology to promote research.
3. Enhance Industry readiness and entrepreneurial abilities through innovative skills
4. Nurture ethical values and social responsibilities

PROGRAM EDUCATIONAL OBJECTIVES

- PEO 1 : Graduates will be efficient software developers in diverse fields and will be successful professionals and/or pursue higher studies.
- PEO 2 : Graduates will be capable to adapt to new computing technology for professional excellence and Research and will be lifelong learners.
- PEO 3 : Graduates will work productively exhibiting ethical qualities for the betterment of society.
- PEO 4 : Graduates will possess leadership qualities, work harmoniously in a team with effective communication skills.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon graduation, students with a degree B.E. in Computer Science & Engineering will be able to:

PSO – 1: To make the students industry ready by facilitating them with software tools in recent technologies

PSO – 2: To develop IT based solutions for problems in diverse domains

Admitted Batch : 2022-23
Academic Year : 2024-25
Scheme & Syllabus for III Year

FIFTH SEMESTER						
Course Category	Course Code	Course Title	L-T-P (Hours)	Credits	Contact Hours	
HSMC	22CS501	Technology Management and Entrepreneurship	3-1-0	3	4	
PCC	22CS502	Software Engineering and Project Management	3-2-0	4	5	
PCC	22CS503	Data Communications	3-0-0	3	3	
IPCC	22CS504	Computer Graphics and Visualization	3-0-2	4	5	
PCC	22CS505	Web Programming	0-0-4	2	4	
PEC	22CS55X	Professional Elective Course - I	3-0-0	3	3	
AEC	22RIP	Research Methodology and IPR	3-0-0	3	3	
HSMC	22EVS	Environmental Studies	0-0-2	1	2	
Total					23	29
<p>The course Analytical ability & soft skills 22ASK will be conducted by the TAP coordinator during the vacation period of fifth semester for one credit.</p> <p>The Marks for the same will be entered in sixth semester grade card.</p>						

Sl. No.	Professional Elective Course - I	
	Course Code	Course Title
1.	22CS551	Digital Image Processing
2.	22CS552	Data Mining and Warehousing
3.	22CS553	Internet of Things
4.	22CS554	Object Oriented Modelling and Design
5.	22CS555	Advance Java
6.	22CS556	Operations Research

SIXTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P (Hours)	Credits	Contact Hours
IPCC	22CS601	Machine Learning	3-0-2	4	5
IPCC	22CS602	Computer Networks	3-0-2	4	5
PCC	22CS603	Finite Automata and Formal Languages	3-1-0	3	4
PI	22CS604	Mini Project	0-0-4	2	4
PI	22CS605	Main Project Phase - I	0-0-4	2	4
AEC	22CS606X	Ability Enhancement Course	0-0-2	1	2
PEC	22CS66X	Professional Elective Course - II	3-0-0	3	3
OEC	22OECS6X	Open Elective – I	3-0-0	3	3
OEC	22SWY	SWAYAM (NPTEL Only)	-	AUDIT	-
AEC/SDC	22ASK	Analytical Ability and Soft Skills	0-0-2	1	2
				Total	23
22CS604 - Mini Project: Student must develop a web based application using the concepts learnt in the courses - Database Management System (22CS404) and Web Programming (22CS505)					

Sl. No.	Professional Elective Course - II	
	Course Code	Course Title
1.	22CS661	Introduction to Computer Vision
2.	22CS662	Artificial Intelligence
3.	22CS663	Wireless Networks
4.	22CS664	Software Architecture
5.	22CS665	C# Programming and .NET
6.	22CS666	Management Information System

Sl. No.	Open Electives	
	Course Code	Course Title
1.	22OECS61	Introduction to Cloud Computing
2.	22OECS62	Introduction to JAVA programming

Sl. No.	Ability Enhancement Course	
	Course Code	Course Title
1.	22CS606A	Application Development Laboratory
2.	22CS606B	Full Stack Web Development

TECHNOLOGY MANAGEMENT AND ENTREPRENEURSHIP			
Course Code	22CS501	L-T-P-C	(3-1-0)3
Exam Hrs.	3	Hours/Week	4
SEE	50Marks	Total Hours	40L+10T

Course Objective: To lead and manage teams, become entrepreneur and to prepare project proposal.

Course Outcomes(COs):Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore corporate culture and management principles.	1	-
2.	Build profile and project proposal	3,10,11,12	2
3.	Acquire skills for Entrepreneurship, Startups and IPR	1,12	-
4.	Document on Industry visit.	8,10	-

Course Contents:

MODULE-1	10 Hrs
Planning, and Decision making: Planning: Preview. Nature of planning, the foundation for planning, some planning concepts. Decision Making: Preview .Nature of decision making. Types of decisions/decision making. Some human aspects of organizing: Preview. Staffing technical organizations .Authority and power .Delegation.	
MODULE-2	10 Hrs
Motivating & Leading Technical People and Controlling: Motivating and leading technical people: Preview. Motivation. Leadership. Motivating and leading technical professionals (methods). Managing the Research Functions: Preview. Product and technology life cycles .Nature of R&D. Research strategy and organization .Selecting R&D projects .Protection of ideas. Intellectual Property Rights (IPR).Creativity.	

MODULE-3	10 Hrs
Entrepreneurship: Meaning Evolution of the concept,functions of an Entrepreneur ,Characteristics of an Entrepreneur ,types of entrepreneurs , Intpreneur. Entrepreneurship :Concept of Entrepreneurship ,Characteristics of Entrepreneurship ,Development of Entrepreneurship ,Stages in Entrepreneurial process ,Role of Entrepreneurs in economic development, Entrepreneurship in India, Entrepreneurship barriers, Women entrepreneur – Concept & steps to develop Women Entrepreneur. Small Scale Industry: Definition ,Characteristics ,Objectives ,Scope and role of SSI in economic Development, Advantages of SSI, Problems of SSI ,Steps to start an SSI.	

MODULE-4	10 Hrs
Government Policy towards SSI; Different Policies of SSI, Introduction to GATT/ WTO. Supporting Agencies of Government for SSI: Meaning, Nature of support; Objectives, functions. Ancillary Industry and Tiny Industry. Institutional Support: Different Schemes: SSIDC, SSIB, DICs/ Single Window Concept, TCOs, ICICI, NSIC, SIDO, IDBI, SIDBI, SFCS, IFCI. Preparation of Project: Meaning, Project identification ,Project selection ,Project Report Need of Project, Contents ;formulation, Network Analysis Errors of project report ,Project Appraisal ,Feasibility Study-	

MarketFeasibilityStudy, TechnicalFeasibilityStudy, FinancialFeasibilityStudy, SocialFeasibilityStudy

Text Books:

1. Daniel Babcock & Lucy C. Morse “Managing Engineering and Technology”, PHI, 6th edition, 2014.
2. Management and Entrepreneurship-N. V. RNaidu, T Krishna Rao.

Reference Books:

1. Entrepreneurship Development, Small Business Enterprises – Poornima .M. Charantimath, – Pearson Education–2006.
2. Dynamics of Entrepreneurial Development &Management-Vasant Desai, Himalaya ublishing House.
3. Management Fundamentals-Concepts, Application, Skill Development –Rober Lousier, Thomson.
4. Principles of Management–P. C .Tripathi, P .N. Reddy–Tata Mc Graw Hill.

MOOCs:

- 1.<https://nptel.ac.in/courses/110/106/110106141>
- 2.<https://nptel.ac.in/courses/127/105/127105007>

Tutorial

1. Resume building
2. Brainstorming session: Frame vision and mission statements
3. Preparing a project proposal
4. SWOC analysis exercises

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	-	-	-	2	3	2	-	1
CO3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	2	-	3	-	-	-	-

Course Title	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT		
Course Code	22CS502	(L-T-P)C	(3-2-0)4
Exam	3 Hrs.	Hours/Week	5
SEE	50 Marks	Total Hours	40L+10T

Course Objective: Use Software Engineering Principles for Application development

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Explore diverse software development process	1	2
2.	Construct SRS for a given scenario	1	2
3.	Design and validate a software product	3,5	2
4.	Apply appropriate project estimation and management techniques	9,11	2

MODULE – 1

10 Hrs.

Introduction: Professional Software Development, Software Engineering Ethics. Case studies: An insulin pump control system, **Software Processes:** Software Processes models, Process activities, coping with change, The Rational Unified Process. **Agile Software Development:** Agile Methods, Plan- driven and Agile Development, Extreme programming. Agile Project Management. Scaling Agile Methods.

Self-Study: Case Studies- A patient information system for mental health care, A wilderness weather station

MODULE – 2

10 Hrs.

Requirements Engineering: Functional and non-functional requirements. The software Requirements Document. Requirements Specification, Requirements Engineering Processes. Requirements Elicitation and Analysis. Requirements validation. Requirements Management. **System Models:** Context models. Interaction models. Structural models. Behavioural models. Model-driven engineering.

Self-Study: Behavioral models as applied to case study.

MODULE -3

10 Hrs.

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. **Software Evolution:** Evolution processes, Program evolution dynamics. Software maintenance.

Self-Study: Legacy system management

MODULE -4

10 Hrs.

Software Project Management: Software Project Management Complexities, Responsibilities of a software project Manager, Project Planning and Metrics for project size estimation, Project estimation techniques, Empirical estimation techniques, Scheduling, Organization and Team Structures.

Self-Study: COCOMO—A Heuristic Estimation Technique, Scrum tool.

Text Books:

1. Ian Sommerville, “Software Engineering”, 9th Edition, Person Education, 2014. (Chapters:1,2,3,4,5,7,8,9)
2. Fundamentals of Software Engineering, Rajib Mall, 2015, Prentice-Hall Of India Pvt. Ltd., (Chapter 3)

Reference Books:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 7th Edition, McGraw-Hill, 2007.
2. Waman S. Jawadekar, "Software Engineering Principles and Practice", Tata McGraw-Hill, 2004.
3. Software Engineering: A Concise introduction to Software Engineering by Pankaj Jalot, Springer.

