ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES (A)
(UGC Autonomous)
Approved by AICTE, Affiliated to Andhra University, Accredited by
N.B.A. & NAAC with 'A' Grade
(Estd : 2001)

2022-23

Academic Regulations (R20-CSE) Curriculum & Syllabi

(III Year II Semester)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION

Our vision is to emerge as a world class Computer Science and Engineering department through excellent teaching and strong research environment that responds swiftly to the challenges of changing computer science technology and addresses technological needs of thestakeholders.

MISSION

To enable our students to master the fundamental principles of computing and to develop in them the skills needed to solve practical problems using contemporary computer-based technologies and practices to cultivate a community of professionals who will serve the public as resources on state-of-the-art computing science and information technology.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1	Employability	Work as Competent Computer Engineer either globally or locally by engaging in professional practice in a variety of roles with ability to serve as a team or individual.
PEO-2	Higher studies	Prepared to pursue masters or research programmes in computer science or otherdisciplines.
PEO-3	Entrepreneurship	Become successful Entrepreneurs who demonstrate strong technical and leadership skills to bring out innovative designs/products that alsoaddresses social issues.
PEO-4	Lifelong learning andethics	Adapt to rapidly changing technology in engineering domains through continuous learningand practice code of ethics.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1	Programming and software Development skills: Ability to acquire programming efficiency to analyze, design and develop optimal solutions, apply standard practices in software project development to deliver quality software product.
2	Computer Science Specific Skills: Ability to formulate, simulate and use knowledge in various domains like data engineering, image processing and information and network security, artificial intelligence etc., and provide solutions to new ideas and innovations

PROGRAM OUTCOMES (POs)

Graduate Attribute1:	Engineering Knowledge
PO-1	Apply the knowledge of basic engineering sciences, humanities, core engineering and computing concept in modeling and designing computer based systems.
Graduate Attribute2:	Problem Analysis
PO-2	Identify, analyze the problems in different domains and define the requirements appropriate to the solution.
Graduate Attribute3:	Design/Development of Solution
PO-3	Design, implement & test a computer-based system, component or process that meet functional constraints such as public health and safety, cultural, societal and environmental considerations.
Graduate Attribute4:	Conduct Investigations of Complex Problems
PO-4	Apply computing knowledge to conduct experiments and solve complex problems, to analyze and interpret the results obtained within specified timeframe and financial constraints consistently.
Graduate Attribute5:	Modern Tool Usage
PO-5	Apply or create modern techniques and tools to solve engineering problems that demonstrate cognition of limitations involved in design choices.
Graduate Attribute6:	The Engineer and Society
PO-6	Apply contextual reason and assess the local and global impact of professional engineering practices on individuals, organizations and society.
Graduate Attribute7:	Environment and Sustainability
PO-7	Assess the impact of engineering practices on societal and environmental sustainability.
Graduate Attribute8:	Ethics
PO-8	Apply professional ethical practices and transform into good responsible citizens with social concern.
Graduate Attribute9:	Individual and Team Work
PO-9	Acquire capacity to understand and solve problems pertainingto various fields of engineering and be able to function

	effectively as an individual and as a member or leader in ateam.
Graduate Attribute10:	Communication
PO-10	Communicate effectively with range of audiences in both oral and written forms through technical papers, seminars, presentations, assignments, project reports etc.
Graduate Attribute11:	Project Management and Finance
PO-11	Apply the knowledge of engineering, management and financial principles to develop and critically assess projectsand their outcomes in multidisciplinary areas.
Graduate Attribute12:	Life-long Learning
PO-12	Recognize the need and prepare oneself for lifelong selflearning to be abreast with rapidly changing technology.

III Year II Semester Course Structure

CODE	SUBJECT NAME	Category	Scheme of instruction			Sessional marks	Semester end Exam marks	Total Marks	Credits
			L	T	P				
CSE321	Open Elective-II*	OE	3	1	0	40	60	100	3
CSE322	Professional Elective -II	PE	3	1	0	40	60	100	3
CSE323	Professional Elective-III	PE	3	1	0	40	60	100	3
CSE324	Object Oriented Software Engineering	PC	3	1	0	40	60	100	3
CSE325	Web Technologies	SOC	3	1	0	40	60	100	3
CSE326	Cryptography & Network Security	PC	3	1	0	40	60	100	3
CSE327	Web Technologies Lab	SOC	0	0	3	50	50	100	1.5
CSE328	Object Oriented Software Engineering Lab	PCL	0	0	3	50	50	100	1.5
CSE329	Quantitative Aptitude II & Verbal Ability	HS	0	0	3	100	0	100	1.5
Total			**18**	**6**	**9**	**440**	**460**	**900**	**22.5**

PROFESSIONAL ELECTIVE –II		PROFESSIONAL ELECTIVE - III	
PE II	CSE322(A) Machine Learning CSE322(B) Mobile Computing CSE322(C) NO SQL Databases CSE322(D) Data Warehousing and Data Mining	PE III	CSE323(A) Distributed Operating Systems CSE323(B) Embedded Systems CSE323(C) Neural Networks and Deep Learning CSE323(D) Pattern Recognition

* ***Open Elective will be Chosen from Other Department Open Electives.***

L - Lecture (clock hours) T - Tutorial (clock hours) P - Practical (clock hours)

OE – Open Elective PE - Professional Elective SOC - Skill Oriented Course

PC – Professional course HS – Humanity Sciences PR - Project

Machine Learning (Professional Elective -II)	
Code: CSE322(A)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Basics of Probabilisty, Statistics, Artificial Intelligence

Course Objectives:

- To know the importance of concept learning in machine learning.
- Construct inductive bias in the decision tree and issues in the decision tree
- Analyze evaluation metrics to estimate accuracy of the machine learning model

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Demonstrate well posed machine learning problems and examine Find-s, version space and candidate elimination algorithm.
CO-2	Construct and analyze the problems and issues of decision tree learning algorithm.
CO-3	Apply various evaluation metric to estimate the accuracy of the model
CO-4	Apply Bayes theorem, concept learning, maximum likelihood, least squared error hypothesis for classification of text data
CO-5	Determine nearest neighborhood learning and locally weighted regression. Illustrate optimization problems using genetic algorithms

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	1	-	-	-	-	-	-	-	2	-	1
2	2	2	2	2	-	-	-	-	1	-	1	2	1	2
3	2	2	3	2	-	-	-	-	1	-	1	2	2	2
4	2	2	3	2	-	-	-	-	1	-	1	2	1	2
5	2	2	3	2	-	-	-	-	1	-	1	2	2	2

SYLLABUS

UNIT – I:

12 Periods

Introduction:
Well-posed learning problems, Types of machine learning, designing a learning system, Perspectives and issues in machine learning. A concept learning task, Concept learning as search,Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version space and candidate elimination, Inductive Bias.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret the concepts of learning system and perspectives issues in machine learning
2. Apply candidate elimination algorithm on any real world problem

UNIT-II:

