MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

MASTER OF TECHNOLOGY
Computer Science & Engineering

COURSE STRUCTURE

&

DETAILED SYLLABI

For the students admitted to

Master of Technology in Computer Science & Engineering from the academic year 2024-25 Batches onwards

M. Tech Regular Two Year P. G. Degree Course

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

M. Tech Two Year Curriculum Structure

Branch: Computer Science & Engineering

Total Credits	70 Credits for 2024 Admitted Batch onwards

R24 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	24CSEP101	Advanced Data Structures and Algorithms	3	0	0	3	3
2	PCC	24CSEP102	Advanced Databases	3	0	0	3	3
3	PEC		**Professional Elective – I** *(Refer ANNEXURE – I)*	3	0	0	3	3
4	PEC		**Professional Elective – II** *(Refer ANNEXURE – I)*	3	0	0	3	3
5	PCC	24CSEP201	Advanced Data Structures and Algorithms Laboratory	0	0	4	4	2
6	PCC	24CSEP202	Advanced Databases Laboratory	0	0	4	4	2
7	MC	24RMP101	Research Methodology and IPR	2	0	0	2	2
8	AC		**Audit Course - I** *(Refer ANNEXURE – I)*	2	0	0	2	0
Total				**16**	**0**	**8**	**24**	**18**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	24CSEP103	Deep Learning and its Applications	3	0	0	3	3
2	PCC	24CSEP104	Advanced Computer Networks	3	0	0	3	3
3	PEC		**Professional Elective – III** *(Refer ANNEXURE – I)*	3	0	0	3	3
4	PEC		**Professional Elective – IV** *(Refer ANNEXURE – I)*	3	0	0	3	3
5	PCC	24CSEP203	Deep Learning and its Applications Laboratory	0	0	4	4	2
6	PCC	24CSEP204	Advanced Computer Networks Laboratory	0	0	4	4	2
7	PR	24CSEP701	Technical Seminar	0	0	4	4	2
8	AC		**Audit Course – II** *(Refer ANNEXURE – II)*	2	0	0	2	0
Total				**14**	**0**	**12**	**26**	**18**

(L = Lecture, T = Tutorial, P = Practical)

M. Tech Computer Science & Engineering

II Year I Semester (Tentative Structure)

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PEC		**Professional Elective - V**	3	0	0	3	3
2	OE		**Open Elective**	3	0	0	3	3
3	PR	24CSEP702	Dissertation Phase I	0	0	20	20	10
4			Co-Curricular Activities	0	0	4	0	2
Total				**6**	**0**	**24**	**26**	**18**

II Year II Semester (Tentative Structure)

S. No.	Category	Course Code	Course Title.	Hours Per Week				Credits
				L	T	P	Total	
1	PR	24CSEP703	Dissertation Phase II	0	0	32	32	16
Total				**0**	**0**	**32**	**32**	**16**

(L = Lecture, T = Tutorial, P = Practical

ANNEXURE - I

LIST OF PROFESSIONAL ELECTIVES

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	24CSEP401	Enterprise Cloud Computing
2.	24CSEP402	Software Reliability Metrics and Models
3.	24CSEP403	Advanced Machine Learning
Any advanced courses can be appended in future.		

Professional Elective – II		
Sl. No.	**Course Code**	**Course Title**
1.	24CSEP404	Advanced Cryptography
2.	24CSEP405	DevOps
3.	24CSEP406	Advanced Data Visualization Techniques
Any advanced courses can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	24CSEP407	Edge Analytics
2.	24CSEP408	Advanced Software Testing
3.	24CSEP409	Machine Vision
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	24CSEP410	Quantum Computing
2.	24CSEP411	Intelligent Information Retrieval
3.	24CSEP412	Knowledge Engineering and Expert Systems
Any advanced courses can be appended in future.		

Professional Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	24CSEP413	Cyber Attacks Detection and Prevention Systems
2.	24CSEP414	Advanced Wireless Sensor Networks
3.	24CSEP415	Robotic Process Automation
Any advanced courses can be appended in future.		

ANNEXURE - II

LIST OF AUDIT COURSES

Audit Course – I		
Sl. No.	**Course Code**	**Course Title**
1.	24AUP901	Disaster Management
2.	24AUP902	Constitution of India

Audit Course – II		
Sl. No.	**Course Code**	**Course Title**
1.	24AUP903	English for Research Paper Writing
2.	24AUP904	Value Education
3.	24AUP905	Stress Management by Yoga

I Year I Semester

M. Tech Computer Science & Engineering

M. Tech I Year I Semester

24CSEP101 ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

Pre-requisite Data Structures

Course Description:

The course aims to develop a comprehensive understanding of dictionaries and hash tables, implement lists and trees, analyse B trees, Splay trees, and 2-3 trees, grasp the significance of text processing and computational geometry, and enhance expertise in algorithmic analysis and design techniques.

Course Objectives:

This course enables students to

1. To understand concepts of dictionaries and hash tables.
2. To implement lists and trees.
3. To analyze usage of B trees, Splay trees and 2-3 trees.
4. To understand the importance of text processing and computational Geometry.
5. To enhance their expertise in algorithmic analysis and algorithm design techniques.

UNIT I DICTIONARIES & HASHING 9 hours

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation- Big Oh, Omega and Theta notations, Complexity Analysis Examples. Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries, Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT II TREES 9 hours

Skip Lists : Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists, Trees: Binary Search Trees (BST), AVL Trees, Red Black Trees: Height of a Red Black Tree, Red Black Trees Bottom-Up Insertion, Top-Down Red Black Trees, Top-Down Deletion in Red Black Trees, Analysis of Operations.

UNIT III ADVANCE TREE CONCEPTS 9 hours

2-3 Trees , Advantage of 2-3 trees over Binary Search Trees, Search and Update Operations on 2-3 Trees, Analysis of Operations, B-Trees: Advantage of B- trees over BSTs, Height of B-Tree, Search and Update Operations on 2-3 Trees, Analysis of Operations, Splay Trees: Splaying, Search and Update Operations on Splay Trees, Amortized Analysis of Splaying.

UNIT IV DYNAMIC PROGRAMMING 9 hours

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

UNIT V COMPUTATIONAL GEOMETRY 9 hours

Computational Geometry: One Dimensional Range Searching, Two-Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the implementation of symbol table using hashing techniques

CO2:Apply advanced abstract data type (ADT) and data structures in solving real world problem

CO3: Effectively combine the fundamental data structures and algorithmic techniques in building a solution to a given problem

CO4: Develop algorithms for text processing applications

CO5: Develop search algorithms using priority search trees, explore the concept of priority range trees, and apply quad trees and k-D trees for efficient spatial data querying.

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, second Edition, Pearson, 2004.
2. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to algorithms. MIT press, 2022.

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia, Algorithm Design, First Edition, Wiley, 2006.
2. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, “Fundamentals of Data Structures in C”, Silicon Pr, 2007.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

M. Tech I Year I Semester

24CSEP102 ADVANCED DATABASES

L	T	P	C
3	0	0	3

Pre-requisite Database Management Systems

Course Description:

This course is designed to provide basic understanding on database systems and its design. The course material further used for developing any web based applications in which database is back end. Course covers from all basic and advanced queries of SQL, PL/SQL programs, NoSQL, Relational algebra, normal forms, transaction management, distributed and parallel database system concepts.

Course Objectives:

This course enables students to

1. Basic concepts in databases both in terms of theoretical and practical.
2. XML Databases and its Operations.
3. No SQL Database and its Applications
4. Parallel and Distributed Databases and its Applications.
5. Database Security and its Challenges.

UNIT I RELATIONAL MODEL 9 hours

Structured Database: Relational Databases- Relational Model, Relational Algebra, Integrity Constraints, Functional Dependency, Database Normalization – First Normal Form – Second Normal Form – Third Normal Form – Boyce Codd Normal Form – Fourth Normal Form – Fifth Normal Form

UNIT II XML DATABASES 9 hours

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases XML Querying – XPath – XQuery

UNIT III NOSQL DATABASES 9 hours

Overview of Semi Structured Database; Unstructured Database: The CAP Theorem, NoSQL Data Models, CRUD Operations, MongoDB: Replica Sets, Indexing, Auto-Sharding, Web Application Development using MongoDB with PHP and Java

UNIT IV PARALLEL AND DISTRIBUTED DATABASE SYSTEMS 9 hours

Parallel Database: Design of Parallel Databases, Parallel Database Architecture, Parallel Query Processing and Evaluation, Optimization, Load Balancing. Image and Multimedia Databases and Web Database.
Distributed Databases: Fragmentation and Replication, Location, and Fragment Transparency, Distributed Query Processing, Distributed Transaction Modeling, Distributed concurrency control. Map Reduce-based distributed data management, Load balancing tools for Distributed Database, Distributed Database Security.