MOOC Course:

<https://nptel.ac.in/courses/106/105/106105182/>

Tutorial:

1. Requirement specification for (functional and nonfunctional) for the specified scenario.
2. Write sequence diagram for the given case.
3. Write a SRS document for the given case study.
4. Discuss on ethical and professional issues and why they are of concern to Software Engineers.
5. Write behavioral model and interaction model for the given scenario.
6. By referring to embedded device depict requirement specification.
7. Employ software testing tool to address a given problem.
8. Practice scrum tool for the Project management.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	3		2	-	-	-	-	-	-	-	-	2
CO4	-	-	-	-	-	-	-	-	3	-	-	2	-	2

DATA COMMUNICATIONS			
Course Code	22CS503	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Students able to gain knowledge of TCP/IP Protocol Model and Functionalities of Data link Layer and Physical Layer

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Perceive the different types of Networks and demonstrate the responsibility each layers of TCP/IP protocol suite.	1,12	-
2.	Analyse the performance of different techniques for data/signal transmission	2	-
3.	Investigate the standard network components to utilize the available network resources	2	-
4.	Formulate and design error detection/ correction algorithms, different framing formats, and medium Access control Methods	3,4	-

Course Contents:

MODULE-1

10 Hrs.

Introduction: Data Communications; Networks; Network Types; **Network Models:** Protocol Layering; TCP / IP Protocol Suite; **Physical Layer:** Introduction to Physical Layer, Data and Signals; Periodic Analog Signals; Digital Signals; Transmission impairment; Data rate limits;

MODULE-2

10 Hrs

Digital Transmission: Digital-to-Digital conversion: Line Coding, Line Coding Schemes, Block Coding, and Scrambling; Analog-to-Digital conversion: Pulse Code Modulation (PCM), Delta Modulation(DM); **Multiplexing:** FDM, WDM, TDM, Multiplexing ; Spread spectrum

MODULE-3

10 Hrs

Transmission Media: Twisted pair cable, Coaxial cable, Fiber-Optic cable, Radio waves, Microwaves, Infrared. **Switching:** Introduction; Circuit-Switched Networks: Three Phases and Delay; Packet Switching: Datagram Networks: Virtual Circuit Networks; **Introduction to Data-Link Layer:** Link-layer Addressing: Three Types of Addresses, Address Resolution Protocol (ARP); **Error Detection and Correction:** Introduction; Block coding: Error Detection; Cyclic codes: CRC, Polynomials, Cyclic Code Encoder using Polynomials, Cyclic Code Analysis, Checksum: Concept, Other Approaches to the Checksum; Forward Error Correction.

MODULE-4

10 Hrs

Data Link Control: DLC Services: Framing, Flow and Error control, Connectionless and Connection Oriented; Data Link Layer Protocols: Simple, Stop & Wait, Piggybacking; HDLC; Point to Point Protocol: Services and Framing; **Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA; **Controlled Access:** Reservation, Polling, Token Passing;

Text Book:

Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 5th Edition.(Chapters 1.1,1.2,.1.3, 2, 3, 4.1,4.2, 6, 7, 8, 9, 10, 11,12, 13)

Reference Books:

- Alberto Leon-Garcia and Indra Widjaja, "Communication Networks–Fundamental Concepts and Keyarchitectures", Tata McGraw- Hill, 2nd Edition.
- William Stallings, "Data and Computer Communication", Pearson Education, 8th Edition

MOOC:

http://nptel.ac.in/keyword_search_result.php?word=data+communication

Course Articulation matrix

Course Title	COMPUTER GRAPHICS AND VISUALIZATION		
Course Code	22CS504	L-T-P-C	(3-0-2)4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	40L + 12P

Course Objective: To learn the concepts of computer graphics to design a 2D and 3D scene using OpenGL.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe core concepts of computer graphics with OpenGL.	1	-
2.	Apply concepts of geometric transformations, projections, and illumination to render image.	2, 3, 4	-
3.	Analyze line clipping and polygonal clipping algorithms	2, 3	-
4.	Design a 2D/3D image using graphical concepts through OpenGL.	2, 3, 4, 5	2

Course Contents:

MODULE – 1	12 Hrs
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Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface: Pen Plotter Model; Graphics architectures; Graphics Programming: The Sierpinski gasket; Programming two-dimensional applications. **The OpenGL:** The OpenGL API; Primitives and attributes;

MODULE – 2	12 Hrs
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The OpenGL (Continued): Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket.

Input and Interaction: Interaction; Input devices; Clients and Servers; Display lists; Display lists and modeling; Programming event-driven input; Menus, Design of Interactive programs, Animating interactive programs.

MODULE – 3	12 Hrs
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Geometric Objects and Transformations: Scalars, points, and vectors Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices

MODULE – 4	12 Hrs
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Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal,

Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Polygonal shading; Light sources in OpenGL; Specification of materials in OpenGL

Implementation: Clipping; Line- Segment Clipping; Bresenham's algorithm

Text Book:

Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", Addison-Wesley, 5th Edition, 2013. (Chapters 1, 2, 3, 4, 5, 6, 7)

Reference Books:

1. F.S. Hill,Jr, “Computer Graphics Using OpenGL”, Pearson education,2nd Edition,2011.
 2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, “Computer Graphics”, Addison-wesley.

Activity:

Write C program using OpenGL functions to

1. Recursively subdivide a tetrahedron to from 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.
 2. Draw a Rocket and allow the user to change the color.
 3. Create robot face using display list.
 4. Generate square for right click and to exit for left click using mouse function.
 5. Draw box at each location on the screen where the mouse cursor is located.
 6. Create hierarchical menus.
 7. Create a house like figure and rotate it about a given fixed point using OpenGL functions.
 8. Create a Rotating Square.
 9. Draw a color cube and spin it using OpenGL transformation matrices.
 10. Clip the line segment A(-4,2) and B(-1,7) in a window defined by left bottom corner at (-3,1) and upper right corner at (2,6). Find the visible portion of the line segment using Cohen Sutherland line clipping algorithm.

Course Articulation matrix

Course Title	WEB PROGRAMMING		
Course Code	22CS505	L-T-P-C	(0-0-4)2
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	28P

Course Objective: Create web pages with client side and server-side scripting

Course Outcomes (COs): Upon completion of the course, students shall be able to :

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Create webpages using HTML/XHTML and CSS.	3,12	2
2.	Develop client-side script to design webpage	3,5,12	2
3.	Develop server-side script to create webpage	3,5,12	2

Course Contents:

1. Write a XHTML document to create web page with forms, links, image
2. Develop and demonstrate a XHTML document that illustrates the use of external style sheet (CSS), ordered list, table, borders, padding, color and the tag.
3. Create a JavaScript that prompts the user for a number and then counts from 1 to that number displaying only the odd numbers using alert window.
4. Write a java script to validate the following fields in a registration page
 - Name (should contains alphabets and the length should not be less than 6 characters)
 - Password(should not be less than 6 characters)
 - E-mail(should not contain invalid addresses)
5. Develop and demonstrate, using JavaScript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
6. Develop and demonstrate, using JavaScript, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough space of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
7. Write an XML file which displays the book details that includes the following:
 - Title of book
 - Author name
 - Edition
 - Price

Write a DTD to validate the above XML file and display the details using XSL.

8. Write XHTML form and PHP to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.
9. Write a PHP program to store current date-time in a COOKIE and display the Last visited on date-time on the web page upon reopening of the same page.
10. Create a XHTML form with Name, Address and E-mail text fields and use PHP script to store the values in MySQL table and to Retrieve and display the data based on Name.

Activity :

Mini project (Carry out a mini project in a team of 2 to 4 members)

Text Book :

Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson Education, 2014.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	-	-	-	-	-	-	2	-	2	
CO2	-	-	3	-	2	-	-	-	-	-	3	-	2	
CO3	-	-	3	-	2	-	-	-	-	-	2	-	2	

Course Title	DIGITAL IMAGE PROCESSING		
Course Code	22CS551	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To study the image fundamentals and mathematical transforms necessary for imageprocessing

Course Outcomes (COs) : Upon the completion of the course the students will be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the basic principles of Digital image processing	1	-
2.	Apply concepts of Digital image processing, transformation, restoration, compression and segmentation	2,3	-
3.	Analyze image processing algorithms	2	-
4.	Develop image processing application for real time problems	3,4,5,9,10	1,2

Course Contents:

MODULE – 1

10 Hrs

Introduction: Basic concepts, Examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of visual perception. Image sensing and acquisition: Image sampling and quantization: Basic concepts in sampling and quantization, Representing digital images, Spatial and Intensity resolutions, some basic relationships between pixels: An Introduction to the Mathematical tools used in digital image processing.

MODULE – 2

10 Hrs

Intensity Transformations and Spatial Filtering: Background: The basics of intensity transformations and spatial filtering, Some basic intensity transformation functions, Histogram Processing. Fundamentals of spatial filtering: The mechanics of spatial filtering, Spatial correlation and convolution. **Image Restoration:** A model of the image restoration/degradation process. Noise Models: Spatial and Frequency properties of Noise.

MODULE – 3

10 Hrs

Image Restoration: Some important noise probability density functions, Periodic noise, Estimation of noise parameters, Restoration in the presence of Noise only- Spatial Filtering, Mean Filters. **Color Image Processing:** Color fundamentals, Color models: The RGB color model. **Image Compression Fundamentals:** Coding redundancy, Spatial and Temporal redundancy, Irrelevant information, Measuring image information, Fidelity Criteria.

MODULE – 4

10 Hrs

Image Compression: Some basic compression methods: Arithmetic coding, LZW coding, Bit_Plane coding, Digital image watermarking. **Image Segmentation :** Fundamentals, Point, Line, and EdgeDetection, Background, Detection of Isolated Points, Line Detection, Edge Models, Basic EdgeDetection: The Image Gradient and its Properties, Gradient Operators, Combining the Gradient with Thresholding, Thresholding: Foundation, The Basics of Intensity Thresholding, The Role of Noise in Image Thresholding, The Role of Illumination and Reflectance in Image Thresholding.