12 Periods

Decision Tree learning:
Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis Space search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in decision tree learning

Learning Outcomes: At the end of this Unit the student will be able to:

1. Classify the data using decision tree and analyze problems in the decision tree learning.
2. Analyze inductive bias in the decision tree and issues in the decision tree

UNIT-III:

12 Periods

Evaluating Hypothesis:
Estimating Hypothesis accuracy- sample error, true error, Confidence intervals for discrete valued hypotheses. Confidence intervals for discrete-valued hypotheses. Basics of sampling theory- Error estimation and estimating binomial proportions, the binomial distribution, mean and variance , Estimators, bias, and variance, confidence intervals ,two-sided and one-sided bounds

Learning Outcomes: At the end of this Unit the student will be able to:

1. Compare sample error and true error for hypothesis
2. Apply various evaluation metrics on the model

UNIT-IV:

12 Periods

Bayesian Learning:
Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, Naïve bayes classifier.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Apply Bayes theorm and concept learning for data analysis.
2. Identify the maximum likelihood of the hypothesis

UNIT-V:

12 Periods

Instance Based Learning:
K-Nearest neighborhood learning- Distance-weighted nearest neighbor algorithm. Remarks of k-nearest neighbor algorithm. Locally weighted regression- Locally weighted linear regression , remarks on Locally weighted regression.

Genetic Algorithm
Motivation ,Representing Hypothesis, Genetic operators, Fitness function and selection ,An Illustrative Example

Learning Outcomes: At the end of this Unit the student will be able to:

1. Build to deploy and maintain the bo Determine nearest neighborhood learning and locally weighted regression.
2. Illustrate optimization problems using genetic algorithms .

Textbooks:

1. "Machine Learning ,Tom M. Mitchell,MGH,1997

Reference books:

1. "Machine Learning, An Algorithmic Perspective, Stephen Marsland, Taylor&Francis (CRC)
2. Introduction to Machine Learning, EthemAlpaydin, PHI,2004.

Mobile Computing (Professional Elective -II)	
Code: CSE322 (B)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Data Communication, Computer Networks

Course Objectives:

- To make the student understand the concept of mobile computing terminology and basic services.
- To understand the wireless protocols.
- To understand various routing mechanisms

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	To interpret GSM architecture and its services.
CO-2	To analyze the various wireless application protocols and its different concepts for various mobile applications.
CO-3	To learn with the representation of mobile network layer protocols and its functionalities.
CO-4	To understand, analyze & develop any existing or new models of mobile environments for 3G networks.
CO-5	To understand, evaluate and create the platforms, protocols and related concepts along with along with mobile in mobile environment.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	1	2	2	-	1	-	-	-	-	1	1	2
2	2	3	2	1	3	-	-	-	-	1	-	1	1	2
3	2	2	3	1	2	-	-	-	-	-	1	1	1	2
4	3	2	2	2	1	-	1	-	-	-	1	1	1	2
5	2	2	2	2	2	-	-	-	-	-	-	2	1	2

SYLLABUS

UNIT-I:

10 Periods

Introduction:
Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.
Global System for Mobile communication(GSM): Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Explain mobile communication architecture with various characteristics.
2. Explain about GSM architecture

UNIT-II:

12 Periods

Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards.
Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies

Learning Outcomes: At the end of this Unit the student will be able to:

1. Explain the importance of MAC and provide architecture details.
2. Compare details among WAP, WLL with WML

UNIT-III:

12 Periods

Mobile Network Layer : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization using Soft computing techniques – ANT Bee colony, Support Vector Machine, Particle Swarm Optimization and Genetic Algorithm

Learning Outcomes: At the end of this Unit the student will be able to:

1. Compare between IP layer with Mobile IP network wrt packet delivery and hand-off management.
2. Explain various Optimization techniques.

UNIT-IV:

12 Periods

Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP.
Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA) and CDMA 2000, Quality of services in 3G

Learning Outcomes: At the end of this Unit the student will be able to:

1. Compare between conventional TCP/IP protocol with Mobile TCP.
2. Explain about various Quality of services in 3G

UNIT-V:

12 Periods

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery ,case study using NS2 –traffic analysis using CBR and VBR
Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Compare DSR algorithm with AODV algorithm.
2. Explain about virtual network and blue tooth technology.

Textbooks:

1. "Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Reference books:

1. "Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation" Second Edition, Mc Graw Hill.
2. Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband," Second Edition, Wiley.

Digital Image Processing (Professional Elective -II)	
Code: CSE322(C)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Knowledge of linear algebra, basic probability and statistics, introductory knowledge of basic programming language, MATLAB/C/Python are preferred

Course Objectives:

- To make the students to be familiar with basic image processing techniques for solving real problems,
- To make the students have a general overview on digital image processing concept along with its uses and applications.
- To make the students gain knowledge about representation of a digital image in different domains and the transformations between those domains,
- To make the students learn about various morphological operations on a digital image.

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Apply the basic concepts of 2D image acquisition, sampling, quantization, relationships between pixels and components of image.
CO-2	Analyze the filtering techniques in spatial domain for face reorganization, pattern reorganization and segmentation.
CO-3	Analyze and apply the filtering techniques in frequency domain for classify the images.
CO-4	Apply image morphological techniques for manipulating digital images.
CO-5	Apply the image Segmentation techniques on Edge detection and Region-Based Segmentation.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	1	2	1	-	1	1	-	-	-	1	1	3
2	3	3	2	2	2	-	-	-	-	-	-	1	1	3
3	3	3	2	2	2	-	-	-	-	-	-	1	1	3
4	3	2	3	3	3	2	1	1	-	-	-	2	2	3
5	3	1	3	3	3	2	1	1	-	-	-	2	2	3

SYLLABUS

UNIT-I:

12 Periods

Introduction:

Digital Image Processing and Applications – Image Representation and Modeling

Digital Image Fundamentals:

Elements of Visual perception – A simple Image Model – Sampling and Quantization – Some Basic Relationship between Pixels.

Elements of digital image processing systems, Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Review the fundamental concepts of a digital image processing system.
2. Describe and explain basic principles of digital image processing

UNIT-II:

12 Periods

Image Transforms & **Color Image Processing:** Background, Some Basic Intensity Transformation Functions, Histogram Processing, Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing, Using Histogram Statistics for Image Enhancement, Color Fundamentals , Color Models , The RGB Color Model , The CMY and CMYK Color Models , The HSI Color Model , Pseudo color Image Processing , Intensity Slicing , Intensity to Color Transformations , Basics of Full-Color Image Processing.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Examine various types of images.
2. Analyze intensity transformations and color images

UNIT-III:

12 Periods

Image Enhancement in Spatial Domain:

Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods

Learning Outcomes: At the end of this Unit the student will be able to:

1. Analyze images in the frequency domain using various transforms.
2. Develop Fourier transform for image processing in frequency domain

UNIT-IV:

12 Periods

Image Enhancement in Frequency Domain:

Background, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, Selective Filtering, Wavelets.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Evaluate the techniques for image enhancement and image restoration.
2. Apply image processing algorithms in practical applications

UNIT-V:

12 Periods

Image Segmentation and Morphology:

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region Growing – Region splitting and Merging .