UNIT V DATABASE SECURITY 9 hours

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.

Course Outcomes:

After completing this Unit, students will be able to
CO1: Design Relational Database for various applications.
CO2: Implement XML Databases and can perform its various Operations.
CO3: Make use of No SQL Database for real-time case studies
CO4: Apply Parallel and Distributed databases to speed up and scale up the database operations.
CO5: Examine various challenges in database security and its solutions.

Text Books:

1. Raghu Rama Krishnan and J. Gehrke,, Database Management Systems, 3rd Edition, 2014,McGraw Hill.
2. A.Silberschatz, H. F. Korth & A. Sudarshan,, Database System Concepts,McGraw Hill, 7th ed, 2019.

Reference Books:

1. R. Elmasri and S. Navathe, Fundamentals of Database Systems, AddisonWesley, 7th ed, 2017,ISBN: 978-9332582705.
2. P. J. Sadalage, M. Fowler, NoSQL Distilled, Addison-Wesley, 8th ed 2012, ISBN: 978-0321826626.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

M. Tech I Year I Semester

24CSEP201 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite Data Structures Laboratory

Course Description:

This course provides comprehensive knowledge of implementing linear and nonlinear data structures, analysing algorithms based on time complexity, and selecting appropriate data structures and algorithm design methods for specific applications. Students will learn to identify suitable data structures for solving various computing problems and gain practical skills in applying advanced trees and graphs to real-world scenarios. This course is essential for developing expertise in efficient data handling and algorithm optimization

Course Objectives:

1. To gain a deeper understanding of different hashing methods like division, multiplication, and universal hashing and how they influence dictionary implementation.
2. To implement and explore various tree structures (AVL, 2-3 Trees) and understand how insertions and deletions affect their balancing and efficiency.
3. To implement fundamental graph traversal techniques (DFS and BFS) and gain insights into their real-world applications.
4. To comprehend and implement algorithms like Prim's and Kruskal's for generating minimum-cost spanning trees, understanding their significance in network optimization.
5. To implement specialized data structures such as Priority Search Tree, Quad Tree, and k-D Tree, and explore their applications in multidimensional data search and spatial queries.

List of Experiments:

To develop a mini-project the following 13 exercises listed below

1. To implement functions of Dictionary using Hashing (division method, Multiplication method, Universal hashing).
2. To perform various operations i.e., insertions and deletions on AVL trees.
3. To perform various operations i.e., insertions and deletions on 2-3 trees.
4. To implement operations on binary heap.
5. To implement operations on graphs
6. To implement Depth First Search for a graph non-recursively.
7. To implement Breadth First Search for a graph non-recursively.
8. To implement Prim's algorithm to generate a min-cost spanning tree.
9. To implement Kruskal's algorithm to generate a min-cost spanning tree.
10. To implement Dijkstra's algorithm to find shortest path in the graph.
11. To implement the Priority Search Tree
12. To implement the Quad tree
13. To implement the k-D tree

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Implement and apply efficient hashing techniques to design faster dictionary lookups and manage large datasets effectively.

CO2: Construct the tree-based data structures (AVL, 2-3 trees) and heap operations to solve complex computational problems related to balancing and efficiency.

CO3: Examine various graph algorithms like DFS and BFS to enabling the design of optimal solutions for shortest path and minimum-cost spanning trees.

CO4: Develop algorithms like Prim's, Kruskal's and Dijkstra's for generating minimum-cost spanning trees, understanding their significance in network optimization.

CO5: Applying advanced structures like Quad Tree and k-D Tree for solving multidimensional data and spatial search problems.

Text Books:

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to algorithms. MIT press, 2022.

Reference Books:

1. Skiena, Steven S. "The Algorithm Design Manual (Texts in Computer Science)." 3rd edition, 2020, Springer.

2. Brass, Peter. Advanced data structures. Vol. 193. Cambridge: Cambridge University Press, 2008.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year I Semester

24CSEP202 ADVANCED DATABASES LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite Database Management Systems Laboratory

Course Description:

The objective of this lab course is to understand the practical applicability of database management system concepts. Working on existing database systems, designing of database, creating relational database, analysis of table design. The lab courses also provide practical knowledge to understand advanced database concepts such as MySQL, Big Data Analysis and MongoDB.

Course Objectives:

1. To understand fundamental database creation and SQL execution for performing various database operations in MySQL.
2. To implement and compare XPath, XQuery, and XSLT queries for retrieving data from an XML database, assessing their performance in terms of speed and efficiency with large datasets.
3. To construct distributed databases using vertical and horizontal fragmentation strategies and understand the implications of replication in distributed systems.
4. To Implement the parallel join and sort algorithms to improve performance in large-scale databases and applying MapReduce techniques to solve complex data processing tasks.
5. To develop unstructured database design and implement distributed and parallel operations using MongoDB, understanding NoSQL paradigms.

List of Experiments:

1. Database Creation and Execution of SQL to understand various database operations using MySQL.
2. To implement the database to store XML data internally? (Flat text, DOM trees, or proprietary format)
3. To implement the XPath, XQuery, and XSLT queries to compare in terms of performance when retrieving data from the XML database.
4. To implement the exporting large XML data from the database into other formats (e.g., JSON, CSV)
5. Design a distributed database for a company in vertical fragmentation mode
6. Design a distributed database for a bookstore in horizontal fragmentation mode
   a. complete horizontal fragmentation
   b. derived horizontal fragmentation
7. Design a distributed database for an online shopping website with
   a. no replication
   b. partial replication
   c. full replication
8. Implement parallel join and parallel sort algorithms with case studies.
9. Implement Map Reduce operation with various use cases.
10. Design and Develop an unstructured Database using MongoDB
11. Implement distributed and Parallel database operations using MongoDB.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Experiment with database creation, executing SQL queries, performing complex joins, and designing optimized views and indexes in MySQL.

CO2: Implementing XPath, XQuery, and XSLT queries for retrieving data from an XML database, assessing their performance in terms of speed and efficiency with large datasets.

CO3: Designing distributed databases for different use cases (vertical, horizontal fragmentation) and handle varying replication strategies (no, partial, full).

CO4: Implementing parallel join and sort algorithms to improve performance in large-scale databases and applying MapReduce techniques to solve complex data processing tasks.

CO5: Develop a NoSQL databases by implementing unstructured databases using MongoDB, mastering distributed and parallel operations.

Text Books:

1. J. Lin, C. Dyer, Data-Intensive Text Processing with Map Reduce, Morgan and Claypool, 1st edition, 2010.
2. P. J. Sadalage, M. Fowler, NoSQL Distilled, Addison-Wesley, 8th edition,2012.

Reference Books:

1. T. White, Hadoop – The Definitive Guide, O'Reilly, 3rd edition, 2012.
2. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2015.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year I Semester

24RMP101 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Pre-requisite Nil

Course Description:

This course aims to provide students with a comprehensive understanding of research methodology and the principles and practices of intellectual property rights (IPR). The course will equip students with the skills needed to design, conduct, and evaluate research effectively while also understanding the legal and ethical considerations surrounding intellectual property.

Course Objectives:

To impart knowledge on

1. Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
2. Intellectual property rights, patenting and licensing

UNIT I RESEARCH PROBLEM FORMULATION 9 hours

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9 hours

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9 hours

Sampling, sampling error, measures of central tendency and variation,; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9 hours

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR, IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9 hours

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

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Course Outcomes:

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem

CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data

CO3: Explain the process of data analysis; interpret and present the result in suitable form

CO4: Explain about Intellectual property rights, types and procedures

CO5: Execute patent filing and licensing

Text Book(s)

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).

2. Soumitro Banerjee, "Research methodology for natural sciences", IISc Press, Kolkata, 2022.
3. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.

