AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV., Vizianagaram)

NAAC "A+" Accredited Institute

Cherukupally (Village), Near Tagarapuvalasa Bridge, Vizianagaram (Dist), AP, Pin-531162.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering (AI & ML)

(Applicable from the academic year 2025-2026 to 2027-2028)

I Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	
1	PC	MTCS1101	**Professional Core-1** Mathematical Foundations of Computer Science	3	0	0	3
2	PC	MTCS1102	**Professional Core-2** Advanced Data Structure and Algorithms	3	0	0	3
3	PE	MTCS11031 MTCS11032 MTCM11031	**Professional Elective-1** 1. Cloud Computing 2. Computer Networks and Security 3. Artificial Intelligence and Knowledge Representation	3	0	0	3
4	PE	MTCS11041 MTCS11042 MTCS11043	**Professional Elective-2** 1. Big Data Analytics 2. Machine Learning and Techniques 3. Distributed Databases	3	0	0	3
5	CC	MTMB1105	Research Methodology and IPR	0	0	0	2
6	LB	MTCS1106	**Laboratory-1** Advanced Data Structure and Algorithms Lab	0	0	4	2
7	LB	MTCS1107	**Laboratory-2** Advanced Computing Lab	0	0	4	2
8	AC	MTAC1108 MTAC1109	**Audit Course-1** 1. English for Research Paper Writing 2. Disaster Management	2	0	0	0
			Total	14	0	8	18

Category	Courses	Credits
PC: Professional Core Course	2	6
PE: Professional Elective Course	2	6
CC: Compulsory Course	1	2
LB: Laboratory Course	2	4
AC: Audit Course	1	0
Total	8	18

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering (AI&ML)

(Applicable from the academic year 2025-2026 to 2026-2027)

I Year II Semester- Course Structure **Regulations: R24**

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	MTCS1201	**Professional Core-3** Advanced Computer Networks	3	0	0	3
2	PC	MTCS1202	**Professional Core-4** Mean Stack Technologies	3	0	0	3
3	PE	MTCS12031 MTCS12032 MTCM12031	**Professional Elective-3** 1. Soft Computing and Techniques 2. Advanced Database and Mining 3. Problem Solving Methods in AI	3	0	0	3
4	PE	MTCS12041 MTCS12042 MTCS12043	**Professional Elective-4** 1. Deep Learning Techniques. 2. Cyber Security and Digital Forensics 3. Social Network Analysis	3	0	0	3
5	LB	MTCS1205	**Laboratory-3** Advanced Network Programming Lab	0	0	4	2
6	LB	MTCS1206	**Laboratory-4** Mean Stack Technologies Lab	0	0	4	2
7	PR	MTCS1207	Technical Seminar/Mini Project	0	0	4	2
8	AC	MTAC1208 MTAC1209	**Audit Course-2** 1.Constitution of India 2.Pedagogy Studies	2	0	0	0
			Total	**14**	**0**	**12**	**18**

Category	Courses	Credits
PC: Professional Core	2	6
PE: Professional Elective	2	6
LB: Laboratory	2	4
PR: Project	1	2
AC: Audit Course	1	0
Total	8	18

Chairperson
Board of Studies (CSE)

MTCS1101 Mathematical Foundations of Computer Science 3 0 0 3

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PS01	PSO 2	PS03	
MTCS1101.1	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of A random variable from its distribution	3	1	-	-	1	-	3	-	-	L1, L2
MTCS1101.2	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based On population parameters.	2	-	2	-	-	-	1	-	2	L1, L2 L3
MTCS1101.3	To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.	-	-	2	-	1	-	3	-	-	L1, L2, L3
MTCS1101.4	Design various ciphers using number theory.	-	3	1	-	-	2	-	-	1	L4
MTCS1101.5	Apply graph theory for real time problems like network routing problem.	3	-	-	-	3	-	1	-	-	L4, L5

SYLLABUS

UNIT-I: 15 Hours

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic in equalities, Markov chains.

Self Learning Topic: Advanced Distribution Theory, Advanced Expectations and Moments, Bayesian Probability COs–CO1

UNIT- II: **15 Hours**

Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data

Self Learning Topic: Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates. **COs–C02**

UNIT–III: **15 Hours**

Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions,

Self Learning Topic: The Chi-Square Test for Goodness of Fit Contingency Tables Yates Correction for Continuity Coefficient of Contingency. **COs–CO3**

UNIT- IV: **15 Hours**

Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple.

Self Learning Topic: Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem). **COs-CO4**

UNIT-V: **15 Hours**

Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multi graphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees(Problems Only and Theorems without Proofs).

Self Learning Topic: Network Flow and Matching, Graph Connectivity and Components, Random Graphs and Probabilistic Graph Theory, Advanced Coloring and Labeling Problems

COs–CO5

Board of Studies: Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

Text Books:

1. Foundation Mathematics for Computer Science, JohnVince, Springer
2. Probability & Statistics, 3rdEdition, Murray R.Spiegel, JohnJ.Schillerand R.AluSrinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers
3. Discrete Mathematics and its Applications with Combinatory and Graph Theory, 7thEdition, H.Rosen, TataMcGrawHill.
4. Probability and Statistics with Reliability, K.Trivedi, Wiley.

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M.Mitzenma cherand E.Upfal.
2. AppliedCombinatorics,AlanTucker, Wiley

Web References:

1. https://youtu.be/IAu27ADpbqw?si=b4d4tolaRg-luEY8
2. https://youtu.be/iL6AzB0sSts?si=SF2oyIe8Zv9RScW
3. https://youtu.be/T9RaSgNSAbM?si=wvHT20O7PseQ
4. 4.https://youtu.be/Wu3wfQeACeU?si=_7wcaFGwvr7w1
5. 5.https://youtu.be/HipVU5vz3Q8?si=twaEGySjlhlUeS

Internal Assessment Pattern

Cognitive Level	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	30	-
L2	30	-
L3	40	30
L4	--	30
L5	--	40
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define an alphabet and string.
2. Define Grammar and Language.
3. Define a Graph.
4. What is meant by primitive recursive function?
5. Define a Computable Function.
6. Explain about Post Correspondence Problem.
7. Explain about Finite Automata with example.
8. Explain the Statements and applications of Euler and Fermat Theorems.
9. Define Elliptic Curves and their applications to Cryptography.
10. Define DFA and NFA with Examples. Differentiate them.

L2: Understand

1. A pair of dice is tossed twice .Find the probability of scoring 7 points,
2. Once (ii) at least once (iii) twice. Fibonacci Series Program
3. Is the function defined as follows a density function? f(x)= e-x,x≥0=0,x< 0.
4. In two large populations there are 30% and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the to population.
5. Fit a parabola of the form Y=a+bx+cx2 to the following data

x	1	2	3	4
	1.7	1.8	2.3	3.2

6. Enumerate the number of non negative integral solutions to the in equality x1+x2+x3+x4+x5≤19.

7. How many numbers can be formed using the digits1, 3,4, 5,6, 8 and 9 if no repetitions Are allowed?
8. Determine the number of edges in i) Complete graph Kn (ii) Complete bipartite graph K m ,n (iii) Cycle graph Cn (v) Null graph Nn LCM of Two Numbers
9. Show that the maximum number of edges in a simple graph with n vertices is n(n-1)/N

L3: Apply

1. The mean of a certain normal population is equal to the standard error of the man of the samples of 100 from that distribution. Find the probability that theme an of the sample of 25 from the distribution will be negative.
2. If X is a continuous Random variable with probability density function given by f(x)=kx,0≤ x<2=2k,2≤ x<4=-kx+6k,4≤ x<6.
3. Find the value of k and mean value of X.
4. In a locality containing 18000 families a sample of 840 families was selected at random of these 840 families, 206 families were found to have a monthly income of Rs.250 or less. It is desire to estimate how many out of 18000 families have a monthly income of Rs.250 o less, within what limits would you place your estimate?
5. Convert the following Grammar into GNF
6. G= ({A1, A2, A3}, {a,b},P,A1) where P contains following productions.A1□A2A3. A2□A3A1/bA3□A1A2/a
7. In how many ways can the letters of the word COMPUTER be arranged? How many of them begin with C and end with R? How many of them do not begin with C but end with R?
8. Out of 9 girls and 15 boys how many different committees can be form each consisting of 6 boys and 4 girls?

L4: Analyzing

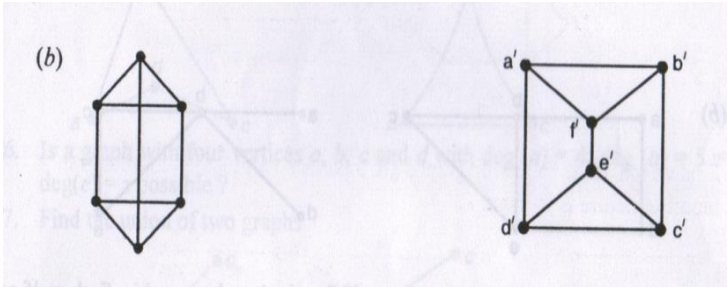
1. Design a Turing Machine for proper subtraction **m-n i**s defined to be **m-n** for **m >=n** and **Zero** for **m<n.**
2. Design a PDA for the Language L={WW^R / W ∈ $(a,b)^*$ }
3. Given the following data

X	0	1	2	3	4
Y	1	5	10	22	38

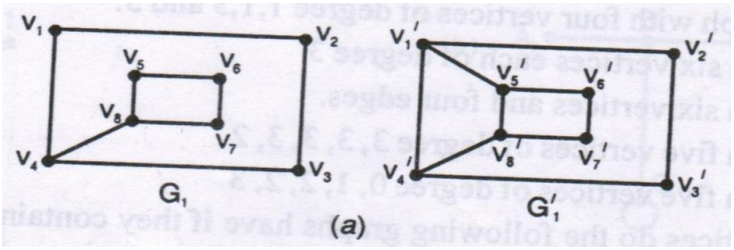
Find the parabola of best fit by the method of moments.

L5: Evaluating

1. Show that the two graphs shown below are isomorphic? [5M]



2. Is the following pairs of graphs are isomorphic or not? [5M]



3. Fit a Poisson distribution to the following data and test for its goodness off it at level of Significance 0.05

X	0	1	2
F(x)	419	352	154

Chairperson
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MTCS1102 ADVANCEDDATA STRUCTURES&ALGORITHMS 3 0 0 3

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. The fundamental design, analysis, and implementation of basic data structures.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction.
4. Significance of algorithms in the computer field
5. Various aspects of algorithm development

Course Code	Course Outcomes	Mapping with PO and PSOs								Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS1102.1	Ability to write and analyze algorithms for algorithm correctness and efficiency	3	3	2	-	-	-	3	-	-	L1,L2
MTCS1102.2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation	3	-	3	1	-	-	3	-	-	L3, L4
MTCS1102.3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	-	3	-	2	-	-	3	-	-	L3, L4
MTCS1102.4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	3	1	2	-	-	-	2	1	-	L4, L5
MTCS1102.5	Ability to compare various searchtrees and find solutions for IT related problems	-	3	2	2	-	-	3	-	-	L4, L5

SYLLABUS

UNIT I: Introduction to Data Structures **15 Hours**

Singly Linked Lists, Doubly Linked Lists, Circular Lists Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.