Preliminaries, Erosion and Dilation, Opening and Closing, the Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Gray-Scale Morphology

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret image segmentation and representation techniques.
2. Evaluate the methodologies for image segmentation, restoration, etc.

Textbooks:

1. Gonzalez Rafael C and Woods Richard E," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
2. Jain Anil K," Fundamentals of Digital Image Processing", PrenticeHall, 1989. (TA1632.J25

Reference books:

1. Pratt William K, "Digital Image Processing: PIKS Scientific Inside", 4th Edition, John Wiley, 2007. (TA1632.P917 2007)
2. Pitas Ioannis, Digital Image Processing Algorithms and Applications, John Wiley, 2000. (TA1637.P681)
3. Anil K. Jain, PHI. Pattern Recognition and Image Analysis, Earl Gose and Richard Johnsonbaugh Steve Jost, PHI," Fundamentals of Digital Image Processing".

Data Warehousing and Data Mining (Professional Elective -II)	
Code: CSE322 (D)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites:

- Database management systems concepts.
- Probability and statistics

Course Objectives:

- To know the data storage in data warehousing.
- To handle real world data to pre-processing
- The importance of data analysis through data mining

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Identify the challenging issues in Data Mining data warehousing.
CO-2	Apply the data pre-processing approaches in the data mining.
CO-3	Analyze association rule mining in various dimensional databases.
CO-4	Apply classification by using decision tree induction, Bayesian, back propagation and prediction methods for data analysis.
CO-5	Apply various clustering techniques

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	**2**	1	-	**-**	1	-	-	1	1	-	**-**	2	-	1
2	**1**	2	1	**-**	**2**	-	-	**1**	1	**-**	**-**	**2**	-	1
3	**2**	3	1	2	**2**	**1**	**--**	2	2	-	2	**2**	3	2
4	**2**	3	1	2	**2**	**1**	**--**	1	1	-	2	2	2	2
5	**2**	2	2	1	**1**	**1**		1	-	-	-	-	2	2

SYLLABUS

UNIT-I:

12 Periods

Introduction:

Data Warehouse: Introduction to Data warehouse, Difference between operational database systems and Data warehouses. Differences between operational databases systems and data warehouses.

Multidimensional data model: From Tables and spreadsheets to Data Cubes, stars, Snowflakes, and Fact Constellations schemas for Multidimensional databases. Examples for defining star, snowflake and fact constellation schemas.

Data Warehouse Architecture: Steps for the design and construction of data warehouses. A three-tier data warehouse architecture. From Data warehousing to data mining: Data warehouse usage, from on-line analytical processing to online analytical mining.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Discuss the data storage in the data warehouse and multidimensional model
2. Explain the architecture of data warehouse

UNIT-II:

12 Periods

Data Mining Introduction: Data mining-on what kind of data, Relational databases, data warehouses, transactional databases, advanced database systems and advanced database applications. Data mining functionalities, classification of data mining systems, Major issues in data mining.

Data Pre-processing: Data cleaning: Missing values, Noisy data, inconsistent Data, Data Integration and Transformation: Data Integration, Data transformation Data Reduction: Data cube aggregation, dimensionality reduction, data compression, Numerosity reduction.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Motivate the importance of data mining, its functionalities and issues
2. Find the importance of data pre-processing methodologies.

UNIT-III:

12 Periods

Association Rule mining in Large Databases: Association rule mining , mining single- dimensional Boolean association rules from transaction databases, Mining multilevel association rules from transaction databases. Mining multidimensional association rules from relational databases. From association mining to correlation analysis. Constraint based association mining.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Generate association rules to given data and analyse market basket analysis
2. Analyze association mining to correlation analysis.

UNIT-IV:

12 Periods

Classification and Prediction: Issues regarding classification and prediction, Classification by decision tree induction, Bayesian classification, Classification by back propagation, Prediction, classification accuracy.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Relate the importance of classification and prediction in data analysis.
2. Apply classification and regression techniques in real time data for analysis.

UNIT-V:

12 Periods

Cluster Analysis: Types of data in cluster analysis, a categorization of major clustering methods, Partition based methods: K-means, K-medoids. Hierarchical methods: BIRCH, CURE Density-based methods: DBSCAN.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Outline various types of clustering methods
2. Apply and analyze various types of clustering methods to real time data set

Textbooks:

1. Jiawei Han and Micheline Kamber Morgan, "*Data Mining Concepts and Techniques*", Second Edition, Kaufman Publications

Reference books:

1. Adriaan, "*Introduction to Data Mining*" , Second Edition, Addison Wesley Publication.
2. A.K.Pujari, "*Data Mining Techniques*", University Press.
3. Dr.M.Ramarkrishna Murty, "*Introduction to data mining and soft computing*", First Edition, University Science Press

Distributed Operating Systems (Professional Elective -III)	
Code: CSE422(A)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Fundamentals of Operating Systems and Computer networks and protocols.

Course Objectives:

- To provide an overview of the concepts of distributed operating systems and challenges that includes Architecture and Fundamental Models.
- To explore about various types of communication procedures and protocols in a distributed operating systems environment.
- To interpret the concept of communication between distributed objects and remote procedural calls.
- To analyse and understand the concepts of Distributed File system.
- To demonstrate the idea of Transactions and Replications in distributed operating system.

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Analyze the system model, software layers of distributed operating systems and its challenges.
CO-2	Examine the inter-process communication, TCP stream communication procedures and protocols.
CO-3	Evaluate the concepts of Remote procedural calls and communication among objects in distributed operating system.
CO-4	Apply the knowledge of peer-to-peer system, distributed mutual exclusion of distributed file system in real world scenario.
CO-5	Apply concurrency control, deadlock management techniques in distributed operating system for group communication.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	3	1	2	1	1	1	1	-	1	-	1	1	1
2	1	3	2	2	1	1	-	1	-	-	1	1	1	1
3	1	2	3	3	1	1	-	-	-	-	1	1	1	1
4	3	1	1	3	1	1	1	1	-	-	1	1	1	1
5	3	1	1	3	1	-	1	-	-	-	-	1	1	1

SYLLABUS

UNIT-I:

12 Periods

Introduction:

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Explore the concepts of Distributed Systems.
2. Analyze the Various System models in distributed systems.

UNIT-II:

12 Periods

Inter process Communication: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Analyse the concept of Inter process communication.
2. Compare the UDP datagram communication and TCP stream communication.

UNIT-III:

12 Periods

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

Learning Outcomes: At the end of this Unit the student will be able to:

1. Determine the design issues and implementation of RMI.
2. Summarize the concept of distributed garbage collection and remote procedure call

UNIT-IV:

12 Periods

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Demonstrate the architecture of file systems and build knowledge on peer-to-peer systems.
2. Identify the various algorithms of Distributed mutual exclusion.