Text Book:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson publications,2018

Reference Books:

1. A.K. Jain, “Fundamentals of Digital Image Processing”, Pearson2nd Edition, 2018.
2. B. Chanda , Dutta Majumdeer, “Digital Image Processing and Analysis”, Prentice-Hall of India Pvt.Ltd., 2nd Edition, 2011.
3. “Introduction to Digital Image Processing with Matlab”, Rafael C. Gonzales, Richard E. Woods, Steven L.Eddins, Mcgraw Higher Ed, 2nd Edition, 2010.

MOOC:

<http://nptel.ac.in/courses/106105032>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	2	1	3	-	-	-	3	3	-	-	3	2

Course Title	DATA MINING AND WAREHOUSING		
Course Code	22CS552	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Students will be able to select appropriate Data mining and warehousing techniques for real-time application

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the fundamentals of data mining and data preprocessing techniques	1,3	
2.	Acquire the knowledge of Data Warehouse design, Modelling, and usage	1	1
3.	Use the process of Classification, Clustering and Association Analysis for a given problem	1,2	-
4.	Implement appropriate data mining algorithm for a given scenario	3,5,9	2

Course Contents:

MODULE – 1	10 Hrs
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Introduction: Data: Why Data Mining? What is Data Mining? What kinds of data can be mined? What kinds of pattern can be mined?, Which technologies are used? Major issues in data mining. Getting to know your data: Data objects and attribute types, Basic statistical description of data: measuring the central tendency, Measuring the dispersion of data, measuring data similarity and dissimilarity

MODULE – 2	10 Hrs
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Data Pre-processing: Data Pre-processing: An overview, Data cleaning, Data integration, Data Reduction: overview of data reduction strategies, wavelet transforms, Principal component analysis, attributes subset selection, Data Transformation: min-max normalization and Z-score normalization.

Data Warehouse and online Analytical processing: Data Warehouse: Basic Concepts ,Data Warehouse modelling : Data cube and OLAP , Data warehouse design and usage: A business analysis frame work for data warehouse design, Data warehouse design process, Data warehouse usage for information processing.

MODULE – 3	10 Hrs
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Classification: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction, Rule-based classification, K- Nearest-neighbour Classifier. Mining frequent patterns.

Association and correlations: Basic Concepts and Methods: Basic Concepts, Frequent item set mining methods: Apriori Algorithm, generating association rules from frequent item sets, Improving the efficiency of Apriori, A Pattern growth Approach for Mining Frequent item sets.

MODULE – 4	10 Hrs
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Cluster Analysis: Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Agglomerative versus divisive hierarchical clustering, DBSCAN. Data Mining Trends and research frontiers: Data Mining Applications, Data mining and society, Data mining trends.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, 1st Edition (Reprint) Pearson Education, 2014.
2. Jiawei Han and Micheline Kamber, Data Mining – Concepts and Techniques, Morgan Kaufmann, 3rd Edition, 2012.

Reference Books:

1. K.P. Soman, Shyam Diwakar, V.Ajay, Insight into Data Mining – Theory and Practice, PHI, 2006.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

MOOCs:

1. <http://nptel.ac.in/courses/110106064/>
2. <http://nptel.ac.in/courses/106106093/>
3. <https://www.edx.org/course/analytics-for-decision-making>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	2	-	-	-	-	-

INTERNET OF THINGS			
Course Code	22CS553	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Explore the interconnection, integration of the physical world and design IOT applications.

Course Outcomes (COs) : Upon the completion of the course the students will be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the impact and challenges posed by IoT networks, compare IoT architectures	1	-
2.	Illustrate smart objects and IoT Access Technologies to leverage connectivity.	1	-
3.	Design IoT interface module using RaspberryPi for a given problem.	2,3	2

Course Contents:

MODULE – 1	10 Hrs
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, IoT Data Management and Compute Stack.	
MODULE – 2	10 Hrs
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e.	
MODULE – 3	10 Hrs
IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances. Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods.	
MODULE – 4	10 Hrs
IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, Exploring the RaspberryPi Board; Operating System setup on RaspberryPi, RaspberryPi commands, Programming RaspberryPi with Python. Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.	

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743).
2. Srinivasa K G, Siddesh G M Hanumantha Raju R "Internet of Things", CENGAGE Learning India, 2017.

Reference Books:

1. Internet of Things - A Hands on Approach, Arshdeep Bahga and Vijay Madisetti Universities Press, 2015.
 2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012.

Course Articulation matrix

Course Title	OBJECT ORIENTED MODELING AND DESIGN		
Course Code	22CS554	L-T-P-C	(3-0-0)3
Exam Hours	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Describe object oriented modeling concept and apply them to solve the problems.

Course Outcomes (COs) : Upon completion of the course, students shall be able to:

COs	Statement	Mapping to POs	Mapping to PSOs
1.	Explore the basic concepts of object oriented modeling.	1,2	-
2.	Design the state diagrams and identify the relationship between class and state models.	3	-
3.	Design use case models, sequence models and activity models.	3	1
4.	Identify appropriate design pattern for a given problem.	2	-

Course Contents:

MODULE 1	10 Hrs
<p>Introduction, Modeling Concepts, Class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; Modeling as Design Technique: Modeling; abstraction; The three models. 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, State Modeling: Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes. Multiple inheritance; Metadata; Reification. Constraints; Derived data; Packages; Practical tips, State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.</p>	
MODULE 2	
<p>Advanced State Modeling, Interaction Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips, Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships.</p>	
<p>Interaction Modeling: Process Overview, System Conception: Procedural sequence models; Special constructs for activity models. Process Overview: Development stages; Development life cycle. System Conception: Devising a system concept; Elaborating a concept; preparing a problem statement.</p>	
MODULE 3	
<p>Domain Analysis, Application Analysis, System Design: 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, Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems.</p>	
<p>System Design , Class Design: Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example, 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.</p>	
MODULE 4	
10 Hrs	

Class Design (contd..), Implementation Modeling, Legacy Systems: Class Design: Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

Design Patterns: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber, Management Patterns: Command processor; View handler. Idioms: Introduction.

Text Books

1. Michael Blaha, James Rumbaugh, Object- Oriented Modeling and Design with UML, Pearson Education, 2nd Edition, 2005. (Chapters 1 to 17, 23).
 2. Frank Buschmann, Regine Meunier, Hans Rohnett, Peter Sommerlad, Michael Stal, Pattern-Oriented Software Architecture- A System of Patterns, Volume 1, John Wiley and Sons, 2006. (Chapters 1,3,5,3,6,4).

Reference Books

1. Grady Booch et al, Object-Oriented Analysis and Design with Applications, Pearson, 3rd Edition, 2007.
 2. Booch G. Runbaugh J, Jacobson. I, The Unified Modeling Language User Guide, Pearson, 2nd Edition, 2005.

Course Articulation matrix

ADVANCE JAVA							
Course Code	22CS555		LTPC	(3-0-0)3			
Exam. Hours	3		Hours / Week	3			
SEE:	50 Marks		Total hours	40			
Course Objective: Students should be able to use J2EE concepts to create an application.							
Course Outcomes(COs): Upon completion of the course, students shall be able to :							
COs	Course Outcomes			Mapping to POs			
1.	Explain and use java enumerations, collections, type wrapper and auto boxing in developing modular programs			1			
2.	Design GUI using swings and applets			3			
3.	Build database applications using JDBC.			2,3			
4.	Develop distributed web application using Servlets and JSP.			2,3			
Course Contents:							
MODULE – 1				10 Hrs			
Enumeration and Autoboxing: Enumeration fundamentals, values() and valuesOf() Methods, Java Enumerations are class types, example, Type Wrappers, Autoboxing and Autounboxing. Event Handling The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes							
MODULE – 2				10 Hrs			
User Interface components with Swing Components and containers, Layout managers, A first simple swing example, Event Handling, Creating a swing applet, Exploring Swing Controls-JLabel and ImageIcon, JTextField The Swing buttons, JTabbedPane, JScrollPane, JList, JComboBox.							
MODULE – 3				10 Hrs			
The Collections Framework – Collections overview, The collection Interfaces, The collection classes, Accessing collection via an iterator. Database Access - The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Statement Objects, Result Set							
MODULE – 4				10 Hrs			
Servlets and JSP - Lifecycle of a servlet, A simple servlet, The Servlet API, javax.servlet Package, Reading Servlet parameters, The javax.servlet.http Package, Handling HTTP Request and Responses, Using Cookies, Session tracking. Java Server Pages (JSP): JSP, JSP Tags, User Sessions, Cookies, Session Objects. RMI - Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.							
Text Books:							
1. Herbert Schildt: Java The Complete Reference Eighth Edition, McGraw Hill, 2013. 2. Jim Keogh: J2EE The Complete Reference, Tata McGraw Hill, 2007.							
Reference Books:							

1. Advanced Java Programming ,Uttam.K.Roy , Oxford Press,2015
 2. Java Fundamentals Herbert Schildt Dale Skrien, McGrawHill 2013
 3. "Head First Servlets and JSP" by Shroff,2nd Edition, O'Reilly Publications ,2008.