Self Learning Topic: Advanced Linked List Variants**,** Advanced Stack and Queue Variants, Recursion and Stack Frames **COs–CO1**

UNIT II: Searching **15 Hours**

Linear and Binary Search Methods, Sorting-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort,

Merge Sort. Trees-Binary trees, properties Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). Graphs- Basic Concepts, Storage structures and Traversals.

Self Learning Topic: Advanced Searching and Sorting, Sorting Algorithm Optimization. **COs–CO2**

UNIT III: Dictionaries **15 Hours**

ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing-Linear Probing, Double Hashing.

Self Learning Topic: Advanced Abstract Data Types (ADTs), Advanced Hashing Techniques.

COs–CO3

UNIT IV: Priority Queues **15 Hours**

Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations Searching, Insertion, Deletion.

Self Learning Topic: Advanced Heap Variants and Applications, Self-Balancing Binary Search Trees,

COs–CO4

UNITV: Search Trees **15 Hours**

AVL Trees, Definition, Height of AVL Tree, Operations-Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Self Learning Topic: Advanced Balanced Trees and Variants, Augmented Search Trees

COs–CO5

Board of Studies: Computer Science and Engineering
Approved in BOS No: 01, 30thJuly, 2024
Approved in ACM No: 01, 30thJuly, 2024

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures,AlgorithmsandApplicationsinjava,2/e,SartajSahni,UniversityPress

Reference Books:

1. DataStructuresandAlgorithmAnalysis,2/e, Mark Allen Weiss, Pearson.
2. DataStructuresandAlgorithms,3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples,N.B.Venkateswarulu,E.V.Prasad and S Chand & Co, 2009

Web References:

1. https://www.geeksforgeeks.org/linked-list-data-structure/
2. https://workat.tech/problem-solving/tutorial/sorting-algorithms-bubble-insertion-selection-sort-veubp86w3e1r
3. https://www.javatpoint.com/avl-tree

Internal Assessment Pattern

CognitiveLevel	InternalAssessment# 1(%)	InternalAssessment# 2(%)
L1	30	-

L2	30	-
L3	20	40
L4	20	30
L5	--	30
Total(%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is Linked List? Give Example for the working of Linked List?
2. Explain Doubly Linked List with Diagram?
3. Explain the operations of Circular Linked List with Example?
4. What is Stack? Explain the operations of stacks with examples?
5. What is a Queue? Explain the operations of queue with example?

L2: Understand

1. What is searching? Explain linear search with an example?
2. Explain Binary Search with an example?
3. What is sorting? Explain Bubble sort algorithm?
4. Explain Selection sort process with example?
5. Explain insertion sort process with example?
6. Explain how merge sort is performed with an example?
7. Explain quick sort algorithm?
8. What is a Tree? Explain about BFT with Example?
9. What is a Graph? Explain about Graph Traversal methods with example?
10. Explain about Infix, prefix, and postfix expressions?

L3: Apply

1. Implement stack ADT using c?
2. Implement queue ADT using c?
3. Explain about Hash Table Representation with example?
4. Explain about Collision Resolution-Separate Chaining?
5. What is Open Addressing? Explain?
6. What is Linear Probing Explain with example?
7. Explain Double Hashing with Example?

L4: Analysing

1. Realizing a Priority Queue Using Heaps? Explain?
2. What is a Priority queue? Explain its operations?
3. What is a Tree? Explain its operations?

L5: Evaluating

1. What is AVL Tree? Explain how to find the height of AVL tree?
2. Explain about Red black Trees?
3. What is a B-Tree? Explain about height of B-Trees?

4. Explain the operations of a B-Tree?
5. Compare and evaluate the Search Trees.

Chairperson
Board of Studies (CSE)

MTCS11031 **CLOUD COMPUTING** **3 0 0 3**

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
2. Explore the key technical, organizational and compliance challenges of cloud computing.
3. Grasp the concepts of virtualization efficiently.
4. Explore the security issues that arise from cloud computing architectures intended for
5. Delivering Cloud based enterprise IT services

Course Code	Course Outcomes	Mapping with POs and PSOs									DoK
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PSO3	
MTCS 11031.1	Understand the Key Concepts of Distributed Computing, Utility Computing, Cloud Computing.	3	-	1	-	-	3	3	-	-	L1, L2
MTCS 11031.2	Apply the underlying principle of cloud virtualization, data management and data visualization	3	3	-	-	-	-	2	3	-	L1, L2 L3
MTCS 11031.3	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud and Cloud Storage.	3	3	-	-	-	-	3	3	-	L1, L2, L3
MTCS 11031.4	Examine the core issues of cloud computing such as security, privacy, and interoperability.	3	3	-	-	-	-	3	3	-	L4
MTCS 11031.5	Provide the appropriate cloud computing solutions and recommendations according to the applications used.	3	1	3	-	-	-	3	2	3	L4, L5

SYLLABUS

UNIT-I: Overview of Computing Paradigm **15 Hours**

Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, and Cloud Computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

Self Learning Topic: Emerging Computing Paradigms, Advanced Cloud Technologies, Advanced Distributed System Topics **COs–CO1**

UNIT- II: Introduction to Cloud Computing and Virtualization **15 Hours**

Cloud issues and challenges, Properties, Characteristics, Deployment models. Cloud resources: Network and API, Virtual and Physical computational resources, Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs.

Self Learning Topic: Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs. **COs-CO2**

UNIT – III: Cloud Services, Technologies and storage **15 Hours**

Service models, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Cloud platform & Management: Computation, Storage, Cloud Storage Providers, S3. Software as a Service (SaaS), Web services, Web 2.0, Web OS, Anything as a service (XaaS). Layered Cloud Architecture Design –NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds, Architectural Design Challenges, Advantages of Cloud Storage

Self Learning Topic: Private and Hybrid Clouds, Architectural Design Challenges, Advantages of Cloud Storage **COs–CO3**

UNIT- IV: Resource Management and Security In Cloud **15 Hours**

Inter Cloud Resource Management , Resource Provisioning and Resource Provisioning Methods , Global Exchange of Cloud Resources ,Security Overview , Cloud Security Challenges , Software-as a-Service Security.

Self Learning Topic: Security Governance, Virtual Machine Security, IAM, Security Standards and Security Risks.

COs–CO4

UNIT-V: Cloud Access and Application Development **15 Hours**

Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault tolerance, Cloud federation, interoperability and standards. Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, How to launch an EC2 Linux instance and connect to it, How to use S3 in java,

Self Learning Topic: Security rules for application and transport layer protocols in EC2, Cloud-based simulation of a distributed trust algorithm **COs– CO5**

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

Text and Reference books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012.
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.

Web References:

1. https://www.javatpoint.com/cloud-computing-tutorial
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.digimat.in/nptel/courses/video/106105167/L01.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-
L2	30	-
L3	40	40
L4	--	40
L5	--	20
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define Cloud Computing.
2. List out the cluster design issues.
3. Name the essential characteristics of cloud computing.
4. Define Grid Computing.
5. Define Utility Computing.
6. What are the technologies for network based systems.
7. What are the system models for Distributed Computing?

L2: Understand

1. Explain the three paradigms in detail.
2. State the most relevant technologies supporting service computing..
3. Explain what you understand the technologies that make up the core of today's web services
4. Explain about Virtual machine monitor
5. What are the benefits of virtualization in the context of cloud computing?
6. How does the virtualization Support the Linux platform?
7. Compare binary translation with full virtualization.
8. Explain the importance of Virtualization Support.
9. Explain the importance of Disaster Recovery.

L3: Apply

1. State the differences between PaaS and SaaS.
2. Evaluate and contrast the merits and demerit of Cloud deployment models: public, private, hybrid, community.
3. What are the different layers available in cloud architecture design?
4. Why do we need a hybrid cloud?
5. Demonstrate the difference between software as a service and software plus service.
6. List the five application areas in SaaS applications.
7. Why do we need cloud storage?
8. Write the services in EaaS
9. Identify the use of S3.

L4: Analysing

1. List the cloud Differences in the perspectives of providers, vendors, and users.
2. Give the diagram for evolution of cloud services.
3. Which three basic cloud security enforcements are expected?
4. Examine whether the virtualization enhances cloud security.

5. "Virtual machine is secured". Is it true? Justify your answer.

L5: Evaluating

1. Evaluate the HDFS concepts with suitable illustrations .Develop a word count application with Hadoop Map Reduce programming model.
2. Evaluate architecture of Open Stack

Chairperson
Board of Studies (CSE)

MTCS11032 **COMPUTER NETWORKS AND SECURITY** **3 0 0 3**

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. To equip students with advanced knowledge of networking models, protocols, and architectures, focusing on IP addressing, network design, data center management, and high-performance technologies, including optimization and emerging trends Top of Form Bottom of Form.
2. To provide students with a comprehensive understanding of network attacks and prevention strategies, including Denial-of-Service attacks, intrusion detection systems, firewalls, and intrusion prevention systems, to effectively safeguard network security.
3. Examine network security fundamentals, including cryptographic methods, authentication, integrity, firewalls, and packet filtering techniques.
4. To provide an in-depth understanding of firewalls, intrusion detection and prevention systems, VPNs, and secure communication protocols, focusing on their implementation, architecture, and security features to protect network infrastructure.
5. Understand multimedia networking, including video/audio properties, streaming techniques, CDNs, and VoIP challenges and solutions.

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO 6	PS0 1	PS0 2	PS0 3	
MTCS 11032.1	Analyze and evaluate complex networking models and protocols, design scalable and reliable network architectures, and apply high-performance technologies to optimize data center networks	3	-	3	2	-	-	3	2	-	L1, L2
MTCS 11032.2	Evaluate and analyze network attacks and defenses, including Denial-of-Service and bandwidth attacks, apply intrusion detection and prevention techniques using firewalls and IDS/IPS systems, and create effective responses to security incidents	-	3	2	-	3	-	2	2		L1, L2, L3
MTCS 11032.3	Apply network security fundamentals by implementing cryptographic methods, authentication and integrity measures, and configuring firewalls and packet filtering techniques.	3	-	2	-	3	-	2	3	3	L2, L3
MTCS 11032.4	configure and manage firewalls and intrusion detection systems, implement VPNs and secure communication protocols, and design advanced security	3	-	3	2	3	-	-	3	3	L3, L4

	measures to ensure robust network protection										
MTCS 11032.5	Analyze and implement multimedia networking concepts by managing video/audio properties, utilizing streaming techniques, configuring CDNs, and addressing VoIP challenges and solutions.	-	-	2	2	-	2	-	3	3	L4

SYLLABUS

UNIT-I: Networking Models and Protocols **12 Hours**

Networking Models and Protocols: OSI and TCP/IP Models: Detailed study and comparison, Protocols: IP (IPv4/IPv6), TCP, UDP, ICMP, **addressing:** IP Addressing, Subnetting, CIDR. **Network Architecture:** Network Topologies: Advanced concepts in LAN, WAN, MAN. **Network Design:** Scalability, reliability, and redundancy. **Data Center Networks:** Architecture, virtualization, and cloud integration.