UNIT-V:

12 Periods

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Determine the concurrency control in distributed transactions.
2. Explore the concept of active and passive replication

Textbooks:

1. Ajay D Kshemkalyani, Mukesh Sighal, "Distributed Computing, Principles, Algorithms and Systems", 1st Edition, 2008,Cambridge.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, 2005,Pearson Publication.

Reference books:

1. Makes Singhal and Niranjan G.Shivaratna ,"Advanced Concepts in Operating Systems" , 1st Edition,1994,Tata McGraw Hill Edition.

Embedded Systems (Professional Elective -III)	
Code: CSE323(B)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites:

- Basic Knowledge of Data Communications, Computer Networks
- Knowledge of Operating Systems Windows, Linux and Programming Languages

Course Objectives:

- Introducing Cyber Security Concepts
- Giving basic exposure about Cyber Crimes
- Explaining tools used in Cyber Crimes
- Explaining Cyber Law present in the system.

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Explain about vulnerability scanning approaches and describe the functionality of different types of scanning and service tools.
CO-2	Comprehend about networking layers and summarize the defence methodologies and its relevant tools functionality
CO-3	Describe and inspect web vulnerabilities through tools.
CO-4	Comprehend the cybercrime scenario and recognize the appropriate cyber law.
CO-5	Demonstrate the cybercrime scenario and solve the crime through investigation by applying ethical hacking mechanisms.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	**2**	**2**	**2**	2	2	2	-	-	-	-	-	**2**	2	2
2	**2**	**2**	**2**	2	2	2	-	-	-	-	-	**2**	2	2
3	**2**	**2**	**3**	2	2	2	-	-	-	-	-	**2**	2	1
4	**2**	**2**	**2**	2	2	2	-	-	-	-	-	**2**	2	1
5	**2**	**2**	**2**	**3**	2	2	-	-	-	**2**	-	**2**	2	2

SYLLABUS

UNIT-I:

10 Periods

Introduction to embedded systems hardware needs; timing diagrams, memories (RAM, ROM, EPROM). Tristate devices, Buses, PLD's. Built-ins on the microprocessor. Interrupts basics, ISR; Context saving, shared data problem. . Atomic and critical section.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe different types of memories used in Embedded System Development
2. Interpret the role of Interrupts in Embedded Systems Performance

UNIT-II:

10 Periods

Survey of software architectures, Round Robin, Function queue scheduling architecture, Use of real time operating system .RTOS, Tasks , Scheduler, Shared data reentrancy, priority inversion, mutex binary semaphore and counting semaphore

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe the role of software architecture in Embedded Systems Performance
2. Explain the application of the Real Time Operating System in Embedded System Development.

UNIT-III:

10 **Periods**

Inter task communication, message queue, mailboxes and pipes, timer functions, events. Interrupt routines in an RTOS environment. Embedded system software design using an RTOS. Hard real time and soft real time system principles, Task division, need of interrupt routines, Interrupt latency, Introduction to Device Drivers.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe the different RTOS features used in Embedded Systems Development.
2. Differentiate Hard real time and Soft real time systems

UNIT-IV:

10 **Periods**

Embedded Software development tools. Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software into the target system**.**

Learning Outcomes: At the end of this Unit the student will be able to:

1. Differentiate host and target systems
2. Describe the need of Cross Compilers, linkers and locators for embedded system development.

UNIT-V:

10 **Periods**

Debugging techniques. Testing on host machine, Instruction set emulators, logic analyzers. In-circuit emulators and monitors.

Case Study

Developing Embedded C Applications Through KEIL Software, Embedded Programming in C++, JAVA, Python.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Explain different types of debugging techniques used in Embedded System Development.
2. Describe the difference between simulation and emulation.

Textbooks:

1. David A. Simon, An Embedded Software Primer, Pearson Education, Inc., 1999
2. Raj Kamal, Embedded Systems, Architecture, Programming and Design, TMH, 2003

Reference books:

1. Sriram V Iyer and Pankaj Gupta, Embedded Real Time Systems programming, TMH, 2004.

Neural Networks and Deep Learning (Professional Elective -III)	
Code: CSE323(C)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Linear Algebra, Calculus, Statistics, General Programming Concepts

Course Objectives:

- Explore the concepts of neural networks and deep learning
- Examine the usage of neural networks
- Describe the data needs of deep learning
- Apply the working knowledge of neural networks and deep learning
- Explore the parameters for different neural networks

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Compare the Artificial Neural Network & Biological Neural Network and identify the need for Activation functions.
CO-2	Identify the need of functional units and differentiate Feed Forward Neural Network and Feedback Neural Network
CO-3	Demonstrate the concept of Deep Neural Network and Analyze the optimization & regularization of Deep Neural Network
CO-4	Identify the need for convolutional neural network and Examine the Various Architectures of Convolution Neural Network
CO-5	Examine the Various Architectures of Recurrent Neural Networks

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	-	-	-	-	-	-	-	1	-	-	-	1
2	2	3	2	-	-	-	-	-	1	2	-	-	-	1
3	2	2	2	-	-	-	-	-	1	2	-	-	-	3
4	2	2	3	2	1	-	-	-	2	2	2	1	-	3
5	2	2	3	2	1	-	-	-	2	2	2	1	-	3

SYLLABUS

UNIT-I:

10 Periods

Introduction:

Characteristics of Neural Networks: Features of Biological Neural Networks, Biological Neural Networks, Comparison of Artificial Neural Network and Biological Neural Network, Historical Development of Neural Network Principles.

Artificial Neural Networks: Terminology, Models of Neuron, Basic Learning Laws, Applications of ANN, Pros and Cons of ANN, Activation Functions: Binary Step Function, Linear Activation, Non Linear Activation Functions.

Learning Outcomes: At the end of this unit, Student will be able to

1. Describe the concepts of neural networks.
2. Apply activation functions for different scenarios.

UNIT-II:

10 Periods

Functional Units of ANN for Pattern Recognition Tasks: Pattern Recognition Problem, Basic Functional Units.

Feed forward Neural Networks: Pattern Classification Network: Perceptron, Linear Inseparability: Hard Problems, Multilayer Feed forward neural network: Generalized Delta Rule- Back propagation learning

Feedback Neural Networks: Analysis of Linear Auto associative FF Networks, Hetero-Associative Neural Network, Hopfield Network, Bidirectional Associative Neural Models (BAM).

Learning Outcomes: At the end of this Unit the student will be able to:

1. Identify the need of Functional Units for Pattern Recognition Tasks.
2. Explore the concepts of Feedforward and Feedback Neural Network.