Reference Books

1. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
2. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

I Year II Semester

M. Tech Computer Science & Engineering

M. Tech I Year II Semester

24CSEP103 DEEP LEARNING AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite Probability and Random Processes, Linear Algebra

Course Description:

This course provides a comprehensive introduction to deep learning, a subset of machine learning that focuses on algorithms inspired by the structure and function of the brain known as artificial neural networks. The course covers the theoretical foundations, methodologies, and practical applications of deep learning. Students will gain hands-on experience with popular deep learning frameworks and tools, and learn how to apply deep learning techniques to solve real-world problems in various domains.

Course Objectives:

1. To understand the fundamental concepts and architectures of deep learning.
2. To develop proficiency in using deep learning frameworks such as TensorFlow and PyTorch.
3. To explore different types of neural networks including CNNs, RNNs, and GANs.
4. To apply deep learning techniques to practical applications such as image recognition, natural language processing, and more.
5. To address the challenges and limitations of deep learning, including overfitting and computational requirements.

UNIT I BASICS OF ARTIFICIAL NEURAL NETWORKS (ANN) 9 hours

Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks

Feedforward Neural Networks**:** Pattern classification using perceprton, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders.

UNIT II DEEP NEURAL NETWORKS (DNN) 9 hours

Difficulty of training DNNs, Greedy layerwise 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)

UNIT III CONVOLUTION NEURAL NETWORKS (CNN) 9 hours

Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.

UNIT IV RECURRENT NEURAL NETWORKS (RNN) 9 hours

Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RU Architecture.

UNIT V GENERATIVE MODELS 9 hours

Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Belief nets, Learning sigmoid belief nets, Deep belief nets. **Applications:** Applications in vision, speech and natural language processing

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Explain the key concepts and techniques of deep learning.

CO2: Implement deep learning models using popular frameworks.

CO3: Design, train, and evaluate neural networks for various tasks.

CO4: Apply deep learning methods to real-world problems and datasets.

CO5: Understand the ethical and societal implications of deep learning applications.

Text Book(s)

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, In preparation for MIT Press, Available online: http://www.deeplearningbook.org, 2016

Reference Books

1. S. Haykin, Neural Networks and Learning Machines , Prentice Hall of India, 2010.
2. Satish Kumar, Neural Networks - A Class Room Approach, Second Edition, Tata McGraw-Hill, 2013
3 B. Yegnanarayana, Artificial Neural Networks, Prentice- Hall of India, 1999
4 C.M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

M. Tech I Year II Semester

24CSEP104 ADVANCED COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite Computer Networks

Course Description:

Network Technologies is a comprehensive study of the principles, protocols, and technologies that underpin modern computer networks. This course delves into the design, implementation, and management of local area networks (LANs), wide area networks (WANs), and the internet. Through a combination of theoretical lectures, practical exercises, and hands-on lab sessions, students will gain a deep understanding of networking fundamentals and advanced topics.

Course Objectives:

This course enables students to

1. To understand the basic concepts of networks
2. To explore various technologies in the wireless domain
3. To study about 4G and 5G cellular networks
4. To learn about Network Function Virtualization
5. To understand the paradigm of Software defined networks

UNIT I NETWORKING CONCEPTS 9 hours

Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. OSI Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall, IP addressing.

UNIT II WIRELESS NETWORKS 9 hours

Wireless Hardware – SSID – Wireless Standards – IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, Ad Hoc Mode and Infrastructure Mode – Bluetooth – zigbee - Security

UNIT III MOBILE DATA NETWORKS 9 hours

4G and 5G Cellular Network – First Generation, Second Generation, Third Generation, Fourth Generation, Fifth Generation – Concepts of 5G – channel access – air interface -Cognitive Radio-spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mm Wave, Introduction to 6G.

UNIT IV SOFTWARE DEFINED NETWORKS 9 hours

SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. Group Table. OpenFlow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. OpenDaylight. OpenDaylight Architecture. OpenDaylight Helium.

UNIT V NETWORK FUNCTIONS VIRTUALIZATION 9 hours

Motivation-Virtual Machines – NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN – Network virtualization – VLAN and VPN

Course Outcomes:

After completing this Unit, students will be able to

CO1: Interpret basic networking concepts
CO2: Compare different wireless networking protocols
CO3: Describe the developments in each generation of mobile data networks
CO4: Develop SDN based applications
CO5: Use concepts of network function virtualization

Text Book(s)

1. James Bernstein, "Networking made Easy", 2018. (Unit 1 and 2)
2. William Stallings –"Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" 1st Edition, Pearson Education, 2016. (Unit 3, 4 and 5)

Reference Books

1. HoudaLabiod, Costantino de Santis, HossamAfifi –"Wi-Fi, Bluetooth, Zigbee and WiMax", Springer 2007
2. Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013
3 Saad Z. Asif – "5G Mobile Communications Concepts and Technologies" CRC press – 2019
4 Thomas D.Nadeau and Ken Gray, "SDN – Software Defined Networks" ,O'Reilly Publishers, 2013.
5 Guy Pujolle, "Software Networks", Second Edition, Wiley-ISTE, 2020

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

M. Tech I Year II Semester

24CSEP203 DEEP LEARNING AND ITS APPLICATIONS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite Python Programming

Course Description:

The Deep Learning and Its Applications Lab is a practical, hands-on course designed to complement the theoretical foundations covered in the Deep Learning and Its Applications lecture series. This lab course provides students with the opportunity to apply deep learning techniques to real-world problems using popular frameworks such as TensorFlow and PyTorch. Students will gain experience in designing, training, and deploying deep learning models across various domains including computer vision, natural language processing, and more.

Course Objectives:

1. To Build The Foundation Of Deep Learning.
2. To Understand How To Build The Neural Network.
3. To enable students to develop successful machine learning concepts.

List of Experiments:

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Autoencoder algorithms for encoding the real-world data

Software Requirements

1. Python
2. Spyder IDE Environment

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Implement deep learning models using TensorFlow and PyTorch.
CO2: Design, train, and evaluate neural networks for different types of data.
CO3: Apply deep learning techniques to real-world datasets in computer vision, NLP, and other areas.
CO4: Use transfer learning to leverage pre-trained models for new tasks.
CO5: Deploy deep learning models and assess their performance in practical scenarios.

Reference Books

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.H., and Van Loan C.F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
5. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
6. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
7. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year II Semester

24CSEP204 ADVANCED COMPUTER NETWORKS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite Computer Networks Laboratory

Course Description:

This course is introduced to give hands on experience in configuring, troubleshooting, and optimizing computer networks. Through a series of practical exercises and lab assignments, students will reinforce theoretical concepts learned in concurrent networking technologies courses and develop essential skills for designing and managing modern network infrastructures.

Course Objectives:

1. To understand the functioning of various protocols in wired and wireless environments.
2. To perform real time experiments using the existing infrastructure.
3. To impart programming skills using NS2/QUALNET.
4. To gain knowledge in constructing LAN, WLAN, and VLAN in a real-time environment.
5. To understand the security algorithms for networks.

List of Experiments:

1. AODV/DSR routing
2. Security algorithms in wired networks
3. MAC protocols wired and wireless networks
4. Configuration of LAN
5. Configuration of VLAN- Tunnelling
6. Configuration of WLAN
7. Mini Project

Hardware/Software Requirements

1. C/Java/Python
3. NS2/ QUALNET /NS3/ OMNET/ equivalent

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Design MAC and routing protocols in Wired and Wireless Environment using NS2/QUALNET.
CO2: Acquire the technical competence to meet out the industry expectation on the state – of the art wired / wireless technologies.
CO3: Acquire the ability to design WLAN/ LAN systems meeting out real time requirements.
CO4: Design and configure a network.
CO5: Design VLAN for secured communication.

Reference Books

1. Behrouz Forouzan, “Introduction to Data Communications and Networking”, Tata McGraw Hill, 5th Edition, 2015.
2. Stallings, “Data and Computer Communications”, PHI, 10th Edition, 2015.
3. Teerawat Issariyakul, Ekram Hossain, “Introduction to Network Simulator NS2”, Springer, Second Edition, 2012.
4. ns-3 Manual
5. OMNeT++ - Simulation Manual
6. QualNet 6.1 User'sGuide Qual Net User's Guide

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

Professional Electives

M. Tech Computer Science & Engineering

M. Tech I Year I Semester

24CSEP401 ENTERPRISE CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite Cloud Computing

Course Description:

This course introduces the fundamentals of cloud computing, covering key concepts, technologies, and infrastructure mechanisms like virtualization and cloud storage. Students will gain hands-on experience managing cloud resources, learn remote administration, SLA management, and billing, and explore how cloud computing transforms enterprise strategies for enhanced operational efficiency and business continuity.