MOOCs

1. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
 2. https://www.youtube.com/watch?v=0KL_zftem4g/

Course Articulation matrix

OPERATIONS RESEARCH			
Course Code	22CS556	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Solve optimization problems using various methods

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop mathematical model for a given problem.	1	-
2.	Apply techniques of Operations Research.	2	-
3.	Solve prediction and estimation problems.	1, 2	-
4.	Expose to the significance of various scientific tools.	5	-

Course Contents:

MODULE – 1		10 Hrs
Introduction: Introduction: The origin, nature and impact of OR; Overview of the Operations Research Modeling Approach: Defining the Problem and Gathering Data; Formulating a Mathematical Model; Deriving Solutions from the Model; Testing the Model; Preparing to Apply the Model; Implementation		
Linear Programming – 1: Prototype example; The Linear Programming (LP) Model, Assumptions of LP, Additional Examples		
MODULE – 2		10 Hrs
Simplex Method - 1: The Essence of the Simplex Method; Setting up the Simplex Method; The Algebra of the Simplex Method; The Simplex Method in Tabular Form; Tie Breaking in the Simplex Method		
Simplex Method – 2: Adapting to other Model Forms; Post Optimality Analysis, Computer implementation		
MODULE – 3		10 Hrs
Revised Simplex Methods: Foundations of the Simplex Method, The revised simplex method, A Fundamental Insight		
Duality Theory: The Essence of Duality Theory; Economic Interpretation of Duality. Primal-Dual Relationships , Adapting to other primal forms, The role of duality in sensitive analysis; The essence of sensitivity analysis; Applying sensitivity analysis, The dual simplex method ; Parametric linear programming; The upper bound technique.		
MODULE – 4		10 Hrs
Transportation Model: Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm. Assignment Model and Network Models : The Assignment Model, CPM and PERT		
Text Books:		
1. Frederick S. Hillier and Gerald J. Lieberman, “Introduction to Operations Research”, Tata McGrawHill, 9th Edition, 2012. (Chapters: 1.1 to 1.3, 2, 3.1 to 3.3, 4.1 to 4.7, 5, 6.1 to 6.7, 7.1)		
2. Hamdy A Taha, “Operations Research: An Introduction”, Prentice Hall India, 8th Edition, 2005.(Chapters: 5, 6.4)		
Reference Book:		
Wayne L. Winston, “Operations Research Applications and Algorithms”, Thomson Course Technology, 4th Edition 2003		

Course Articulation matrix

Course Title	RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS		
Course Code	22RIP	L-T-P	(3-0-0) 3
CIE	50	Hours/Week	3
SEE	50	Total Hours	40

Course Objective: To give an overview of technical research activities and patenting methodology.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Carry out Literature Review and write technical paper	2,3,4,8,12	-
2.	Describe the fundamentals of patent laws and the patent drafting procedure.	6,8,10,12	-
3.	Elucidate the copyright laws and subject matters of copyright	6,8, 10,12	-

MODULE-1

10 Hrs.

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research. **Ethics in Engineering Research:** Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art ,Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward, Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading.

MODULE-2

10 Hrs.

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions.

Technical Writing and Publishing : Free Writing and Mining for Ideas, Attributes and Reasons of Technical Writing, Patent or Technical Paper?—The Choice, Writing, Journal Paper: Structure and Approach: Title, Abstract, and Introduction, Methods, Results, and Discussions, Table, Figures, Acknowledgments, and Closures

MODULE-3

10 Hrs.

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP, Major Amendments in IP Laws and Acts in India.

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements.

Process of Patenting: Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications.

MODULE-4

10 Hrs

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a

Publisher. Copyrights and the Word ‘Adaptation’. Copyrights and the Word ‘Indian Work’. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC).

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration.

Self study: Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, IP Organizations In India.

Text Books:

1. Dipankar Deb, Rajeeb Dey, Valentina E, Balas, “Engineering Research Methodology”, Springer, 2019.
2. Prof. Rupinder Tewari, Ms. Mamta Bhardwa, “Intellectual Property”, Professor Gurpal Singh Sandhu Honorary Director, Publication Bureau, Panjab University, 2021.

Reference Books:

1. David V. Thiel, “Research Methods for Engineers”, Cambridge University Press, 2014.
2. N.K.Acharya, “Intellectual Property Rights”, Asia Law House, 8th Edition, 2021.

MOOC:

https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	3	-	-	-	2	-	-	-	3	-	-
CO2	-	-	-	-	-	3	-	2	-	3	-	3	-	-
CO3	-	-	-	-	-	3	-	2	-	3	-	3	-	-

Course Title		ENVIRONMENTAL STUDIES			
Course Code	22EVS				L-T-P (0-0-2) 1
Exam	3 Hrs.				Hours/Week 2
CIE	100 Marks				Total Hours 20

Course Objective: To create environmental awareness among the students.

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

#	Course Outcomes (CO)	Mapping to POs	Mapping to PSOs
1.	Acquire an awareness of sensitivity to the total environment and its allied problems.	7, 9,12	-
2.	Develop strong feelings of concern, sense of ethical responsibility for the environment and the motivation to act in protecting and improving it.	6,8	-
3.	Analyze and evaluate environmental measures in real world situations in terms of ecological, political, economical, societal and aesthetic factors.	6, 7,8, 9	-

MODULE-1

5 Hrs

Environment: Definition, Ecosystem, Balanced ecosystem, Effects of human activities on environment Agriculture Housing Industry Mining and Transportation.

MODULE-2

5 Hrs

Natural Resources: Water resources, Availability and Quality, Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources - Forest Resources - Material Cycles - Carbon, Nitrogen and Sulphur Cycles.

MODULE-3

5 Hrs

Pollution: Effects of pollution - Water pollution - Air pollution Land pollution - Noise pollution.

MODULE-4

5 Hrs

Current Environmental issues of importance: Acid Rain, Ozone layer depletion - Population Growth, Climate change and Global warming. Environmental Impact Assessment and Sustainable Development Environmental Protection - Legal aspects. Water Act and Air Act.

Text Books:

1. Environmental Studies - Dr. D.L Manjunath, Pearson Education -2006
2. Environmental Studies - Dr. S. M. Prakash - Elite Publishers - 2006

Reference Books:

1. Environmental Studies - Benny Joseph - Tata McGraw ill- 2005
2. Principles of Environmental Science and Engineering P. Venugopala Rao, Prentice Hall of India.
3. Environmental Science and Engineering - Meenakshi, Prentice Hall India.

Assessment Strategy

CIE	Schedule	Assessment Method	Marks	Duration (Min.)
CIE I	At the end of 8 weeks	Objective Questions	25	60
CIE II	At the end of 11 weeks	Objective Questions	25	60
Project	At the end of 14 weeks	Project/Presentation/Prototype development/Plantation	50	-

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	-	3	-	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	3	2	-	-	-	-	-

Course Title	MACHINE LEARNING		
Course Code	22CS601	L-T-P-C	(3-0-2) 4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	40L + 10P

Course Objective: To apply the techniques of machine learning for real time projects.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe and Apply preprocessing, Modeling, Evaluation and concept learning for the given problem.	2, 3	-
2.	Design and Develop various supervised and unsupervised machine learning algorithms for solving the given problem	3, 5	1, 2
3.	Illustrate the Neural networks, Bayesian learning and other forms of learning for the given problem	3, 4, 5	1
4.	Implement various machine learning algorithms for a given data sets.	3, 5	1, 2

Course Contents

MODULE - 1

10 Hrs

Introduction to Machine learning: Human learning and its types, Machine learning and its types, Applications, tools and issues in machine learning, Activities in machine learning, Types of data, Exploring structure of data, Data quality and Preprocessing.

Modelling and Evaluation: Introduction, Selecting a model, training a model, model representation and interpretability, Evaluating performance of a model.

MODULE - 2

10 Hrs

Learning Problems and Concept Learning: Well Posed learning problems, Designing a Learning systems, Concept Learning Tasks, Search, Find-S, Version Spaces and Candidate Elimination Algorithm, Inductive bias.

Supervised Learning: Introduction, example, classification model, classification learning steps, and Common algorithms – KNN, Decision Tree, and Random forest model.

MODULE - 3

10 Hrs

Supervised Learning (contd.): SVM, Regression-Simple linear regression, Multiple linear regression, Assumptions in Regression analysis.

Unsupervised Learning: Supervised Vs Unsupervised, Application, clustering, Finding pattern using Association rule.

MODULE - 4

10 Hrs

Basics of Neural Networks: Exploring the artificial neuron, Types of activation function, Early implementations of ANN, Architectures of NN, Learning process in ANN, Backpropagation algorithm.

Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Bayesian Belief Networks.

Other types of Learning – Representation learning, Active Learning, Instance based Learning, Association rule Learning, Ensemble learning

Practical Component:

1. Demonstration of Python Libraries for Machine Learning-Pandas, Sklearn, numpy, matplotlib.
2. Demonstration of Exploratory Data Analysis and Data Visualization.
3. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
4. For a given set of training data examples stored in a .CSV file, implement and demonstrate the

Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

5. Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
 6. Write a program to demonstrate the working of the decision tree based ID3 **algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
 7. Implement a clustering algorithm using K-means clustering for the given dataset.
 8. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
 9. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Text Books:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019
 2. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. T. Hastie, R. Tibshirani, J. H. Friedman, *The Elements of Statistical Learning*, Springer; 1st edition, 2001
 2. Bishop, C. ,M., *Pattern Recognition and Machine Learning*, Springer, 2006
 3. Yegnanarayana B. *Artificial Neural Netwroks* PHI Learning Pvt., Ltd.
 4. Ethem Alpaydin, *Introduction to Machine Learning*, 2nd Ed., PHI Learning Pvt. Ltd., 2013

MOOCS:

1. https://swayam.gov.in/nd1_noc19_cs52/preview
 2. <https://www.coursera.org/learn/machine-learning/>
 3. <https://nptel.ac.in/courses/106105152>

Course Articulation matrix

Course Title		COMPUTER NETWORKS		
Course Code	22CS602	L-T-P-C	(3-0-2)4	
Exam Hrs.	3	Hours / Week	5	
SEE	50 Marks	Total Hours	40L+12P	

Course Objective: Acquire knowledge of working mechanisms of different types of Networks, Address Mechanisms and Protocols.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Recognize the importance of the Network Layer Services, different versions of IP and Network addressing mechanisms	1,2	-
2.	Analyse the performance of Unicast and Multicast routing algorithms and their uses	2,4,5	-
3.	Design and apply the Transport Layer Protocols for different services.	2,4,5	-
4.	Apply and Investigate the use of different QoS models and their applications	1, 2,4	-