UNIT-III:

10 Periods

Deep neural networks (DNNs): Perspectives and Issues of Deep Learning, Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe the concepts of Deep Neural Networks
2. Analyze the optimization and regularization methods of neural networks

UNIT-IV:

10 Periods

Convolution Neural Networks: From Fully-Connected Layers to Convolutions, Convolutions for Images, Padding and Stride, Multiple Inputs and Outputs Channels, Pooling, Different Deep Convolutional Neural Network Architectures-LeNet, VGG

.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe the basic structure of convolutional neural network.
2. Analyze the Different CNN Architectures

UNIT-V:

10 Periods

Recurrent Neural Networks:

Sequence Models, RNN, Back propagation Through Time.

Modern Recurrent Neural Network: GRU, LSTM, Bidirectional RNN, Encoder-Decoder Learning,

Generative Models: Boltzmann Machine, Restricted Boltzmann Machine, Generative Adversarial Network

Learning Outcomes: At the end of this Unit the student will be able to:

1. Describe the architecture of recurrent neural network.
2. Explore the concepts of Generative Models

Textbooks:

1. Yegnanarayana, B., “Artificial Neural Networks” PHI Learning Pvt. Ltd, 2009.(UNIT-I, UNIT-II)
2. Goodfellow, I., Bengio,Y., and Courville, A., “Deep Learning”, MIT Press, 2016.(UNIT-III)
3. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, “Dive into Deep Learning”, 2021(UNIT-IV,UNIT-V)

Reference books:

1. Satish Kumar, “Neural Networks: A Classroom Approach”, Tata McGraw-Hill Education, 2004.
2. Simon Haykin, “Neural Networks-A comprehensive Foundation” Second edition(UNIT-I)
3. Charu C. Aggarwal, “Neural Networks and Deep Learning-A Textbook”, Springer, 2018.

Pattern Recognition (Professional Elective -III)	
Code: CSE323(D)	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites:

- Number Theory and Linear Algebra, Data Structures, Artificial Intelligence

Course Objectives:

- To analyze and apply the foundations of pattern recognition, various classification and clustering techniques, ensemble classifiers used in Pattern Recognitions.

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Discuss the basic foundations of Pattern Recognition, mathematical concepts
CO-2	Discuss Bayesian decision theory and parameter estimation methods
CO-3	Explain unsupervised learning and hidden markov models
CO-4	Illustrate dimensionality reduction and discriminant functions
CO-5	Explain non-metric methods and ensemble classifiers

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	1	1	1	-	1	1	-	-	-	-	1	1	1
2	2	2	2	2	1	2	1	1	-	-	-	2	1	2
3	1	2	2	2	1	2	1	1	-	-	-	1	1	2
4	1	1	1	1	1	1	1	1	-	-	-	1	1	1
5	1	1	1	1	2	1	1	1	-	-	-	2	1	1

SYLLABUS

UNIT-I:

10 Periods

Basics of Probability, Random Processes and Linear Algebra:
Introduction to Pattern Recognition, Feature Detection, Classification, **Probability:** independence of events, conditional and joint probability, Bayes' theorem; Random Processes: Stationary and nonstationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; **Linear Algebra:** Inner product, outer product, inverses, eigen values, eigen vector.

Learning Outcomes: At the end of this Unit the student will be able to:

1. To discuss foundations of Pattern Recognition.
2. To apply various estimation metrics, functions and operations used in pattern recognition

UNIT-II:

10 Periods

Bayes Decision Theory and Parameter Estimation Methods:
Bayes Decision Theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features
Parameter Estimation Methods: Maximum-Likelihood estimation - Gaussian case, Maximum a Posteriori estimation, Bayesian estimation - Gaussian case.
Learning Outcomes: At the end of this Unit the student will be able to:

1. To discus and apply Bayesian decision theory and its models for classification.
2. To Explain different parameter estimation methods.

UNIT-III:

10 Periods

Unsupervised Learning and Hidden Markov Models:
Unsupervised learning - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation, Maximum entropy estimation, Sequential Pattern Recognition.
Hidden Markov Models (HMMs): Introduction, Discrete HMMs. Continuous HMMs, Nonparametric techniques for density estimation, Parzen-window method, K-Nearest Neighbour method.
Learning Outcomes: At the end of this Unit the student will be able to:

1. To explain unsupervised learning methods in Pattern Recognition.
2. To illustrate basic concepts of Hidden Markov models and its importance in PR.

UNIT-IV:

10 Periods

Dimensionality Reduction and Discriminant Functions:
Dimensionality Reduction: Principal component analysis - it relationship to eigen analysis, Fisher discriminant analysis - Generalized Eigen analysis, Eigen vectors/Singular vectors as dictionaries, Factor Analysis, Total variability space - a dictionary learning methods, Non negative matrix factorization - a dictionary learning method.
Linear discriminant functions: Gradient descent procedures, Perceptrons, Multi-Layer Perceptrons, Support Vector Machines.
Learning Outcomes: At the end of this Unit the student will be able to:

1. To apply various dimensionality reduction techniques.
2. To apply linear discriminant functions and methods in Pattern Recognition.

UNIT-V:

10 Periods

Non-Metric Methods for Pattern Recognition:
Non-metric methods for pattern classification: Non-numeric data or nominal data, Decision trees, CART, ID3, C4.5, Random Forests, Genetic Algorithms, Reinforcement Learning with Human Interaction, Ensemble Classifiers –"Committee Machines ", Applications of Pattern Recognition.
Learning Outcomes: At the end of this Unit the student will be able to:

1. To discuss non-metric methods and various decision tree methods in Pattern Recognition
2. To apply various decision tree and ensemble classifiers in Pattern Recognition.

Textbooks:

1. Duda, Richard O., Peter E. Hart, and David G. Stork. Pattern Classification, John Wiley & Sons, 2001.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. M.Bishop, Pattern Recognition and Machine Learning, Springer, 2007

Reference books:

1. Earl Gose, Richard Johnsonbaugh and Steve Jost, Pattern Recognition and Image Analysis", Prentice Hall of India, 2002.
2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.

Object Oriented Software Engineering (Professional Core)	
Code: CSE324	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites:

- Basic Mathematical Knowledge.
- Basic knowledge on procedural and object oriented programming.
- Basic knowledge on problem solving

Course Objectives:

- To explain the importance of OOSE in Software development.
- To provide knowledge on software Life Cycle and Development Models with object oriented concepts.
- To explain the role of UML and Testing in Software Development.
- To plan and manage the development of software projects

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Analyze the different software process models and their significance.
CO-2	Interpret the functional, non–functional requirements and requirement Engineering Process.
CO-3	Choose the Architecture for a given software application & Design UML diagrams.
CO-4	Demonstrate skills in Object-oriented Modelling and Plan software project management activities.
CO-5	Identify the Testing Strategies and design test suits for the given Test Scenarios.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	-	-	-	-	-	-	-	1	-	-	-	1
2	2	3	2	-	-	-	-	-	1	2	-	-	-	1
3	2	2	2	-	-	-	-	-	1	2	-	-	-	3
4	2	2	3	2	1	-	-	-	2	2	2	1	-	3
5	2	2	3	2	1	-	-	-	2	2	2	1	-	3

SYLLABUS

UNIT-I:

10 Periods

Introduction:

Importance of Software Engineering: Problem Solving Activity, Modelling Activity, Knowledge Acquisition activity, Rationale Driven Activity, Umbrella Activities , Software Engineering Challenges ,Software Development Life Cycle.