Self Learning Topics: **High-Performance Networking:** High-Speed Technologies: Fiber optics, 5G/6G, Network Optimization: QoS, traffic engineering, load balancing. **COS-CO1**

UNIT- II: Network attacks and prevention **15 Hours**

Overview of the Network attacks and prevention: Denial-of-Service Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Defenses Against Denial-of-Service Attacks, responding to a Denial-of-Service Attack Intruders, Intrusion Detection, Analysis Approaches,

Self Learning Topics: Host-Based Intrusion Detection, Network Based Intrusion Detection, Honeypots, Snort, Need for firewalls, types of firewalls, IPS. **COs–CO2**

UNIT–III: Network Security **15 Hours**

Overview of Network Security: Elements (Confidentiality, Integrity, Availability), Classification of Attacks, Security Methods and Protocols. **Symmetric-Key Cryptography:** Data Encryption Standard (DES), Advanced Encryption Standard (AES). Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key Exchange.

Self Learning Topics :**Authentication and Integrity:** Hash Functions, Secure Hash Algorithm (SHA), Digital Signatures. Firewalls and Packet Filtering: Types (Packet Filtering,Stateful Inspection), Proxy Servers. **COs–CO3**

UNIT-IV: Network Security Technologies12 Hours

Firewalls and Intrusion Detection Systems: Firewalls: Packet-filtering, stateful, and application firewalls, **IDS/IPS:** Network-based and host-based systems, signatures vs. anomaly detection, Virtual Private Networks (VPNs)**VPN Protocols:** IPsec, SSL/TLS, MPLS. **VPN Architecture:** Site-to-Site, Remote Access,

Self Learning Topics: **Authentication and Integrity:** Secure Communication Protocols, **SSL/TLS:** Protocols for secure web communication, **Secure Email:** S/MIME, PGP.

COs– CO4

UNIT-V: Multimedia Networking **15 Hours**

Properties of Multimedia: Characteristics of Video and Audio (Compression, Quality), Types of Multimedia Network Applications (Streaming, Conferencing), Multimedia Formats and Standards, Synchronization of Multimedia Data. **Streaming Stored Video:** UDP Streaming (Advantages, Challenges), HTTP Streaming (Techniques, Protocols), Adaptive Streaming (DASH), Buffering Strategies, Content Delivery Techniques. Content Distribution Networks (CDNs): Role and Function, CDN Architectures, Load Balancing, Edge Servers.

Self Learning Topics: **Voice-over-IP (VoIP):** Limitations of Best-Effort IP Service (Jitter, Packet Loss, And Latency), Protocols (RTP, SIP, H.323), Mechanisms for Jitter Removal, Packet Loss Recovery, Quality of Service (QoS) Techniques. **COs– CO5**

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

Text and Reference books:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.
3. Computer networks 4th edition Andrew S Tanenbaum, Pearson
4. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
5. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
6. Mayank Dave, Computer Networks, Second edition, Cengage Learning
7. Computer Security: Principles and Practice, William Stallings, Lawrie Brown, Pearson Reference Book.
8. Cryptography and Network Security, William Stallings, Pearson

Web References:

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138424952317050881 6531_shared/overview
2. https://youtu.be/6g3UI1UVsC4?si=tZ1K5tYoTEFQq5GD

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	20
L2	30	30
L3	40	20
L4	--	15
L5	--	15
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is the fundamental difference between client-server and peer-to-peer architectures?
2. What are cookies, and how do they help manage user sessions?
3. What is the definition of a client-server architecture?

4. What is the primary role of the transport layer in networking?
5. List the main services provided by the transport layer.
6. List the main routing algorithms used in the network layer.
7. What are the basic types of routing in the Internet?
8. What are the three core elements of network security?
9. List the types of attacks classified in network security.
10. What are the key characteristics of video and audio in multimedia?
11. List the types of multimedia network applications.
12. What are the key characteristics of Distributed Denial-of-Service (DDoS) attacks compared to traditional Denial-of-Service (DoS) attacks?
13. What are the primary functions of packet-filtering, stateful, and application firewalls?

L2: Understand

1. How is an HTTP message structured? What are its main components?
2. What is the typical format of an email message?
3. How does the request/response model work in HTTP?
4. Describe how multiplexing and demultiplexing are handled in the transport layer.
5. Explain the relationship between the transport layer and the network layer.
6. Explain the role of input processing, switching, and output processing in a router.
7. What are the advantages of using IPv6 over IPv4?
8. Explain how confidentiality, integrity, and availability contribute to network security.
9. How does the Data Encryption Standard (DES) work, and what are its limitations?
10. Explain how video and audio compression affects multimedia quality.
11. What are the challenges of streaming video over UDP?
12. Explain how application-based bandwidth attacks can impact network performance and describe common strategies used to prevent such attacks.
13. Explain the difference between signature-based and anomaly-based intrusion detection systems (IDS). How do each of these approaches detect intrusions?

L3: Apply

1. How would you use FTP commands to upload a file to a server?
2. Given an email scenario, how would you use SMTP to send a message?
3. Implement a basic UDP socket communication program. What are the key steps?
4. How would you implement UDP for sending data streams in a network application?
5. Apply Go-Back-N protocol to handle packet loss in a network simulation.
6. How would you configure a router to implement IPv6 addressing?
7. Implement route aggregation in a network configuration to enhance scalability.
8. Apply the Advanced Encryption Standard (AES) to encrypt a sample message.
9. Develop a system that uses SHA to verify the integrity of files in a network.
10. Implement a simple multimedia streaming application using HTTP and discuss its advantages.
11. Apply buffering strategies to improve the quality of video streaming over a network.
12. Given a network experiencing a D DoS attack, what immediate actions would you take using rate limiting and traffic filtering techniques to mitigate the attack?
13. Given a network scenario that requires secure remote access, configure a VPN using SSL/TLS protocols and describe how it would be implemented to ensure secure communication.

L4: Analysing

1. Compare and contrast HTTP and FTP in terms of their protocols and usage.
2. Analyze the process of DNS resolution and explain each step involved.
3. Analyze the impact of multiplexing and de multiplexing on network performance.
4. Analyze the role of congestion avoidance techniques in TCP and ATM ABR protocols.
5. Analyze the impact of different queuing mechanisms on router performance.
6. Analyze the differences between intra-AS and inter-AS routing protocols.
7. Analyze how different types of attacks exploit weaknesses in network security.
8. Evaluate the security implications of using public-key cryptography versus symmetric-key cryptography.
9. Analyze the impact of compression techniques on video and audio quality.
10. Evaluate the effectiveness of different buffering strategies for video streaming.
11. Compare the effectiveness of host-based versus network-based intrusion detection systems (IDS) in detecting and responding to various types of network intrusions. What are the strengths and weaknesses of each approach?
12. Analyze the strengths and weaknesses of network-based versus host-based IDS/IPS systems in detecting and responding to network threats. How would you choose between these systems for a specific network environment?

L5: Evaluating

1. Assess the effectiveness of cookies versus sessions for managing user state in web applications.
2. Evaluate the pros and cons of using TCP over UDP for a specific network application.
3. Assess the reliability of Go-Back-N versus Selective Repeat protocols in different network conditions.
4. Evaluate the impact of flow control on TCP performance in high-bandwidth, high-latency networks.
5. Evaluate the impact of IPv6 addressing on network design and performance.
6. Assess the role of IP security mechanisms in protecting data integrity and authenticity.
7. Evaluate the effectiveness of different firewall types in protecting against various network threats.
8. Evaluate the effectiveness of combining hash functions and digital signatures in a secure network protocol.
9. Assess the performance of adaptive streaming (DASH) compared to traditional streaming methods.
10. Assess the role of CDNs in handling high traffic loads and improving content delivery.
11. Evaluate the role of honeypots and Snort in a comprehensive network security strategy. How do they contribute to detecting and preventing attacks, and what are their limitations?
12. Evaluate the effectiveness of integrating IPsec and MPLS in a VPN architecture for a large enterprise. How do these protocols contribute to the overall security and performance of the VPN?

Chairperson
Board of Studies (CSE)

MTCM11031 Artificial Intelligence and Knowledge Representation 3 0 0 3

(Computer Science and Engineering (AI&ML))

Course Objectives:

1. To learn the overview of artificial intelligence principles and approaches.
2. To understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action.
3. To describe the strengths and limitations of various search algorithms and to choose the appropriate algorithm.
4. To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
5. To learn the concepts of Artificial Intelligence, with illustrations of current state of the art research and applications.

Course Code	Course Outcomes	Mapping with POs and PSOs									
		PO1	PO2	PO3	PO4	PO5	PO7	PS01	PSO2	PS03	Dok
MTCM11031.1	Understand the concepts of Artificial intelligence.	2	3	-	-	-	-	2	2	3	L1, L2
MTCM11031.2	Interpret the modern view of Artificial intelligence as the study of agents that receive precepts from the environment and perform actions.	-	2	-	3	-	2	2	3	1	L1, L2, L3
MTCM11031.3	Represent knowledge of the world using logic and infer new facts	2	-	2	3	-		3	1	1	L1, L2, L3
MTCM11031.4	Build awareness of AI facing major challenges	-	-	-	-	2	3	2	3	1	L4
MTCM11031.5	Develop self-learning and research skills to tackle a problem.	-	-	-	-	-	3	2	-	2	L4, L5

SYLLABUS

UNIT-I: 15 Hours

Introduction to Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents, Forms of learning, inductive learning, learning decision trees, explanation-based learning, learning using relevance information, neural net learning & genetic learning.

CO's-CO1

UNIT-II: 15 Hours

Problems, Problem Space & search: Defining the problem as state space search, production system, constraint satisfaction problems, issues in the design of search programs. Search

techniques, solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **CO's -CO2**

UNIT- III: 15 Hours

Optimization Technique in AI: Heuristic search strategies, Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure. **CO's-CO3**

UNIT – IV 15 Hours

Knowledge Representation: Knowledge & Reasoning, Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation, using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions &predicates, resolution, natural deduction. **CO's-CO4**

UNIT–V: 15 Hours

Artificial Intelligence: Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge. Probabilistic reasoning, representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster Shafer theory, Fuzzy sets, and fuzzy logics.