Course Content

MODULE-1		12 Hrs
Network Layer: Network Layer Services, IPv4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, NAT; Network Layer Protocols: Internetwork Protocol: Datagram format, Fragmentation, Options, Security of IPV4 Datagrams; ICMPv4: Messages, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.		
MODULE-2		12 Hrs
Unicast Routing: Introduction: General Idea, Least Cost Routing; Routing Algorithms: Distance Vector, Link-State Routing , Path-Vector Routing; Unicast Routing Protocols: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4); Multicast Routing: Introduction: Unicasting, Multicasting, Broadcasting; MULTICASTING BASICS: Multicast Addresses, Delivery at Data-Link Layer, Collecting Information about Groups, Multicast Forwarding, Two Approaches to Multicasting.		
MODULE-3		12 Hrs
INTRADOMAIN MULTICAST PROTOCOLS: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF) Protocol Independent Multicast (PIM); INTERDOMAIN MULTICAST PROTOCOLS: IGMP: Messages, Propagation of Membership Information, Encapsulation; Next Generation IP: IPV6 Addressing ,The IPV6 Protocol; Transport Layer protocols: Introduction: Services, Port Numbers, User Datagram Protocol(UDP): User Datagram, UDP Services, UDP Applications.		
MODULE-4		12 Hrs
Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, Windows in TCP ; Flow Control, Error Control, TCP Congestion Control; TCP Timer and Options; Stream Control Transmission Protocol (SCTP): Services, Features, Packet Format and Association; Quality of Services: Data Flow Characteristics; Flow Control to Improve QoS: Scheduling, Traffic Shaping or Policing, Resource Reservation, Admission Control; INTEGRATED SERVICES (INTSERV): Flow Specification, Admission, Service Classes, Resource Reservation Protocol (RSVP). DIFFERENTIATED SERVICES (DFFSERV).		
Text Book: Behrouz A. Forouzan, Data Communications and Networking, Tata McGraw-Hill, 5th Edition		

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks—Fundamental Concepts and Keyarchitectures”, Tata McGraw- Hill, 2nd Edition.
 2. William Stallings, “Data and Computer Communication”, Pearson Education, 8th Edition.
 3. Nader F. Mir, Computer and Communication Networks, Pearson Education, 2014.

MOOCs:

1. <http://nptel.ac.in/courses/106105081/>
 2. <https://www.edx.org/course/computer-networks-internet-kironx-fhlcnx>

Laboratory Programs

1. Learn Networking Commands
 2. Simulation of error correction code (like CRC).
 3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes.
 4. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
 5. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets sent with different types of traffic.
 6. Implement distance vector algorithm to find the suitable path for transmission between sender and receiver.
 7. Simulation of Link State Routing algorithm.
 8. Simulation of Routing Information Protocol.
 9. Simulate an Ethernet LAN using n nodes, change error rate and data rate and compare throughput.
 10. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Course Articulation matrix

Course Title	FINITE AUTOMATA AND FORMAL LANGUAGES		
Course Code	22CS603	L-T-P-C	(3-1-0)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40L+10T

Course Objective: To design grammar production for the programming constructs.

Course Outcomes (COs) : Upon Completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe various automata to write grammar productions	1	-
2.	Apply appropriate automata to obtain grammar productions	1,2	-
3.	Design automata for a given programming construct	3	-
4.	Construct an automata and grammar for a given scenario using a simulation tool	3,5	1,2

Course Contents:

MODULE – 1

10 Hrs

Introduction to Finite Automata: Why Study Automata Theory? The Central Concepts of Automata Theory.

Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, on-Deterministic Finite Automata, Finite Automata with Epsilon-Transitions.

MODULE – 2

10 Hrs

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions.

Properties of Regular Languages: Proving Languages Not to Be Regular – Pumping Lemma, Closure Properties of Regular Languages, Equivalence and Minimization of Automata.

MODULE – 3

10 Hrs

Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Pushdown Automata: Definition of the Pushdown Automata, The languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

MODULE – 4

10 Hrs

Properties of Context-Free Languages: Normal Forms for Context-Free Grammars- Eliminating Useless symbols, Eliminating epsilon productions, Eliminating Unit productions, Chomsky Normal Form (CNF), Griebach Normal Form (GNF).

Introduction to Turing Machines: Problems that Computers cannot Solve, The Turing Machine Programming Techniques for Turing Machines.

Text Book:

John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2013.

Reference Books:

1. Peter Linz, An Introduction to Formal Languages and Automata, IV Edition, Narosa Publishing House, 2011.
 2. John C Martin, Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.

MOOCs

<http://elearning.vtu.ac.in>

Activity:

1. Designing of DFA, NFA, Grammar productions using JFLAP tool.
 2. Solve real time application problems like:
 - a. Assume a scenario of an online shopping store which uses electronic money. Identify the events and states for this scenario and design an automata individually for
 - i. Customer
 - ii. Bank
 - iii. Store
 - b. Design an automata to verify the authentication of the user before allowing them to access the confidential information.(Assume the user password is 101101)
 - c. Construct a Finite Automata to search your name in your class attendance list.
 - d. Assume you go for shopping a trouser searching for particular fabric and of particular color. Design grammar for the above scenario.

Course Articulation matrix

MINI PROJECT									
Course Code	22CS604	L-T-P-C		(0-0-4)2					
Exam Hrs.	3	Hours / Week		4					
SEE	50 Marks	Total Hours		52					
Course Objective: Design and implement solution for an identified real world problem.									
Course Outcomes (COs): Upon completion of course the students will be able to:									
#	Course Outcomes			Mapping to POs					
1.	Identify the requirements of a chosen real world problem			1,2,6,7					
2.	Design the solution for the chosen problem and document the same.			1,3,4,10					
3.	Implement the design using appropriate tools			3,5,8,11					
4.	Demonstrate the project work along with report			1, 5,10					
5.	Demonstrate the ability to work effectively as a project member.			1,9					
<ul style="list-style-type: none"> • A team of FOUR students must develop the mini project. However, during the final evaluation, each student must demonstrate the project individually. • The team shall implement a mini project on Web programming and DBMS domain. • The team must submit a Brief Project Report (25 to 30 Pages) after completion with the following contents <ul style="list-style-type: none"> • Introduction • Requirements • Development Process and Models Adopted • Analysis and Design Models • Implementation • Testing • The project report will be evaluated for 25 marks, Demonstration for 50 marks and Viva Voce for 25 marks. 									
Rubrics for Evaluation of Mini Project (Inter-Discipline)									
Phase I (Project Proposal Submission and Evaluation Scheme):									
After finalizing the topic with the guidance of Supervisor, students should submit the project proposal along with Synopsis not exceeding 10 pages. Approval of synopsis is done for 15 marks by concerned project committee.									
Sl. No	Performance Indicators	Needs Improvement (0-1 mark)	Average (2-3 marks)	Good (4-5 marks)	Max marks				
1	Literature Survey	Survey of literature is not recent or no literature survey	Survey of literature is not clear	Literature survey is sufficient.	5				
2	Synopsis writing	Objective of the work is not identified.	Objective of the work is identified but no evidence of Inter disciplinary approach found.	Objective of the work is identified with evidence of Inter disciplinary approach found.	5				
3	Presentation	Contents not delivered completely.	Contents not delivered clearly.	Contents delivered clearly with confidence.	5				
Total					15				

Phase II (Project Progress):					
Evaluation of project phase II is carried out by evaluation committee.					
Sl. No.	Performance Indicators	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Max marks
1.	System design and development	System specification is not identified.	System specification is identified but not satisfactory.	System specification is identified correctly.	5
2.	Identification of appropriate tool for application	Application tools are not identified.	Application tools identified but not used.	Application tools identified and used.	5
3.	Oral presentation	Entire contents not delivered.	Contents not delivered clearly.	Contents delivered clearly with confidence.	5
Total					15

Phase III (Project Demonstration with Report):					
Evaluation of this phase is done by evaluation committee.					
Sl. No	Performance Indicators	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Total marks allocated
1.	Design and Implementation	Not done	Incomplete.	Complete.	5
2.	Demonstration	Incomplete	Complete but not satisfactory.	Complete and satisfactory	5
3.	Documentation	Organization and clarity of report and technical content is not clear and complete	Organization and clarity of report and technical content is clear but not complete.	Organization and clarity of report and technical content is clear and complete.	5
4.	Oral presentation	Presentation with ppt is not clear.	Presentation with ppt is clear but not satisfactory	Presentation with ppt is clear and satisfactory.	5
Total					20

Semester End Evaluation								
Evaluation committee consists of panel of examiners containing external as well as internal evaluators. This evaluation is carried out for 50 marks.								
SN	Performance Indicators			Marks allocated	Marks awarded			
Project execution	Project specification		5	5				
	Progress							
Methodology /Result Analysis	System Design		5	5				
	System Implementation							
	System Testing							
Project Report	Organization and Clarity		5	5				
	Technical content							
	Conclusion and Future Work							
Final presentation			10					
Total Marks			50					

Rubrics for Semester End Exam

	Marks	Overall criteria
1.	48-50	Project is reaching professional standards.
2.	40-47	Project is excellent and may contain publishable material. Presentation is excellent.
3.	35-39	Project and presentation are very good. All design aims are met.
4.	30-34	Project and presentation are good. Most design aims are met.
5.	25-29	Minimum core of design aims has been met. Presentation is satisfactory.
6.	20-24	Design aims and implementation are met partially. Presentation is moderate.
7.	0-20	Most design aims are not met and implementation does not work. Presentation is not satisfactory.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	-	3	3	-	-	-	-	-	3	-	-	3	3
CO3	-	-	3	-	3	-	-	2	-	-	2	-	3	3
CO4	3	-	-	-	3	-	-	-	-	3	-	-	3	3
CO5	3	-	-	-	-	-	-	-	3	-	-	-	-	-