Course Objectives:

1. Understand the foundational concepts, terminologies, and models of cloud computing, including cloud characteristics, delivery models, and deployment models, to build a strong theoretical base.
2. Explore the technologies underpinning cloud computing such as broadband networks, data center infrastructure, service oriented architecture & virtualization, and evaluate their impact on cloud service delivery and performance.
3. Gain hands-on experience with cloud infrastructure mechanisms including virtual servers, cloud storage, and resource replication, and learn to manage and monitor cloud resources effectively.
4. Develop skills to manage cloud environments through the use of remote administration systems, resource management, SLA management, and billing systems, and apply these skills to real-world case studies.
5. Understand the implications of cloud computing for enterprise strategies, including the transition to cloud-centric operations, and learn to design and implement cloud solutions that enhance business continuity and operational efficiency.

UNIT I **9 hours**

Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Cloud Characteristics, Risks and Challenges.

Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT II **9 hours**

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Service Oriented Architecture, Virtualization Technology.

Cloud Computing Mechanisms:

Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication.

UNIT III **9 hours**

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example

Cloud Computing Architecture

Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example

UNIT IV **9 hours**

Cloud-Enabled Smart Enterprises: Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises

Cloud-Inspired Enterprise Transformations: Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy

UNIT V **9 hours**

Transitioning to Cloud-Centric Enterprises: The Tuning Methodology, Contract Management in the Cloud

Cloud-Instigated IT Transformations

Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Interpret the fundamental concepts, terminology, and models of cloud computing, including cloud characteristics, delivery models, and deployment models, and explain their relevance in modern IT environments.

CO2: Analyze cloud-enabling technologies such as broadband networks, data center infrastructure, and virtualization, and assess their effectiveness in supporting cloud services and solutions.

CO3: Implementing and managing cloud infrastructure mechanisms, including setting up virtual servers, utilizing cloud storage solutions, and ensuring resource replication for high availability and reliability.

CO4: Applying cloud management strategies, including the use of remote administration systems, resource management, SLA management, and billing systems, to optimize cloud operations and ensure service quality.

CO5: Designing and implementing cloud-based solutions to drive enterprise transformation, enhancing business continuity, operational efficiency, and aligning cloud strategies with overall business objectives.

Text Books:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition,
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press.

Reference Books:

1. James Bond, The Enterprise Cloud, O'Reilly Media, Inc.
2. Gautham Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge press, 2010.
3. John Rhoton and Risto Haukiojal, "Cloud Computing Architectured: Solution Design Handbook", Recursive Press, 2013.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective I

24CSEP402 SOFTWARE RELIABILITY METRICS AND MODELS

L	T	P	C
3	0	0	3

Pre-requisite Software Engineering

Course Description:

The Course Covers the Topics Include Software Reliability, Software Reliability Metrics, Software Testing Reliability Metrics, Historical Development of Models, Comparison of Software Reliability Models, Fundamentals of Measurement, Measuring Software Product. The Main Goal of This Course is to Help Student to Build Their Ability to do Useful Applications that Could be released for Real-World Use.

Course Objectives:

This Course enables students to

1. Learn different definitions of software quality
2. Know different notions of defects and classify them
3. Understand the basic techniques of data collection and how to apply them.
4. Learn software metrics that define relevant metrics in a rigorous way.
5. Gain confidence in ultra-high reliability.

UNIT I INTRODUCTION TO SOFTWARE RELIABILITY **9 hours**

Basic Concepts – Failure and Faults – Environment – Availability –Modeling –uses – requirements reliability metrics – design & code reliability metrics – testing reliability metrics.

UNIT II SOFTWARE RELIABILITY MODELING **9 hours**

Concepts – General Model Characteristic – Historical Development of models – Model Classification scheme – Markovian models – General concepts – General Poisson Type Models – Binomial Type Models – Poisson Type models – Fault reduction factor for Poisson Type models.

UNIT III COMPARISON OF SOFTWARE RELIABILITY MODELS **9 hours**

Comparison Criteria – Failure Data – Comparison of Predictive Validity of Model Groups – Recommended Models – Comparison of Time Domains – Calendar Time Modeling – Limiting Resource Concept – Resource Usage model – Resource Utilization – Calendar Time Estimation and confidence Intervals.

UNIT IV FUNDAMENTALS OF MEASUREMENT **9 hours**

Measurements in Software Engineering – Scope of Software metrics – Measurements theory – Goal based Framework – Software Measurement Validation.

UNIT V MEASURING SOFTWARE PRODUCT 9 hours

Measurement of Internet Product Attributes – Size and Structure – External Product Attributes – Measurement of Quality – Software Reliability: Measurement and Prediction.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Perform some simple statistical analysis relevant to software measurement data.

CO2: Use from practical examples both the benefits and limitations of software metrics for quality control and assurance

CO3: Explain Comparison of Predictive Validity of Model Groups.

CO4: Describe Measurements in Software Engineering.

CO5: Understand Software Reliability, Measurement and Prediction.

Text Book(s)

1. John D. Musa, Software Reliability Engineering, Tata McGraw Hill, 1999

2. John D. Musa, Anthony Iannino, Kazuhira Okumoto, Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology, McGraw Hill, 1987

Reference Books

1. Norman Fenton, James Bieman, Software Metrics: A Rigorous and Practical Approach, 3rd edition, CRC Press, 2015
2. Patric D. T.O connor, "Practical Reliability Engineering", 4th Edition, John Wesley & sons, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective I

24CSEP403 ADVANCED MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite Machine Learning

Course Description:

Advanced Machine Learning is a graduate level course introducing the theoretical foundations of modern machine learning, as well as advanced methods and frameworks used in modern machine learning. The course treats both the art of designing good learning algorithms, as well as the science of analyzing an algorithm's computational and statistical properties and performance guarantees.

Course Objectives:

This course enables students to

1. Focusing on recent advances in deep learning with neural networks, such as recurrent and Bayesian neural networks.
2. The course will concentrate especially on natural language processing (NLP) and computer vision applications.
3. Introduce the mathematical definitions of the relevant machine learning models and derive their associated optimization algorithms.
4. It will cover a range of applications of neural networks in natural language processing, including analyzing latent dimensions in text, translating between languages, and answering questions.

UNIT I INTRODUCTION TO MACHINE LEARNING 9 hours

Introduction to Machine Learning, Examples of Machine Learning applications - Learning associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning. Supervised learning- Input representation, Hypothesis class, Version space, Vapnik-Chervonenkis (VC) Dimension. Evaluation in ML: metrics, cross-validation, statistics, addressing the multiple comparisons problem.

UNIT II ADVANCED MACHINE LEARNING TOPICS 9 hours

Advanced machine learning topics: Bayesian modelling and Gaussian processes, randomized methods, Bayesian neural networks, approximate inference.

UNIT III DEEP LEARNING 9 hours

Deep learning: regularization, convolutional neural networks, recurrent neural networks, variational autoencoders, generative models, applications.

UNIT IV APPLICATIONS OF MACHINE LEARNING IN NLP 9 hours

Applications of machine learning in natural language processing: recurrent neural networks, backpropagation through time, long short term memory, attention networks, memory networks, neural Turing machines, machine translation, question answering, speech recognition, syntactic and semantic parsing, GPU optimization for neural networks.

UNIT V REINFORCEMENT LEARNING 9 hours

Reinforcement Learning: Introduction to Reinforcement Learning, Multi-armed Bandit Problem, Finite Markov Decision Processes, Dynamic Programming, Eligibility Traces, Policy Gradient Methods, Deep-Q Learning; Applications and Case Studies.

Course Outcomes:

After completing this Unit, students will be able to
CO1: Understand the definition of a range of neural network models.
CO2: Be able to derive and implement optimization algorithms for these models.
CO3: Understand neural implementations of attention mechanisms and sequence embedding models and how these modular components can be combined to build state of the art NLP systems.
CO4: Be able to implement and evaluate common neural network models for language.
CO5: Explore the reinforcement algorithms for real time applciations

Text Book(s)

1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press 2012.