Process Models: Waterfall Model, Incremental Model, Prototype Model, V Model, Spiral Model, Rapid Model, Agile Model.

Learning Outcomes: At the end of this unit, Student will be able to

1. List Various Software Development activities.
2. Classify the Working of Software Process Models.

UNIT-II:

10 Periods

Software Requirement Analysis & Specification: Need for SRS, Characteristics of Requirements, Functional Requirements, Non Functional Requirements, Requirement Specification Document -IEEE Format.

Function Oriented Design: Structured Design Methodology –DFD Diagram, Design Principles, Module-Level Concepts- Cohesion & Coupling.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Find Functional and Non-functional Requirements and prepare SRS Document..
2. Design Data flow in Functional Approach (DFD).

UNIT-III:

10 Periods

Architectural Design: Role of Software Architecture, Architecture Views, Architectural Styles for C & C View- Pipe and Filter, Client and Server, Shared Data.

Object Oriented Design: OO Concepts, Importance of Modelling.

Overview of UML: Building Blocks of UML (Things, Relationships, Diagrams), Class Diagram, Class Relationships, Design Axioms, Corollaries, Use Case- Use Case Scenario, Use Case Diagram, Relationships among Use Cases.

Interaction Diagrams: Sequence Diagram, Collaboration Diagram.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Make use of Various Software Architectures.
2. Design UML Diagrams with Object Oriented Approach.

UNIT-IV:

10 Periods

UML Diagrams: Activity Diagram, State Chart Diagram, Component Diagram & Deployment Diagram.

Object Oriented Methodologies: Unified Methodology, Rambaugh Methodology, Booch Methodology.

Software Project Management: Definition of Software Project, Need of Software Project Management, Software Project management Plan, Effort Estimation ,Case Study on Effort Estimation with COCOMO, Schedule - Overall and detailed scheduling, Risk Management Plan, Project Tracking & Control.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Illustrate Various object oriented Methodologies.
2. Adapt the approaches in Software Project Management to Develop the Software Project

UNIT-V:

10 Periods

Testing: Testing Fundamentals, Testing Process, Levels of Testing ,Test Plan, Test Case Specification, Test Case Execution & Analysis, Defect Logging & Tracking, Black Box Testing, White Box Testing.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Summarize various Software Testing Techniques.
2. Design Test Suites for Test Scenarios.

Textbooks:

1. Timothy C. Lethbridge, "Object Oriented Software Engineering" (Practical Software Development using UML and Java" Tata McGraw-Hill, 2nd Edition, 2019.
2. Booch, Maksimchuk, Engle, Young, Conallen and Houston, "Object Oriented Analysis and Design with Applications ", Pearson Education, 3rd Edition, 2009.
3. Pankaj Jalote, An integrated Approach to Software Engineering, Springer, 3rd edition, 2005.

Reference books:

1. Ivar Jacobson, "Object Oriented Software Engineering", Pearson, 2009.
2. Rumbaugh et. al, "Object Oriented Modeling and Design", Pearson.
3. Bertrand Meyer, *Object-Oriented Software Construction*, Prentice Hall, 2nd edition, 1998.
4. Edwards Yourdon, Carl Argila,"Case Studies in object oriented analysis and design" Prentice Hall.

Web Technologies (Professional Core)	
Code: CSE325	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites:

- Basic Knowledge of Programming Fundamentals
- Knowledge of Programming Languages (C,JAVA,SQL)

Course Objectives:

- To learn designing of dynamic web pages by embedding with CSS, Java Script.
- To know how to design and develop simple database driven web application.
- Making the web applications using Node JS and Express JS
- To know how to design the web pages using Python
- Understanding with NoSQL database technology

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Design the Webpages and templates.
CO-2	Demonstrate on creating a website using PHP and MySQL functionalities.
CO-3	Solve complex type of web applications using Node JS and Express JS
CO-4	Develop the Web applications using Python.
CO-5	Create the Document Oriented Database to interact with NoSQL

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	1	2	1	-	-	2	1	2	2	2	1
2	2	2	2	2	2	-	-	-	2	1	2	2	2	2
3	2	2	3	2	2	-	-	-	2	1	2	2	2	2
4	2	2	2	2	2	-	-	-	2	1	2	2	2	2
5	2	2	2	2	2	-	-	-	2	2	2	2	2	2

SYLLABUS

UNIT-I:

10 Periods

Introduction:

HTML: Basic Tags, fonts, hyperlink, lists, tables, images, frames forms, Cascading style sheets.
Java Script: Introduction, Objects, Events, DHTML

Learning Outcomes: At the end of this unit, Student will be able to

1. To design webpages and validation of webpages.
2. Test and debug JavaScript web applications.

UNIT-II:

10 Periods

PHP: Introduction, Variables, Data types, control statements, Arrays, Functions, Strings, Form processing, File Handling, Cookies and Sessions, PHP with Database.

Learning Outcomes: At the end of this Unit the student will be able to:

1. To develop the PHP scripts to handle HTML forms.
2. To Create PHP programs that use various PHP library functions, and that manipulate files and directories.

UNIT-III:

10 Periods

NodeJS: Basics and Setup, REPL terminal, NPM and Command Utilities, Global Objects, Modules – (OS, Path, DNS, Net, Domain),File System.
ExpressJS : Environment, Routing, Http Methods, URL Binding, Middleware, Templating, Static files, Form data

Learning Outcomes: At the end of this Unit the student will be able to:

1. To Develop interactive Web applications.
2. To Develop single page applications

UNIT-IV:

10 Periods

Flask: Introduction, Installation, Routing , URL Building, Http methods, Templates, Request Object, Sessions and cookies, File Uploading, Redirect & Errors, Flashing.

Learning Outcomes: At the end of this Unit the student will be able to:

1. To design webpages using python and validation of webpages.
2. Apply the routing techniques to access the desired pages

UNIT-V:

10 Periods

MongoDB: Introduction, Installation, Data Types. Data Modelling. Database-Create, Drop.
Collection-Create, Drop. Aggregation, Indexing, CRUD-Operations

Learning Outcomes: At the end of this Unit the student will be able to:

1. To learn how to store and access data from database and dynamic database activities.
2. To learn how to run queries against a MongoDB instance in order to store, manipulate, and retrieve data on it

Textbooks:

1. Thomas A. Powell, - "HTML & CSS Complete Reference",Mc Graw Hill, Fifth Edition,2017.
2. Steven Holzner ,"Php: The Complete Reference ", McGrawHillEducation , fifth edition ,2008.
3. Reg Lim, " Beginning Node.js, Express & MongoDB Development", Kindle Edition, 2019.
4. Miquel Grinberg ,-Flask Web Development, O'Reilly, Second Edition,2018

Reference books:

1. Kogent Learning Solutions Inc. Web Technologies: HTML, JAVASCRIPT , PHP , JAVA , JSP , ASP.NET, XML and Ajax, Black Book, Dreamtech Press , 1st edition (1 January 2009).
2. Kyle Banker, MongoDB in Action, Manning, Second Edition, March 2016.