Natural Language Processing: Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing. Expert Systems, Representing and using domain knowledge, expert system shells, and knowledge acquisition. Basic knowledge of programming language like Prolog**.**

CO's-CO5

Board of Studies: Computer Science and Engineering
Approved in BOS No: 02,9th May, 2025
Approved in ACM No: 02

Text Books:

1. Artificial Intelligence, Ritch & Knight,TMH
2. Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig,Pearson

Reference Books:

1. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI.
2. Prolong Programming for A.I. by Bratko,TMH

WEB REFERENCES :

1. https://cloud.google.com/learn/what-is-artificial-intelligence
2. https://nptel.ac.in/courses/106102220

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-
L2	30	-
L3	30	30
L4	-	30

L5	-	40
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What are the main challenges or problems encountered in Artificial Intelligence (AI) applications?
2. What is the difference between depth-first search and breadth-first search?
3. What is the key difference between A* search and greedy best-first search?
4. What are the key differences between predicate logic and propositional logic in AI knowledge?
5. What is the difference between procedural knowledge and declarative knowledge in AI?

L2: Understand

1. Explain the difference between goal-based agents and utility-based agents in AI.
2. How does a production system work in the context of problem-solving? Explain with an example.
3. Explain how simulated annealing works as an optimization technique. What is its advantage over hill climbing?
4. Explain how natural deduction can be used to derive conclusions from a knowledge base in AI.
5. Explain the concept of probabilistic reasoning and its application in uncertain domains using Bayesian networks.

L3: Apply

1. Given a Tic-Tac-Toe problem, describe how an AI agent can make optimal decisions using a state-space search algorithm.
2. Given a constraint satisfaction problem (CSP) in a scheduling scenario, explain how the backtracking algorithm can be applied to find a feasible solution.
3. If you are tasked with solving a travelling salesman problem, how would you apply genetic algorithms to find an optimal solution?
4. How would you represent the following fact in predicate logic?
5. Given an AI problem involving uncertain outcomes, apply Dempster-Shafer theory to model the uncertainty and make a decision

L4: Analysing

1. Compare inductive learning and explanation-based learning in AI. How do these approaches differ in terms of learning efficiency and application?
2. Analyze the advantages and disadvantages of using bidirectional search compared to depth-first search for solving a problem.
3. Analyze the strengths and weaknesses of local search algorithms like hill climbing in the context of constraint satisfaction problems.
4. Analyze the impact of knowledge representation techniques (e.g., predicate logic vs. semantic networks) on the efficiency of reasoning in AI systems.
5. Compare the methods of syntactic processing and semantic analysis in Natural Language Processing (NLP). How do they contribute to language understanding?

L5: Evaluating

1. Evaluate the effectiveness of neural network learning versus genetic algorithms for solving optimization problems in AI. Which is more suitable for large-scale problems and why?
2. Evaluate the performance of uniform search strategies (e.g., BFS, DFS) when solving a problem with a large state space. Which strategy is the most efficient, and under what conditions?
3. Evaluate the role of adversarial search in game theory. How can the minimax algorithm be used to make optimal decisions in a two-player game?
4. How do fuzzy logic and Bayesian networks address these challenges differently?
5. How effective are expert systems in representing and using domain knowledge for decision-making?

Chairperson
Board of Studies (CSE)

MTCS11041 **BIG DATA ANALYTICS** **3 0 0 3**

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. Understand the fundamentals of Big Data, including its characteristics, types, and sources.
2. Learn about the Big Data ecosystem, including Hadoop, Spark, NoSQL databases, and data warehousing.
3. Develop skills in data processing, storage, and retrieval using Big Data technologies.
4. Understand data analytics concepts, including data mining, machine learning, and data visualization.
5. Learn to work with Big Data tools and technologies, such as Hadoop, Spark, Hive, Pig, and HBase.
6. Develop skills in data analysis, including data cleaning, transformation, and modelling.

Course Code	Course Outcomes	Mapping with PO and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS11O41.1	Demonstrate knowledge of Big Data, Data Analytics, challenges and their solutions in Big Data.	2	-	-	-	3	2	2	2	-	L1,L2
MTCS11O41.2	Analyze Hadoop Framework and eco systems	3	3	2	-	-	-	3	-	-	L3
MTCS11O41.3	Analyze MapReduce and Yarn, Work on NoSQL environment	3	3	-	3	-	-	-	-	3	L4
MTCS11O41.4	Work on NewSQL environment, MongoDB and Cassandra	3	3	-	-	3	-	-	3	2	L5
MTCS11O41.5	Apply the Big Data using Map-reduce programming in Both Hadoop and Spark framework.	3	3	-	-	-	2	-	3	3	L5,L6

SYLLABUS

UNIT- I: Introduction to Big Data: **15 Hours**

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data

Self Learning Topics: Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools **COs –CO1**

UNIT- II: Hadoop Environment Big Data Analytics: **15 Hours**

Classification of Analytics: Challenges, Big Data Analytics important, Data Science, Data Scientist Terminologies used in Big Data Environments, Basically Available Soft State Eventual Consistency, Top Analytics Tools

Hadoop: Requirement of Hadoop Framework, Design principle of Hadoop, Comparison with other system SQL and RDBMS- Hadoop Components.

Self Learning Topics: Architecture, Hadoop 1 vsHadoop 2. Various case studies on Hive and Hadoop architecture used in Twitter. **COs–CO2**

UNIT–III: Introduction to Mongodb and Mapreduce Programming Mongodb 15 Hours

Introduction, Features, Data types, Mongo DB Query language, CRUD operations, Arrays, Functions: Count, Sort, Limit, Skip, Aggregate , Map Reduce. Cursors, Indexes, Mongo Import, Mongo Export.**MongoDB Query Language MapReduce:**Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

Self Learning Topics: Data Analysis: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning**,** Methods, Hierarchical Methods **COs– CO3**

UNIT- IV: Introduction to Hive and Pig Hive 15 Hours

Hive: Introduction, Architecture, Data Types, File Formats, Hive Query Language Statements, Partitions, Bucketing, Views, Sub, Query, Joins, Aggregations, Group by and having, RC File Implementation, Hive User Defined Function, Serialization and Deserialization.

Pig: Introduction, Anatomy, Features, Philosophy, Use Case for Pig, Pig Latin Overview, Pig Primitive Data Types, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank.

Self Learning Topics: User-Defined Functions, Parameter Substitution, Diagnostic Operator, Word Count Example using Pig - Pig at Yahoo!, Pig Versus Hive **COs– CO**

UNIT-V: Introduction to Data Analytics with R Machine Learning: **15 Hours**

Introduction, Supervised Learning, Unsupervised Learning,

Machine Learning Algorithms: Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, Decision Tree.

Self Learning Topics: Big Data Analytics with Big, Data Model, Examples, Cassandra Clients, Hadoop Integration.

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

COs– CO5

Text Books:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, First Edition,2015

Reference Books:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big data for dummies”, John Wiley & Sons, Inc. (2013)
2. Tom White, “Hadoop the Definitive Guide”, O’Reilly Publications, Fourth Edition,2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, “Hadoop for Dummies”, Wiley Publications,2014

Web References:

1. https://youtu.be/r5k-_RLIpuA
2. https://youtu.be/YAzzGal41hA?si=EHeCkt6vyOR33lhN
3. https://youtu.be/WfEbt4mtSws

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	--
L2	30	--
L3	20	-
L4	20	40
L5	--	50
L6		10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is Big Data?
2. List the various dimensions of growth of Big Data
3. Why domain expertise is required for any type of Data Analytics?
4. What is Big data? Describe the main features of a big data in detail
5. List the main characteristics of big data.
6. (ii) Describe big data architecture with a neat schematic diagram
7. Describe the structure of big data representation
8. List the core concepts of HADOOP
9. Define MAP REDUCE concepts
10. List out the Hadoop applications
11. What is data analysis?
12. Describe SVM in detail. (ii) List out and explain some of the applications of SVM in detail
13. List the aggregate data models.

L2: Understand

1. Differentiate Big Data and Conventional Data
2. Give the structure of big data.
3. Summarize how the analytical scalability is handled in big data
4. Differentiate the Analysis and reporting methods and tools
5. What is Hadoop YARN?
6. What are the advantages of HDFS?
7. Discuss the various core components of the Hadoop.
8. Summarize briefly on
   (i) Algorithms using Map Reduce. (ii) Advantages of Map Reduce
9. What is clustering?
10. List the types of hierarchical clustering.
11. Give a short note on types of data in clustering and its Importance.
12. Discuss model based clustering and high dimensional clustering in detail.

L3: Apply

1. `Illustrate the risk of big data.
2. Analyse the structure of bigdata.
3. Illustrate how big data can be represented.
4. Analyse the evolution Tools and Method in big data.
5. Show how Map-Reduce computation executes.
6. Show the importance of resource manager in Hadoop.
   (i) Explain what is YARN.
   (ii) Illustrate HADOOP YARN architecture with neat diagram
7. Show partitioning methods in clustering.
8. Illustrate data definition in Hive.

9. Illustrate in detail Hive QL

L4: Analysing

1. Analyse the challenges in big data.
2. Analyse the challenges of convectional system.
3. Analyse the technologies used to handle big data
4. Analyse what are the challenges in data.
5. Analyse the steps of Map Reduce Algorithms
6. Explain k-means clustering algorithm with an example.

L5: Evaluating

1. Assess the importance of analysis vs reporting
2. Summarize what is R.
3. Summarize grid-based clustering in detail.
4. Evaluate what is Real Time Analytics Platform (RTAP)
5. Assess what is Cassandra Client.

Chairperson
Board of Studies (CSE)

MTCS11042 **Machine Learning Techniques** **3 0 0 3**
(Common to CSE and CSE-(AI&ML))

Course Objectives:

1. To provide a comprehensive understanding of machine learning fundamentals, focusing on concept learning, decision tree algorithms, version spaces, candidate elimination, inductive bias, and heuristic search methods.
2. To provide a comprehensive understanding of Bayesian methods in machine learning, including Bayes' theorem, concept learning, maximum likelihood, minimum description length, Bayes optimal classifiers, Gibbs algorithm, Naïve Bayes classifier, Bayesian belief networks, EM algorithm, probability learning, sample complexity, and hypothesis space models.
3. To understand and apply K-Nearest Neighbour learning, locally weighted regression, radial basis functions, and case-based learning techniques for predictive modelling and classification of SVM
4. To understanding of neural network representations, perception, multilayer networks with back propagation, genetic algorithms, hypothesis space search, genetic programming, and models of evaluation and learning.
5. To understanding rule-based learning methods, including sequential covering algorithms, first-order rules, analytical learning, explanation-based learning, FOCL algorithms, and reinforcement learning techniques such as Q-learning and temporal difference learning.