2. Ian Goodfellow, Yoshua Bengio and Aaron Courville. Deep Learning. MIT Press 2016.

Reference Books

1. Bayesian Reasoning and Machine Learning David Barber, Cambridge University Press, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

M. Tech I Year I Semester

24CSEP404 ADVANCED CRYPTOGRAPHY

L	T	P	C
3	0	0	3

Pre-requisite Cryptography and Network Security

Course Description:

This course covers the foundational concepts of cryptography and cryptosystems, focusing on encryption mechanisms, hash functions, and factoring algorithms. Students will explore advanced topics such as post-quantum cryptography and various cryptographic methods, along with key distribution management techniques, providing a comprehensive understanding of modern cryptographic practices.

Course Objectives:

1. To know the Basic concepts of Cryptography and Cryptosystems.
2. To learn about Encryption Mechanism
3. To learn about Hash functions and Factoring Algorithms
4. To learn about Post-Quantum Cryptography and Different Cryptography methods.
5. To learn about Key Distribution management in Cryptography

UNIT I INTRODUCTION **9 hours**

Introduction to Cryptography-Cryptosystems and Basic Cryptographic Tools-Secret-key Cryptosystems-Public-key Cryptosystems-Block and Stream Ciphers-Hybrid Cryptography-Message Integrity-Message Authentication Codes-Signature Schemes-Nonrepudiation-Certificates-Hash Functions-Cryptographic Protocols-Security-Classical Cryptography-The Shift Cipher-The Substitution Cipher-The Affine Cipher-The Vigenère-The Hill Cipher-The Permutation Cipher-Stream Ciphers-Cryptanalysis

UNIT II SYMMETRIC KEY CRYPTOGRAPHY **9 hours**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclids algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 –Key distribution.

UNIT III PUBLIC KEY CRYPTOGRAPHY **9 hours**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY **9 hours**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509

UNIT V ADVANCED CRYPTOGRAPHY 9 hours

Post-Quantum Cryptography-Lattice-based Cryptography-Code-based Cryptography and the McEliece Cryptosystem-Multivariate Cryptography-Hash-based Signature Schemes-Challenge-and-Response in the Secret-key Setting-Challenge-and-Response in the Public-key Setting-The Schnorr Identification Scheme.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Understanding Basic Concepts of Cryptography and Cryptosystems.
CO2: Knowledge of Encryption Mechanisms.
CO3: Proficiency in Hash Functions and Factoring Algorithms
CO4: Insight into Post-Quantum Cryptography and Diverse Cryptography Methods.
CO5: Understanding Key Distribution and Management in Cryptography.

Text Books:

1. Cryptography Theory and Practice by Douglas R. Stinson Maura B. Paterson, Fourth Edition,2019. 2019 by Taylor & Francis Group, LLC ,CRC Press is an imprint of Taylor & Francis Group, an Informa business
2. "Introduction to Modern Cryptography" by Authors: Jonathan Katz and Yehuda Lindell, CRC Press,2020, 3rd Edition

Reference Books:

1. "Cryptography and Network Security: Principles and Practice" by William Stallings, Pearson 2016, 7th Edition.
2. "Cryptography and Network Security" by Behrouz A. Forouzan and Debdeep Mukhopadhyay McGraw-Hill Education 2015, 3rd Edition.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective II

24CSEP405 DEVOPS

L	T	P	C
3	0	0	3

Pre-requisite Software Engineering

Course Description:

This course is aimed to provide basic understanding of DevOps and its effective pillars such as collaboration, affinity, tools, scaling. This course covers each section of effective DevOps in detail with case studies.

Course Objectives:

This course enables students to

1. Introduce the fundamental concepts of DevOps and its misconceptions
2. Expose the student about the collaboration concepts of DevOps
3. Create a basic understanding of DevOps affinity and its misconceptions.
4. Familiarize the student with DevOps tools and its ecosystem.
5. Enable students to understand the DevOps Scaling and growth strategies.

UNIT I INTRODUCTION to DEVOPS **9 hours**

A History of Devops; Foundational Terminology and Concepts; Software Development; Development, Release, and Deployment Concepts; Infrastructure Concepts; Cultural Concepts; Devops Misconceptions and Anti-Patterns; Common Devops Misconceptions; Devops Anti Patterns.

UNIT II COLLABORATION **9 hours**

Collaboration: Individuals Working Together; Defining Collaboration; Individual Differences and Backgrounds; Opportunities for Competitive Advantage; Mentorship; Mindsets and Learning Organizations; Communication and Conflict Resolution Styles; Empathy and Trust; Humane Staffing and Resources; Collaboration Misconceptions; Collaboration Troubleshooting.

UNIT III AFFINITY **9 hours**

Team building; Teams and Organizational Structure; Finding Common Ground Between Teams; Case Study - United States Patent and Trademark Office; Benefits of Improved Affinity; Requirements for Affinity; Measuring Affinity; Affinity Misconceptions; Affinity Troubleshooting.

UNIT IV TOOLS **9 hours**

Tools: Ecosystem Overview; Software Development; Automation; Monitoring; Evolution of the Ecosystem; Tools: Accelerators of Culture; Irrelevance of Tools; The Impacts of Tools on Culture; Selection of Tools; Auditing Your Tool Ecosystem; Elimination of Tools; Case Study - Examining Etsy.

UNIT V SCALING **9 hours**

Understanding scaling; Considering Enterprise Devops; Organizational Structure; Team Flexibility; Organizational Lifecycle; Complexity and Change; Scaling for Teams; Case Studies: Growing and Scaling Teams; Team Scaling and Growth Strategies; Scaling for Organizations; Examining Target.

Course Outcomes:

After completing this course, students will be able to

CO1: Interpret the DevOps foundation terminology, misconceptions and anti-patterns.
CO2: Apply the DevOps collaboration strategies.
CO3: Illustrate DevOps tools in a specific problem scenario.
CO4: Practice the DevOps affinity schemes.
CO5: Utilize the DevOps scaling approaches for teams and organization.

Text Book(s)

1. Jennifer Davis, Ryn Daniels, Effective DevOps, O'Reilly Publishers, 2018, ISBN:9781491926307.

Reference Books

1. Joakim Verona, Practical DevOps, Packt Publishers, 2016, ISBN: 978-1-78588-287-6.
2. Gene Kim, Jez Humble, Patrick Debois, John Willis, The DevOps Handbook, ITRevolution Publishers, 2021, ISBN:9781950508402.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective – II

24CSEP406 ADVANCED DATA VISUALIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Course Description:

Advanced Data Visualization is about the art and science of visualizing data. Three themes (what, why, and how) will run alongside each other as we cycle through the course. In "what" we focus on specific types of visualizations for a particular purpose, "how" we focus on the process – each visualization starts with and "why" we discuss the theory that ties the "how" and the "what" together, often focusing on the grammar of graphics.

Course Objectives:

1. To understand the various types of data, apply and evaluate the principles of data visualization.
2. Acquire skills to apply visualization techniques to a problem and its associated dataset.
3. To apply structured approach to create effective visualizations from the massive dataset using various visualization tools.

UNIT I BASICS OF DATA VISUALIZATION 9 hours

Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis: Four Levels for Validation. Statistical charts (Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart - Frequency Polygon - Box plot - Scatter plot - Regression curves.) Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT II DATA VISUALIZATION TOOLS 9 hours

Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques - multidimensional techniques - visualizing cluster analysis – K-means and Hierarchical Cluster techniques. Time Series data visualization – Text data visualization – Spatial Data Visualization

UNIT III NETWORK VISUALIZATION 9 hours

Networks and Trees - Heat Map – Tree Map - Map Color and Other Channels Manipulate View - Visual Attributes- Multivariate data visualization – Geometric projection techniques - Icon-based techniques - Pixel-oriented techniques - Hierarchical techniques - Scatterplot matrix - Hyper box - Trellis display - Parallel coordinates.

UNIT IV INTRODUCTION TO DASHBOARDS 9 hours

Dashboard – Introduction– Taxonomies- User Interaction- Organizational Functions-Dashboard Design – Worksheets - Workbooks – Workbook Optimization - Protection and common mistakes. Dashboard creation using visualization tool use cases: Finance-marketing-insurance-healthcare.

UNIT V PLOTTING GEOSPATIAL VISUALIZATION 9 hours

Plotting Geospatial Data: Introduction to Geoplotlib, Design Principles of Geoplotlib, Geospatial Visualizations, Plotting Geospatial Data on a Map Web-Based Visualizations: Concepts of Bokeh, Interfaces-Plotting and Model Interfaces, Output, Bokeh Server, Presentation, Integrating – HTML Document and Bokeh Applications.