Cryptography & Network Security (Professional Elective -III)	
Code: CSE326	**Credits: 3**
Instruction:	Sessional Marks: 40
End Exam: 3 Hours	End Exam Marks: 60

Pre-requisites: Computer Networks, Number Theory, Probability Theory

Course Objectives:

- Explore the concepts of neural networks and deep learning
- Acquire the basics of Cryptographic security.
- Learn the working of the cryptographic algorithms for confidentiality, authentication and integrity.
- Learn the different techniques for distributing public and private keys.
- Understand how the different algorithms are used in different protocols to provide security in network

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Memorize the foundational concepts of Cryptographic systems
CO-2	Develop the applications of cryptographic algorithms in Network Security
CO-3	Demonstrate the algorithms to achieve the security goals of Confidentiality, Authenticationand Integrity to a given application
CO-4	Synthesize the different algorithms to determine protocol implementation and achieve Authentication.
CO-5	Examine the techniques of Intrusion Detection systems and classify the types of Firewalls.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	3	-	3	-	3	3	3	-	-	-	1	1
2	2	2	3	2	3	-	3	3	3	-	-	-	1	2
3	2	2	3	2	3	-	3	3	3	-	-	-	1	1
4	2	2	3	2	3	-	3	3	3	-	-	-	1	2
5	2	2	3	-	3	-	3	3	3	-	-	-	2	1

SYLLABUS

UNIT-I:

10 Periods

Introduction:

Cryptography, Need for Security, Security Goals, Security Methodology, OSI Security Architecture: Threats-Attacks & Attack Types-Services-Mechanisms, Network Security Model: Plain Text-Cipher Text-Encryption-Decryption-Key, Key Range and Key Size, Classic Cryptography: Substitution-Transposition, Steganography.

Basic Concept of Symmetric Cryptography, Cryptanalysis, Algorithm Types and Modes, Principles of Public-Key Cryptography.

Learning Outcomes: At the end of this unit, Student will be able to

1. Explore the concepts of Security.
2. Analyse the importance of Cryptography algorithms.

UNIT-II:

10 Periods

CONFIDENTIALITY:

Symmetric Cryptography Techniques: Feistel Structure, DES-AES-RC4. Asymmetric Cryptography Techniques: Encryption/Decryption using RSA, RSA Key Exchange, Encryption/Decryption using Elliptic Curve Cryptography, Digital Envelope.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Implement symmetric Cryptographic algorithms.
2. Analyze the Asymmetric Cryptographic algorithms.

UNIT-III:

10 Periods

KEY MANAGEMENT AND INTEGRITY:

Key Distribution and Management: Public-key infrastructure, Diffie-Hellman Key Exchange, Digital Certificates (public key), Private Key Management.

Hashing: Cryptographic Hash Function Definition, Applications of Cryptographic Hash Functions, Message Authentication Functions, MD5,SHA-512.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret key distribution and management.
2. Apply Hash Functions to achieve security goals

UNIT-IV:

10 Periods

AUTHENTICATION:

Authentication Using Asymmetric Cryptography (Digital Signatures): Basic Idea of Digital Signatures, RSA Digital Signature Scheme, Digital Signature Standard, Kerberos.

Learning Outcomes: At the end of this Unit the student will be able to:

3. Describe the basic structure of convolutional neural network.
4. Analyze the Different CNN Architectures

UNIT-V:

10 Periods

NETWORK SECURITY:

Application Layer: PGP, S/MIME, Transport Layer: TLS, SSL, Network Layer: IP Security Intrusion Detection Systems (IDS): Types of IDS Technologies, False Positives and

Negatives, Intrusion Detection Techniques, Firewalls: Definition, Packet Filters, Circuit Level filters, Application Layer Filters

Learning Outcomes: At the end of this Unit the student will be able to:

1. Analyse various Intrusion Detection Techniques.
2. Formulate rules for providing security.

Textbooks:

1. Cryptography and Network Security, Forouzan and Mukhopadhyay, 2nd edition, TMH.
2. Cryptography and Network Security: Principles and Practice, William Stallings, 5thedition, Pearson.

Reference books:

1. Cryptography and Network security, Atul Kahate, Tata McGraw- Hill Pub companyLtd., New Delhi
2. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi.
3. Network Security: The Complete Reference, Robert Bregga, Mark Rhodes-Ousley,Keith Strassberg, TMH.

Web Technologies Lab (Professional Core Lab)	
Code: CSE327	**Credits: 1.5**
Instruction:	Sessional Marks: 50
End Exam: 3 Hours	End Exam Marks: 50

Pre-requisites:

- Basic knowledge of Computer Networks
- Exposure to Problem solving techniques and programming skills
- Basic knowledge of JAVA and Python Programming.

Course Objectives:

- Introducing new web application development languages and tools to students.
- Introducing Open Source Technologies- HTML, CSS, JAVASCRIPT, PHP, MYSQL, FLASK

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Design Static Web pages and Dynamic Web pages using HTML and validate withJavaScript respectively.
CO-2	Create website using server side scripting language PHP
CO-3	Develop interactive Web applications using Node JS and ExpressJS
CO-4	Demonstrate the CRUD application using Flask and MongoDB.
CO-5	Design Static Web pages and Dynamic Web pages using HTML and validate withJavaScript respectively.

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	2	2	3	-	-	-	2	2	2	2	2	-
2	1	2	2	2	3	-	-	-	2	2	2	2	2	-
3	1	2	2	2	3	-	-	-	2	2	2	2	2	-
4	1	2	2	2	3	-	-	-	2	2	2	2	2	-
5	1	2	2	2	3	-	-	-	2	2	2	2	2	-

SYLLABUS

List of Experiments

Lab Programs

1	Design Static Webpage using HTML Components	CO1
2	Design Webpage using CSS	CO1
3	Create Dynamic Webpage using JavaScript	CO1
4	Develop Dynamic Webpage Using PHP Script	CO2
5	Develop PHP application with Database connection	CO2
6	Implement Modules in NodeJS	CO3
7	Develop mini application using Express and NodeJS	CO3
8	Implement HTTP methods using Flask	CO4
9	Implement Sessions concept using Flask	CO4
10	Develop CRUD operations using MongoDB	CO4
11	Develop Main Project using Python/Express and MongoDB/MySql.	CO4

Textbooks:

1. Thomas A. Powell, - "HTML & CSS Complete Reference",Mc Graw Hill, Fifth Edition,2017.
2. Steven Holzner ,"Php: The Complete Reference ", McGrawHillEducation, fifth edition ,2008.
3. Reg Lim, " Beginning Node.js, Express & MongoDB Development", Kindle Edition, 2019.
4. Miquel Grinberg ,-Flask Web Development, O'Reilly,Second Edition,2018)

Reference books:

1. Kogent Learning Solutions Inc. Web Technologies: HTML, JAVASCRIPT , PHP , JAVA , JSP , ASP.NET, XML and Ajax, Black Book, Dreamtech Press; 1st edition (1 January 2009).
2. Kyle Banker, MongoDB in Action, Manning, Second Edition, March 2016.