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS 11042.1	Illustrate the fundamental concepts of machine learning.	3	1	-	-	-	1	3	-	-	L1, L2
MTCS 11042.2	Understand the of Bayesian methods and their application in machine learning	-	3	2	-	1	-	3	2	-	L1, L2 L3
MTCS 11042.3	Understanding of several key techniques in predictive modeling and classification, including KNN learning, locally weighted regression, radial basis functions, case-based learning and SVM	-	1	-	3	2	-	-	2	-	L1, L2, L3
MTCS 11042.4	Apply skills neural network representations, perceptron, multilayer networks with back propagation techniques in solving complex problems and optimizing	-	-	3	-	2	1	-	2	1	L4

	machine learning models.										
MTCS 11042.5	Identify comprehensive skills in both rule-based learning and reinforcement learning, preparing students for advanced applications and problem-solving in machine learning.	-	-	1	1	3	-	3	-	1	L4, L5

SYLLABUS

UNIT I : Fundamentals of Machine Learning **15 Hours**

Introduction: Definition of learning systems, Goals and applications of machine learning.

Aspects of developing a learning system: training data, concept representation, function approximation. Learning Problems,Perspectives and Issues, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias, Decision Tree learning, Decision Tree Representation Decision Tree Algorithm, Heuristic Space Search.

Self Learning Topic: Supervised Learning: Advanced Algorithms, Feature Engineering and Data Preparation, Model Evaluation and Selection. **COs- CO1**

UNIT II –Bayesian and Computational Learning **15 Hours**

Bayes Theorem , Concept Learning , Maximum Likelihood , Minimum Description Length Principle , Bayes Optimal Classifier , Gibbs Algorithm , Naïve Bayes Classifier , Bayesian Belief Network , EM Algorithm , Probability Learning , Sample Complexity , Finite and Infinite Hypothesis Spaces , Mistake Bound Model.

Self Learning Topic Advanced Probabilistic Models, Bayesian Methods in Depth, Learning Theory Beyond Mistake Bound **.** **COs-CO2**

UNIT III- Instant Based Learning **15 Hours**

K-Nearest Neighbour Learning, Locally weighted Regression, Radial Basis Functions, and Case Based learning

Support Vector Machines (SVM): Introduction, Large Margin Classifier for linearly separable data.

Self Learning Topic: Linear Soft Margin Classifier for Overlapping Classes, Nonlinear Classifier, and Regression by Support vector Machines. **COs-CO3**

UNIT IV - Neural Networks and Genetic Algorithms **15 Hours**

Neural Network Representation, Problems, Perceptron, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evaluation and Learning. **COs-CO4**

Self Learning Topic: Advanced Neural Architectures, Evolutionary and Bio-Inspired Computation.

UNIT V- Advanced Learning **15 Hours**

Learning Sets of Rules , Sequential Covering Algorithm , Learning Rule Set , First Order Rules , Sets of First Order Rules , Induction on Inverted Deduction , Inverting Resolution , Analytical Learning , Perfect Domain Theories , Explanation Base Learning,

File Processing: Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling).

Self Learning Topic: FOCL Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning. Positioning functions. **COs-CO5**

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01, 30th July, 2024

Text Books:

1. T.M. Mitchell, "Machine Learning", McGraw-Hill, 1997.
2. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly

e-Resources:

1. https://www.deeplearning.ai/machine-learningyearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-
L2	30	-
L3	40	-
L4	--	60
L5	--	40
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Why Machine learning is important?
2. Illustrate terms of machine learning?
3. Write short notes on concept learning as a search?
4. State the inductive Learning Hypothesis?
5. State the concept of ANN.
6. List out the characteristic to which the back propagation algorithm is used.
7. Write short notes on crowding.
8. List the advantages of studying Bayesian learning methods.
9. State about the Gibbs Algorithm.
10. Describe the k-nearest neighbor learning algorithm.
11. State about the curse of dimensionality.
12. Explain about the Reinforcement learning model.
13. State the learn-one-rule.
14. Explain about the Reinforcement learning model.
15. Describe Inverting resolution.

L2: Understand

1. Discuss in detail how to design a program to learn to play checkers.
2. Discuss the Issues in Machine Learning.

3. Discuss in detail the Candidate–Elimination Algorithm with an example.
4. Distinguish between Gradient descent and Delta rule.
5. Discuss in detail the Population Evolution and the Schema Theorem.
6. Discuss hall we conclude from this analysis of the Minimum Description Length principle.
7. Show sample complexity for finite hypothesis spaces and discuss the mistake bound model of learning.
8. Discuss the generic properties of case-based reasoning systems.
9. Demonstrate CADET system with an example
10. Discuss in detail Learning First –order rules.
11. Summarize about the Q-learning model and explain with diagram.
12. Discuss the learning task.

L3: Apply

1. Point out the useful perspective on machine learning.
2. Illustrate with a diagram the decision tree representation for the concept of play tennis.
3. Demonstrate the basic decision tree algorithm.
4. Illustrate the diagram for visualizing the Hypothesis space.
5. State about the various crossovers with diagram.
6. Demonstrate hypothesis space search of Gas with neural network back propagation.
7. Illustrate with an example why Gibbs Algorithm is better than the Bayes Optimal classifier.
8. Construct the vapnik-chervonenkis dimension
9. Examine the k-nearest learning algorithm.
10. Illustrate several generic properties of case –based reasoning systems
11. Illustrate the diagram for the search for rule preconditions as learn-one-rule proceeds from general to specific.
12. Demonstrate about induction as inverted deduction

L4: Analysing

1. Conclude the following :
   (i) Compact Representation for Version Spaces
   (ii) The LIST-THEN-ELIMINATE Algorithm.
2. (i) Explain in detail an Unbiased Learner for Enjoy sport learning task.
   (ii) List out about the Futility of Bias-Free Learning
3. Analyze the multi-layer perceptron model with a neat diagram.
4. Explore how the hypothesis in GAs are represented by bit strings
5. Write about the IF -THEN rules and why it can be encoded.
6. Explain maximum likelihood algorithm.
7. Explain naive Bayes classifier with example.
8. Explain detail about the PAC Learnability.
9. Explain the inductive bias of k-Nearest neighbor algorithm with example.
10. Write in detail sequential –covering algorithm.
11. State about the AQ algorithm.
12. Write some common evaluation functions in the learning rule sets.

L5: Evaluating

1. Explain in detail the FIND-S: FINDING A MAXIMALLY SPECIFIC HYPOTHESIS.
2. Will the Candidate –Elimination Algorithm Converge to the Correct Hypothesis?

3. Explain the candidate elimination algorithm. Apply the algorithm to obtain the final version space with an example
4. Compose for which problems are ANN learning is well suited and write down the characteristics.
5. Summarize the derivation of the Back propagation Algorithm
6. Formulate the models of evolution and learning in Genetic algorithm.
7. Assess the parallelizing Genetic Algorithms with an example.
8. Does the patient have cancer, or does he not? A patient takes a lab test and the result comes back positive. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Furthermore, 0.008 of the entire population have this cancer
9. Summarize the General Statement of EM Algorithm
10. Compose the three properties that is shared by the Instance-based methods.
11. Summarize the three lazy learning methods.
12. Formulate the Generalize the Locally weighted regression model.
13. Explain about the Case-based reasoning (CBR).
14. Assess the learning sets of rules and how it differs from other algorithms.
15. Summarize the merits and demerits of FOCL Algorithm
16. Assess the Temporal Difference Learning model with an example.

Chairperson
Board of Studies (CSE)

MTCS11043 DISTRIBUTED DATABASES 3 0 0 3

(Common to CSE and CSE (AI & ML))

Course Objectives:

1. Develop a foundational understanding of distributed database systems, including their definition, key characteristics, and advantages over centralized databases.
2. Learn how distributed databases process queries and the techniques used to optimize query performance across multiple nodes.
3. Understand the challenges associated with ensuring consistency and handling concurrency in distributed databases.
4. Learn about mechanisms for fault tolerance and recovery in distributed databases to ensure system reliability and data integrity
5. Gain hands-on experience with popular distributed database technologies, including installation, configuration, and usage
6. Equip students with the skills needed to design, implement, and manage distributed database systems in real-world scenarios.

Course Code	Course Outcomes	Mapping with PO and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS 11043.1	Understand Distributed Database Concepts	3									L1, L2
MTCS 11043.2	Students will be able to design and optimize distributed queries, including query decomposition, execution, and performance tuning in a distributed database environment		3								L1, L2, L3
MTCS 11043.3	Analyze and Resolve Consistency and Concurrency Issues				3						L3, L4
MTCS 11043.4	Evaluate and Implement Fault Tolerance and Recovery Mechanisms										L4
MTCS 11043.5	Understand and Implement Object-Oriented Data Models										L4, L5

SYLLABUS

UNIT-I: Introduction **10 Hours**

Distributed Database Concepts Definition of Distributed databases and Distributed Database Management System (DDBMS), Distributed transparent system. DDBMS Architecture: DBMS standardization, Global, Local, External, and Internal Schemas, Architectural models for DDBMS.

Distributed database design: Design problem of distributed systems, Design, strategies (top-down, bottom-up), Fragmentation, Allocation and replication of fragments. **COs-CO1**

Self-Learning Topics: Consistency Models

UNIT-II: Query processing and decomposition **12 Hours**

Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms. **COs–CO2**

Self-Learning Topics: Join Optimization in Distributed Databases

UNIT–III: Transaction Management: **10 Hours**

Definition, properties of transaction, types of transactions.

Distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management. **COs-CO3**

Self-Learning Topics: Performance Considerations

UNIT- IV: Distributed DBMS Reliability **12 Hours**

Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.

Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters. **COs–CO4**

Self-Learning Topics: Local and Distributed Reliability Protocols

UNIT-V: Distributed object Database Management Systems **12 Hours**

Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.

Object Oriented Data Model: Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS.

Self-Learning Topics: No SQL Object Databases (e.g., db4o, Object DB), Object-Relational Mapping (ORM) Tools (e.g., Hibernate, SQL Alchemy), Polyglot Persistence in Distributed Architectures

COs–CO5

Board of Studies : Computer Science and Engineering
Approved in BOS No: 02,
Approved in ACM No:

TEXT BOOKS:

1. M. Tamer OZSU and PatuckValduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.
3. Database Management Systems, 3rd edition, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill (2002).
4. Fundamentals of Database Systems, 6thEdition, Elmasri and Nava the, Addison. Wesley (2003).
5. Distributed Object-Oriented Systems: A Practical Approach -André B. Schaefer and Sylvain L. Frey.
6. Object-Oriented Databases: Concepts and Applications David C. Hay, John T. R. Richards, and Philip J. S. Milne.