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the different data types, visualization types to bring out the insight

CO2: Demonstrate the analysis of large dataset using various visualization techniques and tools

CO3: Relate the visualization towards the problem based on the dataset to analyse and bring out valuable insight on large dataset.

CO4: Design visualization dashboard to support the decision making on large scale data.

CO5: Apply visualization techniques for various Geospatial data analysis tasks

Text Book(s)

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.

Reference Books

1. Mario Dobler, Tim Grobmann, “Data Visualization with Python”, O’Reilly, First Edition, 2019
2. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective - III

24CSEP407 EDGE ANALYTICS

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the Fundamentals of Edge Analytics.
2. Explore Edge Analytics Components and Communication Protocols
3. Gain hands-on experience Integrate Edge Devices with Cloud Platforms.
4. Utilize Micro Python for Edge Analytics Applications.
5. Design and Secure Edge Analytics Applications

UNIT I **9 hours**

Introduction to Edge Analytics, What is edge analytics, Applying and comparing architectures, Key benefits of edge analytics, Edge analytics architectures, Using edge analytics in the real world.

UNIT II **9 hours**

Basic edge analytics components, connecting a sensor to the ESP-12F microcontroller, KOM-MICS smart factory platform, Communications protocols used in edge analytics, Wi-Fi communication for edge analytics, Bluetooth for edge analytics communication, Cellular technologies for edge analytics communication, Long-distance communication using LoRa and Signfox for edge analytics.

UNIT III **9 hours**

Working with Microsoft Azure IoT Hub, Cloud Service providers, Microsoft Azure, Exploring the Azure portal, Azure ioT Hub, Using the Raspberry Pi with Azure IoT edge, Connecting our Raspberry Pi edge device, adding a simulated temperature sensor to our edge device.

UNIT IV **9 hours**

Using Micropython for Edge Analytics, Understanding Micropython, Exploring the hardware that runs MicroPython, Using MicroPython for an edge analytics application, Using edge intelligence with microcontrollers, Azure Machine Learning designer, Azure IoT edge custom vision.

UNIT V **9 hours**

Designing a Smart Doorbell with Visual Recognition setting up the environment, Writing the edge code, creating the Node-RED dashboard, Types of attacks against our edge analytics applications, Protecting our edge analytics applications.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Comprehensive Understanding of Edge Analytics.
CO2: Proficiency in Edge Analytics Components and Protocols.
CO3: Gain practical skills in integrating edge devices with cloud platforms.
CO4: Ability to Develop MicroPython-based Applications.
CO5: Competence in Designing and Securing Edge Applications.

Text Books:

1. Hands-On Edge Analytics with Azure IoT: Design and develop IoT applications with edge analytical solutions including Azure IoT Edge by Colin Dow (2020)

Reference Books:

1. Learn Edge Analytics - Fundamentals of Edge Analytics: Automated analytics at source using Microsoft Azure by Ashish Mahajan(2018)
2. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
3. Cloud and Distributed Computing: Algorithms and Systems, Rajiv Misra, Yashwant Patel, Wiley 2020

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

24CSEP408 ADVANCED SOFTWARE TESTING

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the criteria for testing process
2. Study the significance of testing
3. Study the testing to be done at various levels
4. Understand the procedure for designing test cases
5. Understand the various Non-functional testing methods

UNIT I **9 hours**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model - Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer / Tester Support of Developing a Defect Repository

UNIT II **9 hours**

Finite state machines (FSM) - properties of FSM, Conformance testing, test generation, test optimization, Fault detection. Combinatorial designs – combinatorial test design process. Pairwise design: Binary factors and multi-valued factors. Orthogonal arrays and multi level orthogonal arrays

UNIT III **9 hours**

Test Adequacy: Basics, measurement of test adequacy, infeasibility and test adequacy. Adequacy criteria based control – statement, block, conditions and decisions coverage techniques. Basics of Junit tool for Java. Metrics Importance of Metrics in Testing - Effectiveness of Testing – Defect Density – Defect Leakage Ratio – Residual Defect Density – Test Team Efficiency – Test Case Efficiency.

UNIT IV **9 hours**

Regression Testing, Regression test process. Regression test selection techniques: Test all, Random selection, modification traversing tests, using execution trace. Test minimization and prioritization.

UNIT V **9 hours**

Non-functional testing Load testing, performance testing, GUI testing, Security testing techniques and tools. Automation: Case studies functional test automation using Selenium

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Ability to systematically test the applications
CO2: Ability to write the test cases
CO3: Ability to use testing tools effectively
CO4: Analyze the various testing tools.
CO5: Use various testing methods and verify

Text Books:

1. Aditya P Mathur, Foundations of software testing, 2nd edition, Pearson , 2013.
2. Boris Beizer, “Software Testing Techniques”, 2nd Edition, Dream tech press, 2003.

Reference Books:

1. M G Limaye, “Software Testing – Principles, Techniques and Tools”, Tata McGraw Hill, 2009.
2. Edward Kit, “Software Testing in the Real World - Improving the Process”, Pearson Education, 2004
3. William E. Perry, “Effective methods for software testing”, 2nd Edition, John Wiley, 2000.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

24CSEP409 MACHINE VISION

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the history and importance of Machine vision.
2. Expose the students to various image processing techniques.
3. Expose the students to the various image classification and segmentation procedures.
4. Understand the types of deep learning models for feature extraction.
5. Analyse and design deep learning frameworks for real-time problems.

UNIT I INTRODUCTION 6 hours

Definition- Applications of Machine Vision – Historical background and development – Importance and relevance in modern technology

UNIT II IMAGE BASICS AND PRE-PROCESSING TECHNIQUES 9 hours

Understanding digital images (pixels, resolution, color spaces (RGB, grayscale) - Image representation in computers: matrices and arrays, Image formats: JPEG, PNG, etc. - Image enhancement: histogram equalization, contrast stretching - Image operations (blurring, sharpening, edge detection) - Filtering techniques(convolution, Gaussian filter) - Filtering: smoothing, sharpening, edge detection using techniques like Sobel, Prewitt, and Canny - Morphological operations: erosion, dilation, opening, and closing.

UNIT III IMAGE CLASSIFICATION AND SEGMENTATION 9 hours

Feature Extraction: Introduction to feature extraction techniques such as Harris corner detection, SIFT, SURF, and ORB. - Feature descriptors: Histogram of Oriented Gradients (HOG), Scale Invariant Feature - Image Classification: SVM, Decision Trees, Gradient Boosting Machines, Naïve Bayes - Image Segmentation: Thresholding, Region-based segmentation, Edge based segmentation, Semantic segmentation, Instance segmentation

UNIT IV DEEP LEARNING FOR MACHINE VISION 12 hours

Neural network architecture overview. - Basics of convolutional neural networks (CNNs). - Training CNNs for image classification tasks. - Transfer learning and fine-tuning pre-trained models like VGG, ResNet, and Google's inception. – Training of deep learning models for image segmentation tasks – U-Net, nn-UNet , Transformers – Swin Transformer, Vision Transformer, Yolo for object detection

UNIT V APPLICATIONS 9 hours

Hand-printed Character Recognition - Color Segmentation of Football Images – Instance segmentation of bio-medical images – Classification of medical images using pre-trained models

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the need, historical background and development of machine vision for many real-time problems.
CO2: Demonstrate the understanding of basic concepts in digital image processing and analysis.
CO3: Demonstrate understanding of a variety of digital image segmenting and classifying algorithms.
CO4: Interpret a variety of deep learning models are image processing tasks.
CO5: Develop deep learning models for real-time problems.

Text Books:

1. Computer Vision: Algorithms and Applications (Texts in Computer Science) 2020 2nd Edition, Springer, by Richard Szeliski, ISBN 978-1-84882-934-3, ISBN 978-1-84882-935-0 (ebook)

Reference Books:

1. Computer Vision: A Modern Approach, 2nd Edition, Forsyth and Ponce, Pearson, 2012
2. Deep Learning, Goodfellow, Bengio and Courville, The MIT Press, 2016

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective-IV

24CSEP410 QUANTUM COMPUTING

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the fundamental concepts behind quantum computation.
2. To know the background of classical computing and quantum computing.
3. To learn the fundamental concepts behind quantum computation.
4. To study the details of quantum mechanics and the relation to Computer Science.
5. To gain knowledge about the basic hardware and mathematical models of quantum computation.