Object Oriented Software Engineering Lab (Professional Core Lab)	
Code: CSE328	**Credits: 1.5**
Instruction:	Sessional Marks: 50
End Exam: 3 Hours	End Exam Marks: 50

Pre-requisites:

- Basic Mathematical Knowledge
- Basic knowledge on procedural and object oriented programming
- Basic knowledge on problem solving.

Course Objectives:

- To provide working knowledge of UML.
- To provide working knowledge of the technologies essentially for incorporating in the project.
- To expertise for testing and document software.
- To present the project in a professional manner

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Design DFD, UML Diagrams for the specified software project
CO-2	Write the Software Requirements Document for a specified project
CO-3	Design Test Suites
CO-4	Discuss about the project implementation among the team members and improve their professional skills
CO-5	

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	3	3	2	3	2	-	1	1	1	2	2	3	3
2	-	2	1	1	-	2	1	1	1	2	1	-	2	-
3	-	2	3	2	-	2	-	2	1	-	1	-	1	-
4	-	-	-	1	-	-	-	-	3	2	-	1	-	-
5	-	3	3	2	3	2	-	1	1	1	2	2	3	3

SYLLABUS

List of Experiments

List of Programs:

Exp. No.	Name of the Experiment	CO
1	Introduction and Project Definition	2 ,4
2	System Modelling –DFD Diagram	1,4
3	Introduction to UML and Use Case Scenario, Use Case Diagram	1,4
4	Object Oriented Analysis : Discovering Classes , Class Diagram	1,4
5	Interaction Diagrams: Sequence and Collaboration Diagrams	1,4
6	State Chart Diagram	1,4
7	Flow of Events and Activity Diagrams	1,4
8	Component and Deployment Diagrams	1,4
9	Software Requirements Specification Document	2,4
10	Design Test Cases	3,4
11	Test Report & Error Report	2,3,4
12	PPT Presentation of their project	4

Textbooks:

1. Roger S Pressman,Software Engineering: A Practitioner's approach,Tata McGraw Hill Education,8th edition,2015
2. Pankaj Jalote, An integrated Approach to Software Engineering, Springer, 3rd edition,2005
3. Timothy C. Lethbridge, "Object Oriented Software Engineering" (Practical Software Development using UML and Java" Tata McGraw-Hill,2nd Edition,2019

Reference books:

1. Ali Bahrami, Object Oriented Systems Development, Tata Mcgraw-Hill Education ,1st Edition, 2008.

Quantitative Aptitude –II & Verbal Ability ()	
Code: CSE329	**Credits: 3**
Instruction:	Sessional Marks: 100
End Exam: 3 Hours	End Exam Marks: -

Pre-requisites: Computer Networks, Number Theory, Probability Theory

Course Objectives:

Quantitative aptitude-II

- To categorize, apply and use thought process to distinguish between concepts of reasoning
- To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

By the end of the course, the student will be able to:	
CO-1	Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.
CO-2	Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.
CO-3	Understand and solve puzzle related questions from specific and other competitive tests
CO-4	-
CO-5	-

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	-	-	-	-	-	-	2	2	-	-	2	2
2	3	1	-	-	-	-	-	-	2	2	-	-	2	2
3	2	2	-	-	-	-	-	-	2	2	-	-	2	2
4	2	1	-	-	-	-	-	-	2	2	-	-	2	2
5	3	1	-	-	-	-	-	-	2	2	-	-	2	2

Verbal Aptitude:

- To categorize and explain principles of grammar in order to minimize errors in English.
- To list and quote high frequency words by giving relevant examples.
- To categorize, apply and use data as per the requirement.
- To construct and make use of idioms, phrasal verbs and other expressions used in professional contexts.
- To critically evaluate reading material for better comprehension

Course Outcomes (CO):

By the end of the course, the student will be able to:	
CO-1	Detect grammatical errors in the text/sentences and rectify them while answering their competitive/ company specific tests and frame grammatically correct sentences while writing.
CO-2	Answer questions on synonyms, antonyms, hyponyms, hypernyms and other vocabulary-based exercises while attempting company specific and other competitive tests.
CO-3	Use their logical thinking ability and solve questions related to reasoning based exercises.
CO-4	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent.
CO-5	Analyse the given data/text and find out the correct responses to the questions asked based on the reading exercises; identify relationships or patterns within groups of words or sentences

Mapping of Course Outcomes with Program Outcomes:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	-	-	-	-	-	-	2	3	-	-	2	3
2	1	-	-	-	-	-	-	-	2	3	-	-	1	3
3	1	2	-	-	-	-	-	-	2	3	-	-	2	3
4	1	-	-	-	-	-	-	-	2	3	-	-	1	3
5	1	2	-	-	-	-	-	-	2	3	-	-	2	3

SYLLABUS

UNIT-I:

10 Periods

Numerical Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series, Seating arrangements, Directions, blood relations and puzzle test.

Learning Outcomes: At the end of this unit, Student will be able to

1. Explore number series, classification of numbers, Letter series.
2. Analyze Seating arrangements, Directions and Puzzle test.

UNIT-II:

5 Periods

Combinatorics:

Counting techniques, Permutations, Combinations and Probability.

.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Analyze Counting techniques.
2. Analyze permutations and combinations.

UNIT-III:

5 Periods

Data Sufficiency:

Syllogisms.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret and Syllogisms.

UNIT-IV:

5 Periods

Applications of Base System:

Clocks (Base 24), Calendars (Base7), Cutting of Cubes and cuboids

.

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret and analyze different application of Base system.

UNIT-V:

5 Periods

Puzzle Solving & Time Management:

Selective puzzles from previous year placement papers
Selective puzzles from book Puzzles to puzzle you by shakunatala devi
Selective puzzles from book more puzzles by shakunatala devi
Selective puzzles from book puzzles by George summers

Learning Outcomes: At the end of this Unit the student will be able to:

1. Interpret and apply Puzzle Solving and Time Management.

Textbooks:

1. Quantitative aptitude by RS Agarwal, S Chand Publications-Latest Edition-2021 -Revised
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications-2018 publications - Revised Edition
3. More puzzles by shakunatala devi orient paper back publication-Old Edition -1976.

Reference books:

1. Barron's by Sharon Welner Green and Ira K Wolf - Galgotia Publications pvt. Ltd.)-28th Edition-2017
2. A new Approach to Reasoning Verbal & Non-Verbal by BS Sijwali Arihant publications -2017 Edition Revised
3. Logical Reasoning for CAT Arun Sharma McGraw hill publications -4TH Edition-2017 Edition.