Course Title		MAIN PROJECT PHASE - I		
Course Code	22CS605	L-T-P-C	(0-0-4)2	
Exam Hrs.	3	Hours / Week	4	
SEE	50 Marks	Total Hours	-	
Course Objective:		To be able to identify a relevant problem that requires technical solution and conduct survey for the same.		
Course Outcomes (COs):		Upon the completion of the course the students will be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs	
1.	Identify a problem, through Extensive literature Survey leading to publication of a survey paper.	1,2	-	
2.	Plan & design the solution to the chosen problem	3	2	
3.	Make oral presentation and documentation of the work carried out	9,10	-	
Course Contents:				
<p>During VII semester, candidates in consultation with the guides shall carry out literature survey to finalize the topic of the project. <i>The same project will be continued in Eighth semester.</i> Students are expected to present the project synopsis, system analysis, requirements specification and should publish a technical paper on Literature Survey. The evaluation will be carried out in three stages</p> <ul style="list-style-type: none"> • Project Stage 1 – Team Formation , Topic Selection & Guide allotment (No marks) • Project Stage 2 – Extensive Literature Survey , Problem Definition • Project Stage 3 – Preliminary Design, Report Preparation and Publication <p>The evaluation of the project phases shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinator in consultation with the Head of the department. <i>For Multidisciplinary projects guides will be allotted from each concerned branch.</i></p>				
Performance Indicators	Low (40%)	Medium(70%)	High(100%)	
Literature Survey and Problem Definition (20 Marks)	Literature Survey not pertaining to the title of the project (8)	Incomplete literature survey and improper problem definition (14)	Extensive literature survey with clear state of the art problem definition (20)	
Preliminary Design (10 Marks)	Has no coherent strategies for problem Solving (4)	Has some strategies for problem – solving, but does not apply them consistently (7)	Formulates strategies for solving problems (10)	
Presentation (10 marks)	Disorganized and ineffective presentation (4)	Organized, but ineffective presentation (7)	Effective organized presentation (10)	
Report Preparation (30 Marks)	Disorganized and contents are not sufficient	Organized but not good content wise	Effectively organized and well framed contents	
Paper Publication (20 Marks)	Paper submitted & awaiting results (8)	National conference International Conference (14)	Journal (20)	

Punctuality (Project Dairy Maintenance) (10 marks)	Not meeting the guide regularly (4)	Meeting regularly but doesn't document details of every session (7)	Up to date dairy maintenance(10)
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Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-

Course Title		APPLICATION DEVELOPMENT LABORATORY					
Course Code	22CS606A				L-T-P-C		(0-0-2)1
Exam Hrs.	3				Hours / Week		2
SEE	50 Marks				Total Hours		14P

Course Objective: Design and develop apps for android devices.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop simple applications, using built-in widgets and components of android studio.	3,5,9	1,2
2.	Document the apps designed.	10	1

Course Contents:

1. Develop an android application which accepts the SGPA of all the six semesters and displays your CGPA.
2. Develop an android application to login into a system which is redirected to the Home screen.
The login should be successful on
email: admin@example.com
password: rtWi2p_10
If the email/password is invalid display a Toast with an error message
3. Assume you are accepting employee details: Name, Designation, Salary, Phone number. Develop app that displays an alert message if phone number entered is more than 10 digits.
4. Design an app that displays the names of all planets in our universe. Clicking on “Solar System” in first activity should display all the planet’s names in second activity and it should return the total number of planets to first activity.
5. Develop a QUIZ app that displays a question with four answers as options. Clicking an option should display whether the selected option is right or wrong.
6. Assume you need to accept order online for fast food items. Design an app such that it accepts the order for multiple items and displays the total amount to be paid on placing the order.
7. Design an app to display menu options on clicking a button “FILE”. The menu options are: New, Open, Save, Save as, And Print. Clicking on any option should display the relevant information.
8. Design an app to accept your name, roll number and branch programmatically.
9. Develop an android application to list all the engineering branches of MCE and displays a brief information of any department which the user clicks on in a separate page.
10. Consider a scenario where you need to send an email to multiple users. Design an app to implement the same.
11. Develop an android application to display a gallery view (Grid View) of at least 10 images.
12. Develop an android application to render the text data into Text View from the remote server. Show progress bar when the data is loading or Toast message if data fails to load.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	3		3	-	-	-	3	-	-	-	2	2
CO2	-	-	-	-	-	-	-	-	-	3	-	-	2	-

Course Title	FULL STACK DEVELOPMENT LABORATORY		
Course Code	22CS606B	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	14P

Course Objective: To gain knowledge of full-stack development.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Implement Web Pages using Basic and Advanced HTML	2, 5	-
2.	Develop a complete web application for a given scenario	3, 5, 9, 12	-

Course Contents:

1. HTML and CSS Webpage:

Create a simple webpage that showcases your favorite hobby. Use HTML to structure the content and CSS to style the page, including adding colors, fonts, and images.

2. JavaScript Form Validation:

Develop a web form with fields for name, email, and password. Implement JavaScript validation to ensure that all fields are filled correctly before submitting the form.

3. Node.js Server with Express:

Build a basic server using Node.js and Express. Create routes to handle HTTP requests like GET and POST and respond with simple JSON data.

4. Database Integration:

Extend the previous Node.js server by integrating a database (e.g., SQLite or MongoDB). Implement endpoints to perform CRUD operations on a dataset.

5. RESTful API:

Design and implement a RESTful API using Node.js, Express, and a database of your choice. Define endpoints for managing resources, such as creating, reading, updating, and deleting data.

6. React Component Library:

Create a library of reusable React components. Build components like buttons, cards, and modals and use them in a sample React application.

7. Write a program to create a simple calculator Application using React JS.

8. Create a Simple Login form using React JS.

9. Full-Stack Task Manager:

Develop a task manager application with React on the front end and Node.js/Express on the back end. Allow users to add, update, and delete tasks.

10. Real-Time Chat Application:

Build a real-time chat application using React for the front end and Node.js with Socket.IO for the back end. Enable users to send and receive messages in real-time.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	3	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	3	-	-	-	3	-	-	2	-	-

Course Title	INTRODUCTION TO COMPUTER VISION		
Course Code	22CS661	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To learn basic principles of image formation, image processing algorithms and different algorithms for recognition from single or multiple images (video).

Course Outcome: Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain Image formation process	1	-
2.	Perform shape analysis	3	-
3.	Develop applications using computer vision techniques	2	-
4.	Explain video processing and motion computation	1	-

Course Content

MODULE – 1	10 Hrs
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Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration.

MODULE – 2	10 Hrs
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Early Vision – One Image: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Local Image Features, Texture.

MODULE - 3	10 Hrs
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Early Vision – Multiple Images: Stereopsis and Structure from Motion

Early Vision – Mid-level Vision: Segmentation by Clustering, Grouping and Model fitting, Tracking.

MODULE – 4	10 Hrs
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High-level Vision: Registration, Smooth Surface and their Outlines, Range Data Detecting Objects in Images, Recognition.

Text Books:

1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer, 2nd edition, 2020, <http://szeliski.org/Book/>

2. Computer Vision – A modern approach, by D. Forsyth and J. Ponce, Prentice Hall, 2nd edition, 2012

Reference Books:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.

3. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University, Press, 2012

5. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

6. Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in OpenCV And Tensorflow With Python, Shamshad Ansari, Apress, 2020

Course Articulation matrix

Course Title	ARTIFICIAL INTELLIGENCE		
Course Code	22CS662	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Students will be able to apply the concepts of Artificial Intelligence to construct knowledge-based.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe different types of Artificial Intelligence agents and search strategies.	1	-
2.	Analyze different search strategies for a given problem.	2	-
3.	Design simple knowledge-based systems using first-order logic.	2,3	2
4.	Analyze different learning techniques.	2	-

Course Contents:

MODULE – 1 **10 Hrs**

Introduction: What is AI? Intelligent Agents: Agents and environment; Good behavior: The Concept of Rationality; The nature of environment; The structure of agents. Problem-solving: Problem-solving agents. Example problems; Searching for solution; Uninformed search strategies: Breadth-first search, Uniform- cost search.

MODULE – 2 **10 Hrs**

Uninformed search strategies: Depth-first search, Depth-limited search, Iterative deepening depth first search, Bidirectional search, Comparing uninformed search strategies; Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Optimality of A*, Memory-bounded heuristic search; Heuristic functions; Local Search Algorithms and Optimization Problems: Hill-climbing search, Simulated annealing, Local beam search, Genetic algorithms.

MODULE – 3 **10 Hrs**

On-line search agents and unknown Environments: Online search problems, Online search agents, online local search, learning in online search, Logical Agents: Knowledge-based agents; The Wumpus world; First-Order Logic: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic, Knowledge engineering in first-order logic.

MODULE – 4 **10 Hrs**

Learning from Examples: Forms of Learning; supervised learning; Learning decision trees; Practical Machine Learning. Statistical and Reinforcement learning: Statistical learning, maximum likelihood parameter learning, Bayesian parameter, learning, passive reinforcement learning, active reinforcement learning.

Text Book:

Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Third edition, Pearson, 2014.

Reference Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B Nair, Third edition, McGraw- Hill Education, 2015.
2. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	-	-

Course Title	WIRELESS NETWORKS		
Course Code	22CS663	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50Marks	Total Hours	40

Course Objective: Gain knowledge of various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.