UNIT I FUNDAMENTAL CONCEPTS OF QUANTUM COMPUTING 9 hours

What is information? Is information physical? - Quantitative measure of information - History of quantum computation and quantum information - Quantum bits- A brief history of quantum computation and Quantum algorithms, Experimental quantum information processing, Quantum information.

UNIT II INTRODUCTION TO QUANTUM MECHANICS 9 hours

Linear algebra- Bases and linear independence , Linear operators and matrices, The Pauli matrices, inner products, Eigenvectors and eigenvalues , Operator functions , The postulates of quantum mechanics- State space, Evolution, Quantum measurement, Distinguishing quantum states, Projective measurements, POVM measurements, Quantum mechanics: a global view, The density operator- The Schmidt decomposition and purifications- EPR and the Bell inequality.

UNIT III QUANTUM COMPUTATION 9 hours

Quantum circuits- Quantum algorithms, Single qubit operations, Controlled operations, Measurement, Universal quantum gates- Two-level unitary gates are universal, Single qubit and CNOT gates are universal, A discrete set of universal operations, Quantum computational complexity, Simulation of quantum systems.

UNIT IV QUANTUM SEARCH ALGORITHMS 9 hours

The quantum search algorithm, Quantum search as a quantum simulation- Quantum counting, Speeding up the solution of NP-complete problems, Quantum search of an unstructured database, Optimality of the search algorithm, Black box algorithm limits, Quantum computers: physical realization- Conditions for quantum computation, Harmonic oscillator quantum computer, Optical photon quantum computer.

UNIT V QUANTUM NOISE AND QUANTUM OPERATIONS 9 hours

Introduction- The three qubit bit flip code, Three qubit phase flip code- Theory of quantum error-correction, Constructing quantum codes, Stabilizer codes- The stabilizer formalism- Unitary gates and the stabilizer formalism- Measurement in the stabilizer formalism- The Gottesman–Knill theorem- Stabilizer code constructions- Fault-tolerant quantum computation.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: understand the evolution of quantum computing

CO2: analyze the various quantum computational models

CO3: apply the principles of quantum mechanics in quantum computing.

CO4: Understand the quantum operations such as noise and error–correction.

CO5: utilize the quantum algorithm for real time applications.

Text Books:

1. Michael A Nielsen; Isaac L Chuang, Quantum computation and quantum information, Cambridge university press, 2010.
2. Michel LeBellac, , A Short Introduction To Quantum Information And Quantum Computation, Cambridge university press, 2006
3. Tim Spiller, Hoi-Kwong Lo, Introduction to quantum computation and quantum information, World Scientific Publishing Company, 2001.

Reference Books:

1. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.
2. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective-IV

24CSEP411 INTELLIGENT INFORMATION RETRIEVAL

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the foundational principles of IR systems, including models and indexing techniques.
2. Explore various methods for representing documents and analyzing queries within IR systems.
3. Examine different retrieval models and text analytics techniques.
4. Analyze web search mechanics and techniques, including indexing and link analysis.
5. Investigate the applications and methodologies of web mining and online IR system design.

UNIT I FUNDAMENTALS OF IR SYSTEMS 9 hours

Overview of IR Systems, Information retrieval using the Boolean model, the dictionary and postings lists, Tolerant retrieval, Automatic Indexing, Index construction and compression, Scoring, Vector space model and term weighting, Statistical Characteristics of Text, Regular Expressions.

UNIT II DOCUMENT REPRESENTATION AND QUERY ANALYSIS 9 hours

Statistical Characteristics of Text, Regular Expressions, Text Normalization, Edit Distance, N- Gram Language Models, Naive Bayes and Sentiment Classification-Logistic Regression for Document Analysis, Basic Query Processing,Data Structure and File Organization for IR, Evaluation in information retrieval-Relevance feedback, User Profiles, Collaborative Filtering and query expansion.

UNIT III RETRIEVAL MODELS, TEXT ANALYTICS 9 hours

Similarity Measures and Ranking, Boolean Matching, Vector Space Models, Probabilistic Models, XML Retrieval, Language models for information retrieval. Text classification-vector space classification-support vector machines and machine learning on documents-Clustering-flat clustering- hierarchical clustering-Matrix decompositions and Latent semantic indexing

UNIT IV WEB SEARCH ANALYSIS 9 hours

Web search basics. web characteristics-index size and estimation- near duplicates and shingling- web crawling-distributing indexes- connectivity servers-link analysis-web as a graph-PageRank- Hubs and authoritative pages- summarization-question answering

UNIT V WEB MINING AND ONLINE IR SYSTEMS 9 hours

Web mining and its applications-Mining Twitter, Facebook, Instagram, Linkedin, Mailboxes and GitHub. Online IR systems- online public access catalogs-digital libraries-architectural issues- document models - representations and access protocols.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Apply basic IR models and indexing methods in practical scenarios.
CO2: Implement document representation techniques and query processing strategies.
CO3: Evaluate various retrieval models and text analytics methods for effectiveness.
CO4: Assess the functionality and efficiency of web search systems, including link analysis.
CO5: Design web mining techniques and online IR systems tailored to specific applications.

Text Books:

1. C. D. Manning, P. Raghavan, and H. Schutze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Ricardo Baezce Yates, Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search, 2nd Edition, 2010.
3. Mikhail Klassen, Matthew A. Russell, Mining the Social Web, O'Reilly Media, Inc., 3rd Edition, 2019.

Reference Books:

1. Ceri, S., Bozzon, A., Brambilla, M., Della Valle, E., Fraternali, P., and Quarteroni, S., Web Information Retrieval, Springer Science & Business Media, 2013.
2. D. Jurafsky, and J. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Prentice Hall, Second Edition, 2013.
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis, Springer, 2010.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective-IV

24CSEP412 KNOWLEDGE ENGINEERING AND EXPERT SYSTEM

L	T	P	C
3	0	0	3

Prerequisites: nil

Course Objectives:

1. To offer a comprehensive summary of the Expert System.
2. To familiarize students with the intricacies of many topics in Expert Systems, including the construction of expert systems and knowledge engineering.
3. To provide a thorough explanation of different evaluation methods used in expert systems.
4. To provide implementation insight about the topics covered in the course.

UNIT I INTRODUCTION TO EXPERT SYSTEM 9 hours

The nature of Expert Systems. Types of applications of Expert Systems; the relationship of Expert Systems to Artificial Intelligence and Knowledge-Based Systems. The nature of expertise. Distinguishing features of Expert Systems. Benefits of using an Expert System, choosing an application.

UNIT II WORKING OF EXPERT SYSTEM 9 hours

Theoretical Foundations. What an expert system is; how it works and how it is built - basic forms of inference: abduction; deduction; induction.

UNIT III KNOWLEDGE REPRESENTATION 9 hours

The representation and manipulation of knowledge in a computer. Rule-based representations (with backward and forward reasoning); logic-based representations (with resolution refutation); taxonomies; meronomies; frames (with inheritance and exceptions); semantic and partitioned nets (query handling).

UNIT IV ARCHITECTURE OF EXPERT SYSTEM 9 hours

Basic components of an expert system. Generation of explanations. Handling of uncertainties. Truth Maintenance Systems. Expert System Architectures. An analysis of some classic expert systems. Limitations of first-generation expert systems. Deep expert systems. Co-operating expert systems and the blackboard model.

UNIT V APPLICATION OF EXPERT SYSTEM 9 hours

Building Expert Systems. Methodologies for building expert systems: knowledge acquisition and elicitation; formalization; representation and evaluation. Knowledge Engineering tools, Case Study.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Students will possess the ability to articulate and elucidate the fundamental concepts behind the development of knowledge bases and expert systems.

CO2: Students will be knowledgeable about the tools and the processes used for the creation of an expert system.

CO3: Students will have a comprehensive understanding of the tools and methodologies employed in the development of an expert system.

CO4: Students will have the opportunity to thoroughly analyze an established expert system, focusing on fundamental techniques for constructing a knowledge base.
CO5: Students will have the opportunity to analyze the characteristics of established systems using a case-study approach, where they can compare and contrast different methods.