Reference Books:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The

Complete Book", Second Edition, Pearson International Edition.
2. Principles of Distributed Database Systems; 2nd EditedBy M. Tamer Ozsu and Patrick Valduriez, Person Education Asia.
3. Database System Concepts, 5th edition, Avi Silberschatz , Henry F. Korth , S. Sudarshan: McGraw-Hill (2010)
4. Database Systems: Concepts, Design and Applications, 2nd edition, Shio Kumar Singh, Pearson Publishing, (2011).
5. Multi-dimensional aggregation for temporal data. M. Bohlen, J. Gamper, and C.S. Jensen. In Proc. of EDBT-2006, pp. 257-275, (2006).
6. Moving objects databases (chapter 1 and 2), R.H. Güting and M. Schneider: Morgan Kaufmann Publishers, Inc., (2005)

Web References:

1. https://www.javatpoint.com/distributed-database-system/
2. https://www.geeksforgeeks.org/distributed-database-system/
3. https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.html/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	-
L2	40	-
L3	30	40
L4	-	30
L5	-	20
L6	-	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Explain Distributed Database Management System? Define the four types of schemas in a distributed database system?
2. What is fragmentation in distributed database design?
3. What are the main objectives of query processing in distributed databases?
4. Define query decomposition in the context of distributed query processing
5. What are the properties of a transaction in a distributed database?
6. Define serializability in the context of distributed concurrency control.
7. What are the properties of a transaction in a distributed database?
8. Define serializability in the context of distributed concurrency control
9. What are the key concepts of reliability in distributed database systems?
10. Define fault-tolerance in the context of distributed databases
11. What are the fundamental object concepts in a distributed object database management system (OODBMS)?
12. Define object-oriented data model

L2: Understand

1. Explain the concept of a distributed transparent system in the context of distributed databases?
2. Describe the top-down and bottom-up design strategies for distributed databases
3. Explain the layers of query processing in a distributed database system
4. Describe the role of localization of distributed data in query processing
5. Explain the layers of query processing in a distributed database system
6. Describe the role of localization of distributed data in query processing.
7. Explain the concept of concurrency control mechanisms in distributed databases.
8. Describe the role of time-stamped concurrency control algorithms in distributed databases
9. Explain how site failures and network partitioning affect distributed database reliability.
10. Describe the different architectures for parallel database systems
11. Explain the concept of object distribution in distributed object databases.
12. Describe the key differences between Object-Oriented Database Management Systems (OODBMS) and Object-Relational Database Management Systems (ORDBMS).

L3: Apply

1. Given a scenario where a distributed database needs to be designed for a multinational company, how would you approach fragmentation and replication?
2. Apply the concept of consistency models to a distributed database system for an online retail platform.
3. Given a distributed database with multiple data fragments, how would you approach query optimization to improve performance?
4. How would you implement a query decomposition strategy for a complex multi-table join query in a distributed database?
5. Given a distributed database with multiple data fragments, how would you approach query optimization to improve performance?
6. How would you implement a query decomposition strategy for a complex multi-table join query in a distributed database?
7. Given a distributed database with high transaction volumes, how would you apply optimistic concurrency control to manage conflicts?
8. How would you address deadlock management in a distributed database system using time-stamped concurrency control?
9. Given a scenario where a distributed database system needs to be highly reliable, how would you approach fault-tolerance and failure recovery?
10. How would you optimize parallel query processing in a distributed database system to handle large-scale data efficiently?
11. Given a scenario where a distributed system needs to manage complex data with multiple relationships, how would you apply object distribution techniques?
12. How would you design an object-oriented data model for a system requiring persistent storage of objects with complex hierarchies?

L4: Analyze

1. Compare the advantages and disadvantages of vertical and horizontal fragmentation in terms of query performance and data management.

2. Analyze how the architecture of a distributed database system affects data transparency and schema management.
3. Compare centralized and distributed query optimization approaches
4. Analyze the impact of query processing layers on the overall performance of a distributed database system.
5. Compare centralized and distributed query optimization approaches.
6. Analyze the impact of query processing layers on the overall performance of a distributed database system.
7. Compare optimistic and pessimistic concurrency control methods in terms of their impact on system performance and consistency.
8. Analyze how different concurrency control mechanisms affect transaction throughput and system scalability in a distributed database.
9. Compare the impact of Shared-Nothing versus Shared-Disk architectures on parallel query processing performance.
10. Analyze how different reliability protocols affect the recovery process in distributed database systems.
11. Compare the advantages and disadvantages of OODBMS and ORDBMS for managing complex data types and relationships.
12. Analyze how persistence of objects is handled in both OODBMS and ORDBMS.

L5: Evaluate

1. Evaluate the trade-offs between using a top-down versus a bottom-up design approach for a distributed database.
2. Assess the impact of data replication on the performance and consistency of a distributed database system.
3. Evaluate the effectiveness of different distributed query optimization algorithms in handling large-scale data
4. Assess the trade-offs between centralized and distributed query processing in terms of performance and complexity.
5. Evaluate the effectiveness of different distributed query optimization algorithms in handling large-scale data.
6. Assess the trade-offs between centralized and distributed query processing in terms of performance and complexity.
7. Evaluate the effectiveness of different deadlock detection and resolution strategies in distributed databases.
8. Assess the trade-offs between using serializability versus weaker consistency models in distributed databases.
9. Evaluate the effectiveness of different fault-tolerance techniques in maintaining the reliability of a distributed database system.
10. Assess the trade-offs between using parallel database clusters and traditional single-node databases in terms of scalability and performance.
11. Evaluate the effectiveness of distributed object storage techniques in handling large-scale distributed applications.

Chairperson
Board of Studies (CSE)

MTVDCC1101 RESEARCH METHODOLOGY & IPR 2 0 0 2

Course Objectives:

1. To understand the research problem
2. To know the literature studies, plagiarism and ethics
3. To get the knowledge about technical writing
4. To analyze the nature of intellectual property rights and new developments
5. To know the patent rights

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs			Dok
		PO2	P03	PO5	
MTVDCC1101.1	Understand research problem formulation	3	3	2	L1,L2
MTVDCC1101.2	Analyze research related information	3	3	2	L4
MTVDCC1101.3	Follow research ethics	2	3	2	L3
MTVDCC1101.4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.	1	3	2	L2,L3,L5
MTVDCC1101.5	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	2	3	2	L2,L3,L4, L5

SYLLABUS

UNIT-1: 12 Hours

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations. **COs–CO1**

UNIT-2: 12 Hours

Effective literature studies approaches, analysis Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee. **COs–CO2**

UNIT-3: **12 Hours**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under

PCT. **COs–CO3**

UNIT-4: **12 Hours**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. **COs–CO4**

UNIT-5: **12 Hours**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

COs–CO5

Board of Studies : Electronics and Communication Engineering
Approved in BOS No: 01,3rd August, 2024
Approved in ACM No: 01,

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students""
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

Reference Books:

1. Mayall , "Industrial Design", McGraw Hill, 1992.
2. Niebel , "Product Design", McGraw Hill, 1974.
3. Asimov , "Introduction to Design", Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
5. Technological Age", 2016.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Web References:

1. https://www.ebooksdirectory.com/
2. http://www.sciencedirect.com/Science
3. https://onlinecourses.nptel.ac.in/
4. https://www.link.springer.com/physics/
5. https://www.loc.gov/rr/scitech/selected-internet/physics.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	20
L2	30	30
L3	40	40
L4	--	05
L5	--	05
Total (%)	**100**	**100**

Short and Long Answers Questions of Various Cognitive Levels:

L1: Remember

1. What is the Meaning of research problem?
2. What are the key elements of your research proposal?

3. What are the key types of intellectual property?
4. What are the exclusive rights granted by a patent?
5. How do IITs contribute to the field of IPR?

L2: Understand

1. What are the key factors contributing to this research problem?
2. How do you understand the significance of your research problem?
3. What are the main steps involved in the patent application process?
4. How does the scope of patent rights differ from the scope of geographical indications?
5. What role do IITs play in promoting IPR awareness among students and researchers?

L3: Apply

1. How can the findings be applied to solve practical issues related to the research problem?
2. How will you apply your research methodology to address the problem?
3. How can a company protect its new product design under intellectual property laws?
4. How can licensing agreements be structured to benefit both the patent holder and the licensee?
5. How can IITs facilitate technology transfer to industry partners?

L4: Analysing

1. What are the underlying causes of the problem, and how do they interact?
2. What are the strengths and weaknesses of your proposed research approach?
3. How can a business integrate IP strategies into its overall innovation management plan?
4. How do the rights of a patent holder differ from those involved in the transfer of technology?
5. How do IITs' IPR strategies compare to those of other research institutions?

L5: Evaluating

1. How effective are the proposed solutions in addressing the research problem?
2. How will you evaluate the success of your research and its potential impact?
3. What are the potential advantages and disadvantages of using the PCT system for international patent protection?
4. How effective are current patent databases in providing comprehensive and up-to-date patent information?
5. How well are IITs addressing the challenges of technology transfer and commercialization?

Chairperson
Board of Studies (ECE)

MTCS1106 **Advanced Data Structures & Algorithms Lab** **0 0 4 2**

(Common to CSE and CSE (AI&ML))

Course Objectives:

1. Knowing about oops concepts for a specific problem.
2. Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs			
		PO1	PO2	PO3	Dok
MTCS1106.1	Identify classes, objects, members of a class and relationships among them needed for a specific problem	3	3	3	L1, L2
MTCS1106.2	Examine algorithms performance using Prior analysis and asymptotic notations.	3	3	3	L2, L3
MTCS1106.3	Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)	3	3	3	L2, L3

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01

Developing the following programs:

Experiment 1:

Write a java program to perform various operations on single linked list

Experiment 2:

Write a java program for the following

a) Reverse a linked list
b) Sort the data in a linked list
c) Remove duplicates
d) Merge two linked lists

Experiment 3:

Write a java program to perform various operations on doubly linked list.

Experiment 4:

Write a java program to perform various operations on circular linked list.

Experiment 5:

Write a java program for performing various operations on stack using linked list.

Experiment 6:

Write a java program for performing various operations on queue using linked list.

Experiment 7:

Write a java program for the following using stack

a) Infix to postfix conversion.
b) Expression evaluation.
c) Obtain the binary number for a given decimal number.

Experiment 8:

Write a java program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.

Experiment 9:

Write a java program to implement the following for a graph.

(a) BFS (b) DFS

Experiment 10:

Write a java program to implement Merge & Heap Sort of given elements.