CourseOutcomes(COs):Uponcompletionofthecourse,studentsshallbeableto:

#	Course Outcomes	Mapping To POs	Mapping To PSOs
1.	Explain fundamentals of wireless communications.	1	-
2.	Analyse security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.	2	-
3.	Demonstrate basic skills for cellular networks design.	3	-
4.	Apply knowledge of TCP/IP extensions for mobile and wireless networking.	1	-

Course Contents:

MODULE-1	10 Hrs
Introduction: Wired Network vs. Wireless Network, Overview of Wireless Applications, Wireless Transmission: Path loss, Multi-path propagation, Doppler shift, Fading, Time Division Multiplexing, Frequency Division Multiplexing, Code, Spread Spectrum Technique, Satellite Communication;	
MODULE-2	10 Hrs
CELLULAR SYSTEM: Cellular Network Organization, Cellular System Evolution, Cellular Fundamentals: Capacity, Topology, Operation of Cellular Systems, Handoff, Power control, Case study: Global System for Mobile communication (GSM) Network, General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA 2000), Cordless System, Wireless Local Loop, Mobility Management-Location Management, HLR-VLR scheme, Hierarchical scheme, Predictive location management schemes;	
MODULE-3	10 Hrs
WIRELESS NETWORK: Protocols: Media Access Protocol, Mobile IP, Mobile Transport Layer Protocol, Wireless Access Protocol, Ad-Hoc Networks and Routing, Standards: IEEE 802.11, Wi-Fi, Wireless Broadband-Wi-MAX, Bluetooth, IEEE 802.15, Security in Wireless Network, Hyper LAN.	
MODULE-4	10 Hrs
MOBILE COMPUTING: Mobile Computing, Issues: Resource Management, Interference, Bandwidth, Cell Splitting, Frequency reuse, Mobile Data Transaction Models, File Systems, Mobility Management, Security.	

Text Books:

1. William Stallings, "Wireless Communications & Networks", 2/E, Pearson Education India, Reprint 2007.
2. Jochen Schiller, "Mobile Communications", 2/E, Pearson Education India, reprint 2007

Reference Books:

1. Sandeep Singhal, "The Wireless Application Protocol" , Addison Wesley, India, reprint 2001
2. T S Rappaport, "Wireless Communications: Principles & Practice", 2/E, Pearson Education, 2002.

3. C E Perkins, "Ad Hoc Networking", Addison Wesley, 2000.

MOOCs:
https://onlinecourses.nptel.ac.in/noc20_ee61/preview

Course Articulation matrix

Course Title	SOFTWARE ARCHITECTURE		
Course Code	22CS664	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Learn the principles and concepts of applying various design patterns in designing a wide variety of software systems.

Course Outcomes (COs) : Upon the completion of the course the students will be able to :

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify the significance of software architecture.	1	-
2.	Apply quality attributes to create an architecture for the given application.	2	-
3.	Analyze the architectural pattern to build the system from components.	2	-
4.	Create documentation relevant to the chosen architecture.	1,10	2

Course Contents:

MODULE – 1	10 Hrs
<p>What Is Software Architecture? : What Software Architecture Is and What It Isn't; Architectural Structures and Views; Architectural Patterns; What Makes a "Good" Architecture? Why Is Software Architecture Important? Inhibiting or Enabling a System's Quality Attributes; Reasoning About and Managing Change ; Predicting System Qualities; Enhancing Communication among Stakeholders; Carrying Early Design Decisions ; Defining Constraints on an Implementation; Influencing the Organizational Structure ; Enabling Evolutionary Prototyping Improving Cost and Schedule Estimates ;Supplying a Transferable, Reusable Model; Allowing Incorporation of Independently Developed Components; Restricting the Vocabulary of Design Alternatives; Providing a Basis for Training; The Many Contexts of Software Architecture: Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?, What Do Architectures Influence?, Quality Attributes Understanding Quality Attributes; Architecture and Requirements ; Functionality; Quality Attribute ;Considerations ; Specifying Quality Attribute; Requirements ; Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions.</p>	

MODULE – 2	10 Hrs
<p>Availability: Availability General Scenario; Tactics for Availability; Modifiability: Modifiability General Scenario; Tactics for Modifiability Performance: Performance General Scenario; Tactics for Performance; Security: Security General Scenario; Tactics for Security;</p>	

MODULE – 3	10 Hrs
<p>Architectural Patterns – 1: Introduction; from mud to structure: Layers, Pipes and Filters.</p>	
<p>Architectural Patterns – 2: Distributed Systems: Broker;</p>	
MODULE – 4	10 Hrs

Architectural Patterns – 3: Adaptable Systems: Microkernel; **Some Design Patterns:** Structural decomposition: Whole – Part;

Documenting Software Architectures: Uses and Audiences for Architecture; Documentation; Notations for Architecture; Documentation; Views; Choosing the Views; Combining Views; Building the Documentation Package; Documenting Behavior; Architecture Documentation and Quality Attributes; Documenting Architectures That Change Faster Than You Can Document Them.

Text Books:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3rd Edition, Addison-Wesley, 2013.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2009.

Reference Books:

1. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2008.
2. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	2	-	-	-	2

C# PROGRAMMING AND .NET			
Course Code	22CS665	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Students will be able to develop various console and windows applications.

Course Outcomes(COs):Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop programs that use reusability properties and namespaces.	3	-
2.	Design applications using classes, methods, interfaces and inheritance techniques and manage exceptions.	1, 3	-
3.	Create delegates, packages and manage database.	2, 3	-
4.	Demonstrate windows application system and build their own applications	3	1

Course Contents:

MODULE – 1		10 Hrs
<p>Overview of C#:Introduction , A Simple C# Program, Namespaces , Adding Comments, Main Returning a Value, Using Aliases for Namespace Classes, Passing String Objects to WriteLine Method, Command Line Arguments, Main with a Class, Providing Interactive Input, Using Mathematical Functions, Multiple Main Methods, Compile Time Errors. Literals, Variables and Data Types: Introduction, Literals , Variables , Data Types , Value Types Reference Types, Declaration of Variables , Initialization of Variables , Default Values ,Constant Variables , Scope of Variables , Boxing and Unboxing. Operators and Expressions : Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators , Special Operators ,Arithmetic Expressions, Evaluation of Expressions ,Precedence of Arithmetic Operators, Type Conversions ,Operator Precedence and Associatively. Mathematical Functions. Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if... else Statement, Nesting of if... else Statements, The else if Ladder, The Switch Statement The? : Operator. Decision Making and Looping: Introduction, The while Statement The do Statement, The for Statement, The foreach Statement. Methods in C#:Introduction, Declaring Methods, The Main Method, Invoking Methods, Nesting of Methods, Method Parameters, Pass by Value, Pass by Reference, The Output Parameters, Variable Argument Lists, Methods Overloading. Handling Arrays: One-Dimensional Arrays, Creating an Array, Two- Dimensional Arrays, Variable- Size Arrays, the System. Array Class. Manipulating Strings : Creating Strings, String Methods, Inserting Strings, Comparing Strings, Finding Substrings, Mutable Strings, Arrays of Strings</p>		
MODULE – 2		10 Hrs
<p>Classes and Objects :Introduction, Basic principles of OOP, Defining a Class, Adding Variables and Methods, Member Access Modifiers, Creating Objects, Accessing Class members, Constructors, Overloaded Constructors, Static Members, Static Constructors, Private Constructors, Copy Constructors, Destructors, Member Initialization. Inheritance and Polymorphism: Introduction, Classical Inheritance, Containment Inheritance, Defining a Subclass, Visibility Control, Defining Subclass Constructors, Multilevel Inheritance, Hierarchical Inheritance, Overriding Methods, Hiding Methods, Abstract Classes, Abstract Methods, Sealed Classes: Preventing Inheritance, Sealed Methods, The this reference, Nesting of Classes, Constant Members, Read-only Members, Properties, Indexers. Polymorphism, Interface: Multiple Inheritance, Multiple Inheritance: Introduction, Defining an Interface, Extending an Interface, Implementing Interfaces, Interfaces and Inheritance, Explicit Interface Implementation, Abstract Class and Interfaces.</p>		

<p>Operator Overloading: Introduction, Over loadable Operators, Need for Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Comparison Operators</p> <p>Delegates and Events: Introduction, Delegates, Delegate Declaration, Delegate Methods, Delegate Instantiation, Delegate Invocation, Using Delegates, Multicast Delegates, Events. Managing Errors and Exceptions: Introduction, What is Debugging? Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch statements, The Exception Hierarchy, General Catch Handler, Using Finally statement, Nested Try Blocks, Throwing our Own Exceptions, Checked and Unchecked Operators, Using Exceptions for Debugging.</p>	
MODULE – 3	10 Hrs
<p>Understanding. NET: The C# Environment: Building a Better Window (Introducing Windows Forms): Overview of the System. Windows. Forms Namespace, Working with the Windows Forms Types, The Role of the Application Class ,The Anatomy of a Form, The Functionality of the Control Class, The Functionality of the Form Class, Building Windows Applications with Visual Studio 2005, Working with MenuStrips and ContextMenuStrips, Working with StatusStrips.</p>	
<p>Programming with Windows Forms Controls: The World of Windows Forms Controls, Adding Controls to Forms by and, Adding Controls to Forms Using Visual Studio 2005, Working with the Basic Controls, Configuring the Tab Order, Setting the Form's Default Input Button, Working with More Exotic Controls, Building Custom Windows Forms Controls, Testing the CarControl Type, Building a Custom CarControl Form Host.</p>	
MODULE – 4	10 Hrs
<p>Data Access with ADO.NET: A High-Level Definition of ADO.NET, Understanding, DO.NET Data Providers, Additional ADO.NET Namespaces, The System. Data Types, Abstracting Data Providers Using Interfaces, Increasing Flexibility Using Application ,Configuration Files, The .NET 2.0 Provider Factory Model, The <connectionStrings> Element Installing the Cars Database, Understanding the Connected Layer of ADO.NET, Working with Data Readers, Modifying Tables Using Command Objects, Working with Parameterized Command Objects, Executing a Stored Procedure Using DbCommand, Asynchronous Data Access Under .NET 2.0,Understanding the Disconnected Layer of ADO.NET.</p>	
<p>ASP. NET Web Pages and Web Controls: The Role of HTTP, Understanding Web Applications and Web Servers, The Role of HTML, The Role of Client-Side Scripting, Submitting the Form Data (GET and POST), Building a Classic ASP Page, Problems with Classic ASP, The ASP.NET 2.0 Namespaces, The ASP.NET Web Page Code Model, Details of an ASP.NET Website Directory Structure, The ASP.NET 2.0 Page Compilation Cycle, The Inheritance Chain of the Page Type, Interacting with the Incoming HTTP Request, Interacting with the Outgoing HTTP Response, The Life Cycle of an ASP.NET Web Page, Understanding the Nature of Web Controls</p>	
<p>Text Books :</p> <ol style="list-style-type: none"> 1. Andrew Troelsen , "Pro C# and the .NET 3, Special edition, A Press, 2012 2. E. Balagurusamy," Programming in C# A Primer", 3rd edition, TMH, 2010. 	
<p>Reference Book:</p> <ol style="list-style-type: none"> 1. Tom Archer: Inside C#, WP Publishers, 2001. 	
<p>MOOCs:</p> <ol style="list-style-type: none"> 1. https://www.udemy.com/course/c-net-for-beginners/ 2. https://www.udemy.com/course/aspnet-webforms/ 	

Course Articulation matrix

Course Title	MANAGEMENT INFORMATION SYSTEMS		
Course Code	22CS666	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To describe the role of information technology and decision support systems in business .