Text Books:

1. P Jackson, Introduction to Expert Systems, Addison Wesley, 1990 (2nd Edition)

Reference Books:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, McGraw-Hill, Inc, 1991 (2nd Edition)
2. Jackson. Jean-Louis Lauriere, Problem Solving and Artificial Intelligence, Prentice Hall, 1990

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Audit Courses

M. Tech Computer Science & Engineering

Audit Course - I

24AUP901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Objectives:

Upon the completion of subject student will be able to-

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches,
5. Planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I DISASTER CLASSIFICATION **6 hours**

Disaster: definition, factors and significance; difference between hazard and Disaster; natural disaster: earthquakes, volcanisms, cyclones, tsunamis, floods, droughts and famines, landslides and avalanches; man-made disasters: nuclear reactor meltdown, industrial accidents, oil slicks and spills, outbreaks of disease and epidemics, war and conflicts

UNIT-II REPERCUSSIONS OF DISASTERS **6 hours**

Economic damage, loss of human and animal life, destruction of ecosystem. **Disaster Prone Areas in India:** Study of seismic zones; areas prone to floods and droughts, landslides and Avalanches; areas prone to cyclonic and coastal hazards with special reference to tsunami.

UNIT-III DISASTER PREPAREDNESS AND MANAGEMENT **6 hours**

Preparedness: monitoring of phenomena triggering a disaster or hazard; Evaluation of risk: application of remote sensing, data from meteorological and Other agencies, media reports: governmental and community preparedness.

UNIT-IV RISK ASSESSMENT **6 hours**

Disaster risk: concept and elements, disaster risk reduction, global and national disaster risk situation. Techniques of risk assessment, global co-operation in risk assessment and warning.

UNIT-V DISASTER MITIGATION **6 hours**

Meaning, concept and strategies of disaster mitigation, emerging trends in Mitigation. Structural mitigation and non-structural mitigation, programs of Disaster mitigation in India.

Course outcomes:

After the completion of the subject following outcomes can be achieved-
CO1: Students will be able to understand disaster and its types in general.
CO2: They will understand the post disaster damage in terms of both like and commodity.
CO3: They will have clear picture of disaster-prone zones.
CO4: They will be able to understand the pre and post disaster preparedness needed to mitigate the disaster impact in large scale.
CO5: Student will also understand to quantify the risk in terms of monetary for both commodity and life.
CO6: Student will also learn the structural and non-structural measures for risk mitigation

Reference Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
2. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
3. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
4. Goel S. L., Disaster Administration And Management Text and Case Studies" ,Deep&Deep Publication Pvt. Ltd., New Delhi

Mode of Evaluation: Assignments, Mid Term Tests

Audit Course - I

24AUP902 CONSTITUTION OF INDIA

L	T	P	C
2	0	0	0

Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
4. To get knowledge about the Indian Federal System and Center – State Relations
5. To Understand the Election Commission functions and administration system

UNIT-I: INTRODUCTION **6 hours**

Historical Background – Drafting Committee (Composition & Working) – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT-II: STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6 hours**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT-III: STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6 hours**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT-IV CONSTITUTION FUNCTIONS **6 hours**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT-V: ELECTION COMMISSION **6 hours**

Central Election Commission - Role and functioning – Chief Election Commissioner and Election Commissioners – State Election Commission – Institute and Bodies for the welfare of SC/ST/OBC and Women

Course Outcomes:

Upon completion of the course, students will be able to:
CO1: Know about Human rights protection by Indian Constitution.
CO2: Understand the functions of the Indian government
CO3: Understand and abide the rules of the Indian constitution.
CO4: Role of Constitution in Socio-economic development and welfare activities of the Country.

Textbooks:

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.

References Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, 1st Edition, 2015
3. M.P. Jain, Indian Constitution Law, 7thEdn., Lexis Nexis, 204
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

Mode of Evaluation: Assignments, Mid Term Tests

Audit Course -II

24AUP903 ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

UNIT I: SCIENTIFIC WRITING: AN INTRODUCTION **6 hours**

What is scientific writing – Language in scientific writing – Use and miss-use of English – Elements of scientific writing - Paraphrasing and Plagiarism - Hedging and Criticizing – How to identify research problem

UNIT II: WRITING TITLE AND ABSTRACT **6 hours**

Strategies for writing effective title –Planning and preparing your abstract - Things to consider while writing abstract – Useful phrases for writing abstract

UNIT III: ORGANISING THE LITERATURE; METHODS OF DATA COLLECTION AND DATA ANALYSIS **6 hours**

What is review of the literature - Techniques of reading and citing various studies relevant to the study – Things to consider while organising review of the literature – useful phrases while writing review of the literature. Introduction to various methods of data collection –Preparing tools and describing them - How to interpret and analyse data.

UNIT IV: WRITING FINDINGS, DISCUSSION AND CONCLUSION **6 hours**

Useful vocabulary while writing findings, discussion, and conclusion –elaboration of the findings - Preparing and describing charts and graphs –how to organise your discussion section – Discussing the findings of your study with the literature available

UNIT V: PREPARING REFERENCES, APPENDIXES AND PROOFREADING THE PAPER **6 hours**

Various styles of referencing and bibliography (APA, MLA, Oxford, Harvard, Chicago), – Organising and preparing Appendixes – Various strategies of proofreading

Course Outcomes:

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

CO1: Become aware of various components of academic writing

CO2: Improve and use academic vocabulary while writing a research papers

CO3: Plan and write quality research papers in their respective field

References:

1. Adrian Wallwork, (2011). English for Writing Research Papers. Springer New York
2. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
3. Day, R. (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
4. Highman, N. (1998), Handbook
5. Research Papers, Springer New York Dordrecht
6. Kate L. Turabian, (2007).A Manual for Writers of Research Papers, Theses, and Dissertations, Seventh Edition: Chicago Style for Students and Researchers *[7th ed.]*Chicago Guides to Writing, Editing, and Publishing

Mode of Evaluation: Assignments, Mid Term Tests

Audit Course-II

24AUP904 VALUE EDUCATION

Course Prerequisite: NIL

L	T	P	C
2	0	0	0

Course Objectives:

Students will be able to:

1. Understand value of education
2. Understand value of self- development
3. Imbibe personality development
4. Imbibe spiritual development and to about the importance of character
5. Incorporate good emotional intelligence with self-control

UNIT-I **6 hours**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

UNIT-II **6 hours**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III **6 hours**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship.

Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV **6 hours**

Character –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message.

UNIT-V **6 hours**

Competence- Emotional Intelligence- Mind your Mind, Self-control, Honesty, Studying effectively

Course Outcomes:

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the moral personality
4. Development of spiritual personality
5. Development of emotional personality for efficiency in work

Text/Reference Books:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Mode of Evaluation: Assignments, Mid Term Tests

Audit Course - II

24AUP905 STRESS MANAGEMENT BY YOGA

Course Prerequisite: None

L	T	P	C
2	0	0	0

Course Objectives

Students will be able to:

1. To know the human psyche: Yogic and modern concepts
2. To have the importance for mental health
3. To know the relationship between mind and body
4. To understand the concept of stress according to modern science and yoga
5. To achieve overall health of mind through yoga

UNIT-I SCIENTIFIC FOUNDATIONS OF STRESS **6 hours**

Concept of stress – Sources of stress - Types of Stress – Personality factors and Stress – Stress and the college student

UNIT-II CONSEQUENCES OF STRESS ON HUMAN MIND **6 hours**

Human Psyche: Yogic and Modern concepts, behavior and consciousness – Frustration – Conflicts – Psychosomatic Disorders

UNIT-III MENTAL HYGIENE AND YOGA **6 hours**

Mental health: A Yogic Perspective – Mental hygiene and role of Yoga in mental hygiene – Yogic principles for the management of stress (Prayer and meditation for mental health)

UNIT-IV ASHTANGA YOGA INTRODUCTION **6 hours**

Introduction to Ashtanga Yoga – Concepts and techniques of stress management in Ashtanga yoga of Patanjali Yoga sutra (i.e. Benefits of Meditation for stress management)

UNIT-V YOGIC MANAGEMENT OF STRESS **6 hours**

Specific practices for stress management: Yogasana, breath awareness, shavasana, yoganidra, pranayama and meditation

Course Outcomes:

Students will be able to:

1. Understand the role of yoga in stress management
2. Understanding the role of yoga in life management
3. Understanding the role of yoga in mental hygiene
4. To Develop strong mental health
5. To Develop healthy mind and there by improve efficiency

Text/Reference Books:

1. 'Certification of yoga professionals, Official guide book for Level 1 and Level 2" Excel books private limited, Noida
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Mode of Evaluation: Assignments, Mid Term Tests