Experiment 11:

Write a java program to implement Quick Sort of given elements.

Experiment 12:

Write a java program to implement various operations on AVL trees.

Experiment 13:

Write a java program to perform the following operations:

(a) Insertion into a B-tree (b) Searching in a B-tree

Experiment 14:

Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals

Experiment 15:

Write a java program to implement all the functions of Dictionary (ADT) using Hashing.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B. Venkateswarulu, E.V.Prasad and S Chand & Co, 2009

Chairperson
Board of Studies (CSE)

MTCS1107 ADVANCED COMPUTING LAB 0 0 4 2

Course Objectives:

1. The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

At the end of the course, students will be able to:

Course Code	Course Outcomes	Mapping with POs and PSOs			
		PO1	**PO2**	**PO3**	Dok
MTCS1107.1	The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.	3	3	3	L1, L2
MTCS1107.2	Development and use of s IoT technology in Societal and Industrial Applications.	3	3	3	L2, L3
MTCS1107.3	Skills to undertake high quality academic and industrial research in Sensors and IoT.	3	3	3	L2, L3

Board of Studies : Computer Science and Engineering
Approved in BoS No : 01, 30th July, 2024
Approved in ACM No: 01

Developing the following programs:

Experiment 1: Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.

Experiment 2: Study and Install IDE of Arduino and different types of Arduino.

Experiment 3: Study and Implement Zigbee Protocol using Arduino / RaspberryPi.

Experiment 4: Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a 3 frequently reviewed together.

Write a single Spark application that

- Transposes the original Amazon food dataset, obtaining a Pair RDD of the type<user_id>→ <list of the product_ ids reviewed by user_id>
- Counts the frequencies of all the pairs of products reviewed together.
- Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Experiment 6:

Write a program to Implement Bankers algorithm for Dead Lock Avoidance.

Experiment 7:

Write a program to Producer-consumer problem Using semaphores.

Experiment 8:

Write a program for an image enhancement using pixel operation.

Experiment 9:

Write a Program to enhance image using image arithmetic and logical operations.

Experiment 10:

Write a program of bit stuffing used by Data Link Layer.

Experiment 11:

Write a program to configure a Network using Distance Vector Routing protocol.

Experiment 12:

Write a program to perform the function oriented diagram: DFD and Structured chart.

Experiment 13:

Write a program to perform the system analysis: Requirement analysis, SRS.

Experiment 14:

Write a program to draw the structural view diagram: Class diagram, object diagram.

Experiment 15:

Write C programs for implementing the Demorgan's law.

Text Books:

1. Foundation Mathematics for Computer Science, JohnVince, Springer
2. Probability & Statistics, 3rdEdition, MurrayR. Spiegel, JohnJ. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M.Mitzenmacher and E. Upfal.
2. Applied Combinatorics, AlanTucker, Wiley

Chairperson
Board of Studies (CSE)

MTCS1201 ADVANCED COMPUTER NETWORKS 3 0 0 3

Course Objectives:

1. The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
2. Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation LANs/WANs, internetworking technologies, Routing and Addressing.
3. Provide the mathematical background of routing protocols.
4. Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Code	CourseOutcomes	MappingwithPOsandPSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2	PS03	
MTCS 1201.1	Illustrate reference models with layers, protocols and interfaces.	3									L1, L2
MTCS1 201.2	Define the routing algorithms, Sub netting and Addressing of IP V4and IPV6.										L1, L2, L3
MTCS1 201.3	Define and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.				3						L1, L2, L3
MTCS1 201.4	Demonstrate the concepts Wireless LANS,WIMAX,IEEE 802.11,Cellular telephony and Satellite networks										L4
MTCS1 201.5	Explain the emerging trends in networks-MANETS and WSN										L4, L5

SYLLABUS

UNIT-I: 10 Hours

Network layer: Network Layer design issues: store-and forward packet switching, services provided transport layers,implementation connection less services,implementation connection

oriented services, comparison of virtual –circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, congestion control algorithms :Approaches to congestion control, Traffic aware routing, Admission control.

Self Learning Topics: Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements,Traffic shaping, Leaky and Token buckets **Cos-CO1**

UNIT-II: **12 Hours**

Internetworking and IP protocols: How networks differ, How net works can be connected, inter networking, tunneling, The network layer in the internet,IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers.

Self Learning Topics: Transition from IPV4 to IPV6, Internet Control Protocols-IMCP,ARP,DHCP **COs-CO2**

UNIT- III: **10 Hours**

Transport Layer Protocols: Introduction, Services, Port numbers, User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, ATCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers.

Self Learning Topics:SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control. **COs-CO3**

UNIT– IV **10 Hours**

Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers Other Wireless Networks: WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations and Generations.

Self Learning Topics: Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

COs-CO4

UNIT–V: **15 Hours**

Emerging trends in Computer networks:

Mobile computing: Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE AdHoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security. Wireless Sensor.

Networks: WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design , Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features.

Self Learning Topics:P2P Networks: Characteristics of P2P Networks, Classification ofP2P systems, Gnutella, Bit Torrent, Session Initiation Protocol(SIP) , Characteristics and addressing, Components of SIP, SIP establishment, SIP security. **COs-CO5**

Board of Studies : Computer Science and Engineering Approved in BOS No: 02, 9th May, 2025

Approved in ACM No: 02

Text books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH

2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave,CENGAGE

References:

1. Computer Networks and Internets, Duglas E. Comer, 6th Edition, Pearson.
2. Computer networks, A system Approach, 5th ed,Larry L Peterson and Bruce S Davie, Elsevier

Web links:

1. https://onlinecourses.nptel.ac.in/noc23_cs35/preview
2. https://archive.nptel.ac.in/courses/108/106/106106167/
3. https://www.linkedin.com/pulse/computer-networks-emerging-trends-kisore-jack-4afic

Internal Assessment Pattern

Cognitive Level	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	30	20
L2	30	30
L3	40	40
L4	--	05
L5	--	05
Total(%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is TCP? Explain TCP segment format in detail.
2. Explain SCTP packet format and list its advantages.
3. What is routing algorithm? Explain hierarchical routing algorithm.
4. What is congestion? Explain Load shedding algorithm.

L2:Understand

1. What is fragmentation? Explain the transparent and non-transparent fragmentation in detail.
2. Explain IPV4 header format.
3. Explain UDP in detail.
4. Explain about flow control and error control with respect to TCP.
5. What are the mobility issues in mobile computing?

L3: Apply

1. Elaborate on different methods in TCP to handle flow control.
2. Explain association establishment process in SCTP.
3. Discuss about the protocol stack issues in mobile computing.
4. Elaborate on Load Shedding and Random Early Detection in congestion control.
5. Give an elaborated comparison of virtual circuit and datagram subnets.

L4: Analysing

1. Explain protocol stack issues and mobility issues in mobile computing.
2. Define different routing protocols in MANETs.
3. With a neat sketch explain the architecture of IPv4 datagram.
4. Discuss the applications, characteristics and architecture of Wireless Sensor networks.

L5: Evaluating

1. What is fragmentation? Explain the fragmentation in IPV4.
2. Explain the process of Transition from IPV4 toIPV6.
3. Explain the protocol Stack Issues in Mobile Computing Environment.
4. Explain the importance of the AdHoc networks security.
5. For a given IP address172.16.10.22and mask 255.255.255.240,find the following: Subnet mask, broadcast address and valid range of IP addresses in this network.

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MTCS1202 MEAN STACK TECHNOLOGIES 3 0 0 3

Course Objectives:

1. Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
2. Writing optimized front end code HTML and JavaScript.
3. Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
4. Design and implementation of Robust and Scalable Front End Applications

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2	PS03	
MTCS 1202.1	After the completion of the course, student will be able to design web pages.	3									L1, L2
MTCS 1202.2	Identify the Basic Concepts of Web & Markup Languages.		3								L1, L2 L3
MTCS 1202.3	Develop web Applications using Scripting Languages & Frameworks.		3								L1, L2, L3
MTCS 1202.4	Make use of Express JS and Node JS frameworks										L4
MTCS 1202.5	Illustrate the uses of web services concepts like restful, react js.										L4, L5

SYLLABUS

UNIT I: Introduction to Web: **12 Hours**

Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

Self Learning Topics: Domain Name System (DNS) , Protocols (HTTP, FTP, SMTP)

COs-CO1

UNIT II: JavaScript: **12 Hours**

The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, $eval, Strings.

Self Learning Topics: Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS **COs-CO2**

UNIT III: Node.js: **13 Hours**

Introduction, Advantages, Node.js Process Model, NodeJS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your

first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling.

Self Learning Topics: API Handling, Debugging, Developing Template Engines, Using Process Managers, Security & Deployment. **COs-CO3**

UNIT IV: Restful Web Services: **12 Hours**

Using the Uniform Interface, Designing URIs, Web Linking, And Conditional Requests. React Js: Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, React DOM, Children.

Self Learning Topics: Constructing Elements with Data, React Components, DOM Rendering, Factories **COs-CO4**

UNIT V: Mongo DB: **10 Hours**

Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

Self Learning Topics: Monitoring and Logging on Cloud: Using tools like Prometheus, Grafana, CloudWatch,Scalability and Load Balancing on Cloud. **COs-CO5**

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, 9th May, 2025

Approved in ACM No: 02

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Pro Mean Stack Development, ELadElrom, Apress
4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly

Reference Books:

1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006) 2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
2. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech
3. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
4. Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

Web Reference:

1. https://youtu.be/ipkjfvl40s0?si=U1ghHK825qIWtl6c
2. https://www.javatpoint.com/mongodb-tutorial
3. https://www.geeksforgeeks.org/express-js/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	45
L2	30	20

L3	40	15
L4	--	10
L5	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define naming rules in XML.
2. Define XML? What are the advantages of XML?
3. What is JavaScript? Write the advantages of JavaScript?
4. What is the scope of the variables in JavaScript?
5. Explain about the jsp processing.
6. Explain the components of jsp.
7. What are RESTful Web Services?
8. What is a REST Resource?
9. What is MongoDB?
10. What is the importance of MongoDB?

L2: Understand

1. Explain the procedure for validating the XML Documents
2. Explain about various types of XML Parsers
3. What is the difference between GET and POST methods in JavaScript?
4. List the types of Style sheets.
5. Explain about Scriptlet Tag.
6. What are implicit objects in jsp?
7. Why Are Rest Services Easily Scalable
8. What is caching in REST API?
9. What type of database is MongoDB?
10. What are stages in MongoDB?

L3: Apply

1. Compare HTML and XML
2. How can both Internal and External DTDs be used in an XML File? Show with an Example
3. Define Frameset, Frame Tag. Divide the web page into four equal parts each individual part displays different web page.
4. Explain various operators and data types available in java script with examples.
5. Justify the differences between servlets and jsp.
6. Explain about the jsp processing.
7. What are the limitations of React?
8. What are refs in React?
9. What is MongoDB best used for?
10. What are the 4 basic operations in MongoDB?