Course Outcomes (COs) : Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to POs
1.	Describe basic concepts and technologies used in the field of management information systems.	1, 11	-
2.	Compare the processes of developing and implementing information systems.	1, 2	-
3.	Outline the role of the ethical, social, and security issues of information systems.	1,8	-
4.	Apply information systems to accomplish the objectives of an organization.	1, 10	-

Course Contents:

MODULE – 1

10 Hrs

Management Information System (MIS): Concept , MIS: Definition ,Role of the Management Information System , Impact of the Management Information System , MIS and the User , Management as a Control System , MIS: A Support to the Management , Management Effectiveness and MIS , Organisation as a System , MIS: Organisation Effectiveness , MIS for a Digital Firms

MODULE – 2

10 Hrs

System Engineering-Analys and design: System Concepts, System control, Types of system, Handling System Complexity, Classes of Systems, General Model of MIS, Need for system analysis, System analysis of the existing system, System analysis of a new requirements, System Development Model.

MODULE – 3

10 Hrs

Decision Support Systems and Knowledge Management: Decision Support Systems (DSS): Concept and Philosophy ,DSS Models: Behavioural, Management Science and Operations Research Models ,Group Decision Support System (GDSS) ,Artificial Intelligence (AI)system, Knowledge based Expert System (KBES) , DSS Application in E-enterprise , MIS and the Benefits of DSS.

MODULE – 4

10 Hrs

Technology of information system: Data processing, Transaction processing ,application processing, Information system processing, OLAP for Analytical Information ,TQM of Information System , Human Factors and User Interface , Real Time Systems and Good Design , Case Tools and I-Case , Strategic Nature of IT Decision , Evaluation and Feasibility of IT Solutions , MIS: Choice of the ‘Information Technology’

Text Book:

1. Jawadekar, W.S., "Management Information Systems", Tata McGraw Hill Private Limited, New Delhi, 2013, 5th edition.

Reference Books:

1. Goyal, D.P.: "Management Information System", MACMILLAN India Limited, New Delhi, 2008.
2. Mahadeo Jaiswal, Monika Mital: "Management Information System", Oxford University Press, New Delhi.
3. Kenneth C. Laudon and Jane P. Laudon: "Management Information Systems" 9/e, Pearson Education, New Delhi.

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	2	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	2	-	-	-	-

Course Title	INTRODUCTION TO CLOUD COMPUTING		
Course Code	22OECS61	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: To expose students to frontier areas of cloud computing service models and applications.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Uncover history and leverage elements of cloud computing	1	-
2.	Recognize the different virtualization techniques, architecture and types of clouds	2	-
3.	Ascertain different cloud platforms and adopt Cloud Computing services and tools in real life scenarios.	2,7	-
4.	Integrate new standards for access management, security and privacy at different levels of cloud services	6,8	-
5.	Develop and deploy an application for cloud platform	5,9,10,12	1,2

Course Contents:

MODULE – 1	10 Hrs
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Introduction: Cloud computing at a glance, historical developments, building cloud computing environments, computing platforms and technologies. **Principles of parallel and Distributed computing:** Eras of computing, parallel vs. Distributed computing, elements of parallel computing, elements of distributed computing, technologies for distributed computing.

MODULE – 2	10 Hrs
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Virtualization: Introduction, characteristics of virtualized environments, Taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization technology.

Cloud Computing architecture: Introduction, Cloud reference model, types of clouds, economics of the cloud, open challenges.

MODULE – 3	10 Hrs
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Cloud platforms in industry: Amazon Web Services, Google AppEngine, Microsoft Azure.

Advanced topics in cloud computing: Energy efficiency in clouds, Market based management of clouds, Federated clouds/Inter clouds, Third party cloud services.

MODULE – 4	10 Hrs
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Infrastructure security, IAM: **Infrastructure security:** network level, host level, application level,

Identity and Access management: trust boundaries and IAM, why IAM? IAM challenges, IAM definitions, IAM architecture and practices, getting ready for cloud, IAM standards and protocols for cloud services, IAM practices in the cloud, cloud authorization management;

Security management in the cloud: security management standards, security management in the cloud, availability management, Saas, Paas. Iaas availability management, access control, security vulnerability, patch and configuration management. **Privacy:** What is privacy? What is data life cycle? What are the key privacy concerns in cloud? who is responsible for protecting privacy?

Text Books:

1. Mastering Cloud Computing, McGraw Hill publication, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi
2. Cloud security and privacy an enterprise perspective on risks and compliances,2013, Tin Mather, Subra Kumarswamy, Shahed Latif

Reference Books:

1. Cloud Computing: Theory and Practice, Dan C Marinescu, first edition, MK publishers.
2. Cloud Computing- A practical approach, McGraw Hill publication, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter.

MOOCs:

1. <https://www.youtube.com/watch?v=Eg4AAGCE7X4>
2. <https://www.coursera.org/learn/cloud-computing>
3. <https://www.edx.org/course/introduction-cloud-computing-microsoft-cloud200x>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-		2	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	3	2	-	2	3	2

Course Title	INTRODUCTION TO JAVA PROGRAMMING		
Course Code	22OECS62	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40

Course Objective: Develop java application programs using object-oriented concepts.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Explain Object Oriented concepts and basics of java programming	1	-
2	Analyze the given code snippet	2	-
3	Develop a java program for the given problem.	3	-

Course Contents:

MODULE – 1 **10 Hrs**

Object Oriented Concepts and Java: Concepts of Object-Oriented programming language: Object, Class, Message passing, inheritance, encapsulation, and polymorphism Difference between OOP and other conventional programming – advantages and disadvantages of OOP.

Java Programming Fundamentals: The Byte Code, The Java Buzzwords, A first Simple program, The Java Keywords, Identifiers in Java.

Data Types and Operators: Java's Primitive Types, The Scope and Lifetime of Variables, Operators: Arithmetic, Bitwise, Relational, Boolean Logical, Assignment Operators, the '?' Operator, Type conversion and Casting, Arrays, Strings

MODULE – 2 **10 Hrs**

Program Control Statements: Input characters from the Keyboard, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, While Loop, do-while Loop, Use of break and continue.

Introducing Classes, Objects and Methods: Class Fundamentals, Declaring Objects, Object Reference Variables, Methods, Constructors, the "This" keyword, Garbage collection, Overloading Methods and constructors, Argument Passing, Returning Objects, Access Control, Understanding Static, Nested and Inner Classes.

MODULE – 3 **10 Hrs**

Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors and inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why overridden Methods, Using Abstract Classes, Using final.

MODULE – 4 **10 Hrs**

Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Implementing Multiple Interfaces, Packages: Package Fundamentals, Packages and Member Access, Importing Packages.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and Catch, Multiple catch Clauses, throw, finally.

Text Book:

Java –The complete Reference, Herbert Schildt, Eight Edition, Tata Mcgraw Hill Education

Reference Books:

1. Programming in JAVA2, Dr K Somasundaram ,Jaico publications
2. Java Programming ,Hari Mohan Pandey, Pearson Education, 2012.
3. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson.

MOOCs:

1. <http://nptel.ac.in/courses/106106147/>
 2. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
 3. https://www.youtube.com/watch?v=0KL_zfem4g
 4. <https://www.coursera.org/specializations/object-oriented-programming>

Course Articulation matrix

Course Title	ANALYTICAL ABILITY AND SOFT SKILLS		
Course Code	22ASK	L-T-P	(0-0-2)1
Exam	1	Hours/Week	2
SEE	50 Marks	Total Hours	24

This course will be conducted at the end of fifth semester for two weeks by TAP department.

Course Objective: To Enhance problem solving skills and communication skills

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

#	Course Outcomes	Mapping toPO's	Mapping to PSO's
1.	Apply methods to solve numerical and reasoning problems	2,3	-
2.	Lead a team in corporate offices	8,9	-
3.	Communicate effectively in professional ambience	10	-

Course Content

MODULE – 1

Hard Skills: Speed/Distance, Probability, Permutations/Combinations, Profit/Loss, Simple Interest/Compound Interest, Number theories, Number/Letter series, Coding/Decoding, Blood relations, Directions, Clock, Calendar. Logical reasoning problems

MODULE – 2

Soft Skills: Basic grammar, Spotting errors, Sentence formation, Email writing, Public speaking, Client communication, Leadership, Managerial skills, Stress management, Presentation Skills

MODULE -3

Technical Skills: Review of C programming, Simple coding, Syntax rules, MCQs on C language.

MODULE -4

Activities: GD, JAM, Mock Interview, Pick and speak, Presentation

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-