L4: Analysing

1. Explain about XML Schema with an example.
2. What is an XML DOM.? How DOM parses the XML file.
3. Explain various operators and data types available in java script with examples.

4. Can Browsers Read Jsx
5. Which tool is best for MongoDB?

L5: Evaluating

1. Explain about various types of XML Parsers
2. What is the need of scripting languages in mean stack Technologies?
3. Explain the components of jsp.
4. Explain CORS in React?
5. Is MongoDB frontend or backend? Explain why?

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Board of Studies (CSE)

MTCS1203 SOFT COMPUTING TECHNIQUES 3 0 0 3

Course Objectives:

1. Artificial Intelligence, Various types of production systems, characteristics of production systems.
2. Neural Networks, architecture, functions and various algorithms involved.
3. Fuzzy Logic, Various fuzzy systems and their functions.
4. Genetic algorithms, its applications and advances.

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2	PS03	
MTCS1203.1	Learn about soft computing techniques and their applications	3	-	2	-	-	-	-	3	2	L1, L2
MTCS1203.2	Analyse various neural network architectures	1	-	2	-	-	1	3	3	-	L1, L2 L3
MTCS1203.3	Define Fuzzy systems.	2	2	-	-	1	-	2	-	-	L1, L2, L3
MTCS1203.4	Analyse the genetic algorithms and their applications.	-	-	2	1	-	-	3	-	3	L4
MTCS1203.5	Analyse various swarm intelligence systems	3	-	-	1	2	-	1	3	-	L4, L5

SYLLABUS

UNIT I - Introduction to Soft Computing **10 Hours**

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, Introduction Artificial Intelligence-Artificial Neural Networks, Fuzzy Systems-Genetic Algorithm and Evolutionary Programming, Swarm Intelligent Systems , Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta, Perceptron Network-Adaline Network, Madaline Network. **COs–CO1**

Self Learning Concepts: Soft Computing vs. Hard Computing, Artificial Neural Networks (ANNs).

UNIT II - Artificial Neural Networks **13 Hours**

Back propagation Neural Networks, Kohonen Neural Network, Learning Vector Quantization, Hamming Neural Network, Hopfield Neural Network, Bi-directional Associative Memory, Adaptive Resonance Theory Neural Networks, Support Vector Machines, Spike Neuron Models. Hetro associative memory network, temporal associative memory networks, Time Delay Network, Tree Neural Network, iterative auto associative memory networks, Special Networks: Simulated annealing, Boltzmann machine, Gaussian Machine, Cauchy Machine, Probabilistic neural net, cascade correlation network, cognition network. **COs–C02**

Self Learning Concepts: Learning Vector Quantization (LVQ), Iterative Auto-associative Memory Networks.

UNIT III - Fuzzy Systems **8 Hours**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy

Relations, Membership Functions, Defuzzification, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning, Introduction to Fuzzy Decision Making, Lambda, cuts for fuzzy relations, Lambda-cuts for fuzzy sets, measures of fuzziness, architecture and operation of FLC system. **COs-CO3**

Self Learning Concepts: Fuzzy Rule Base and Approximate Reasoning, Lambda-Cuts for Fuzzy Relations.

UNIT IV - Genetic Algorithms **10 Hours**

Basic Concepts, Working Principles, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators, Convergence of Genetic Algorithm, genetic algorithm and search space, genetic algorithm vs. traditional algorithms, stopping condition for genetic algorithm flow, classification of genetic algorithm. **COs–CO4**

Self Learning Concepts: Inheritance Operators, Genetic Algorithm vs. Traditional Algorithms

UNIT V – Swarm Intelligent System **8 Hours**

Swarm intelligent system: Introduction to swarm intelligence, back ground, Ant colony system, working of ant colony optimization, Particle swarm intelligent systems, artificial bee colony system, cuckoo search algorithm. **COs–CO5**

Self Learning Concepts: Ant Colony System (ACS) **,** Particle Swarm Intelligent Systems (PSO)

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01

TEXT BOOKS:

1. Soft computing with MATLAB program. Padhy, S.P.Simon,Oxford university press, 2015
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.
3. Introduction to Artificial Neural Systems-Jacek.MZurada, Jaico PublishingHouse,1999

REFERENCE BOOKS:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of IndiaPvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - Kisha Mehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.

WEB REFERENCES:

1. https://www.bing.com/videos/riverview/relatedvideo?q=web%20references%20in%20soft%20computing&mid=A28F9C4BA3A51CE2C7EBA28F9C4BA3A51CE2C7EB&ajaxhist=0
2. https://www.bing.com/videos/riverview/relatedvideo?&q=web+references+in+soft+computing&qpvt=web+references+in+soft+computing&mid=A28F9C4BA3A51CE2C7EBA28F9C4BA3A51CE2C7EB&&FORM=VRDGAR

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	40	--
L2	40	--
L3	20	40
L4	--	35

L5	--	25
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is soft computing?
2. Define perceptron learning rule
3. Outline an artificial neural network
4. Define Intelligent System
5. Explain Swarm Intelligent System and its Properties
   (ii) List the advantages and disadvantages of Swarm Intelligent System
6. Write short notes on following
7. (i)Artificial Intelligence (ii) Artificial Neural Network (iii) Neural Networks
8. 7. Explain the following (i) Evolutionary Programming (ii) Fuzzy Systems (iii) Genetic Algorithm
9. (i) Write about Hebbian learning rule. (ii) Describe the delta learning rule
10. Name some application of Kohonen self-organizing network.10 With a neat Architecture.

L2: Understand

1. Classify the various types of soft computing techniques
2. Why is the McCulloch-Pitts neuron model widely used in logic functions?
3. what is the significance of error signal in perceptron network?
4. Write the training algorithm and testing algorithm of Adaline Network and with a neat architecture.
5. With a neat architecture, write the training algorithm and testing algorithm of Madaline Network.
6. Why Hopfield network is called as recurrent neural network?
7. What is the purpose of Hopfield Network? Give an example?
8. Illustrate architecture and explain the algorithm of Bidirectional Associative memory.
9. Interpret the Centre of gravity method of defuzzification
10. (i) Differentiate between Mamdani FIS and Sugeno FIS.
    (ii) Write short note on Mult objective decision making.

L3: Apply

1. Mention few applications of Adaline and Madaline
2. Develop the training algorithm used for the Hebb network
3. Using Adaline network to train ANDNOT function with bipolar inputs and targets. Perform 2 epochs of training
4. Build OR function with binary inputs and bipolar targets using perceptron training algorithm up to 2 Epochs
5. How is competition performed for clustering of the vectors?
6. Consider a Kohonen self-organizing net with two cluster units and five input units. The weight vectors for the cluster units are w1 = [1.0, 0.8, 0.6, 0.4, 0,2] & w2 = [0.2, 0.4, 0.6, 0.8, 1.0] Use the square of the Euclidean distance to find winning cluster unit for the input pattern x = [0.5, 1.0, 0.5, 0.0 0.0] Using a learning rate of 0.2, find the new weights for the winning unit.
7. Identify the different Fuzzy relation operation?

8. State few advantages and disadvantages of Genetic Algorithm.

L4: Analysing

1. what are the limitations of perceptron?
2. Explain the single perceptron with its learning algorithm
3. Classify the topologies used in spiking neuron models.
4. Classify the methods of defuzzification
5. Can a two input Adaline compute the XOR function? (ii) Analyze the XOR function using Madaline?

L5: Evaluating

1. Justify Swarm intelligence is superior to conventional computing algorithm
2. Implement XOR function using McCulloch –Pitts neuron (consider binary data)
3. Construct and test the Hamming network to cluster four vectors. Given the exemplar vectors
4. e (1) = [1 -1 -1 -1]; e(2)=[-1 -1 -1 1] The bipolar input vectors are x1=[-1 -1 1 -1] x2=[-1 -1 1 1] x2=[-1 -1 -1 1] x2=[1 1 -1 -1]
5. Consider an ART 1 network with four F1 units and three F2 units. Assume the initial weights as follows: Bottom-up weights (bij): {{0.67, 0, 0.2}, {0, 0, 0.2}, {0, 0, 0.2}, {0, 0.67, 0.2}} and Top-down weights (tij): {{1, 0, 0, 0}, {0, 0, 0, 1}, {1, 1, 1, 1}}.
6. Determine the new weight matrices after the vector (0, 0, 1, 1) is presented, if a. the vigilance parameter is given as 0.3; b. the vigilance parameter is given as 0.7

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MTCS12032 ADVANCED DATABASE AND MINING 3 0 0 3

(Common to CSE and CSE-(AI&ML))

Course Objectives:

1. Understand the evolution of database systems from early file systems to modern relational databases.
2. Understand about joins and OLAP operations.
3. Understand the concept of data warehousing and how it differs from traditional database management systems
4. Learn data processing techniques including cleaning, transformation, reduction, and discretization.
5. Understand the techniques for mining frequent patterns, associations, and correlations.
6. Study classification algorithms including decision trees, Bayesian networks, and instance-based methods.

Course Code	Course Outcomes	Mapping with POs and PSOs								Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PS02	PS03	
MTCS 12032.1	Demonstrate the basic elements of a relational database management system	3	2	3		3		2	3		L1, L2
MTCS 12032.2	Familiarize with the basic issues of transaction processing and concurrency control.	2			3				3	3	L1, L2 L3
MTCS 12032.3	Design and Modeling of Data Warehouse		3	3			2			3	L1, L2, L3
MTCS 12032.4	Discover interesting pattern from large amount of data				3				2		L4
MTCS 12032.5	Evaluating a range of data mining algorithms using data mining tools effectively	2	3		3			2			L4, L5

SYLLABUS

UNIT-I: 15 Hours

Introduction: History of Data base Systems. Data base System Applications, data base System VS file System. Data Models ,the ER Model , Relational Model , Other Models , Introduction to the Relational Model , Integrity Constraint Over relations , Enforcing Integrity constraints, Introduction to Views, Destroying /altering Tables and Views Normalization Techniques: Functional Dependency, 1NF, 2NF, 3NF, BCNF.

Self Learning Topics: Multi valued Dependency; Loss-less Join and Dependency Preservation.

COs – C01

UNIT- II: **15 Hours**

Transaction Processing: Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, schedules, serialisability, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing, Database performance Tuning and Query optimization: Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Correctness of interleaved execution.

Self Learning Topics: Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees. **COs –C02**

UNIT- III: **15 Hours**

Data warehousing: data warehouse and DBMS, multidimensional data model, OLAP operations. Data processing: cleaning, transformation, reduction, filters and discretization with weka. Data mining knowledge representation.

Self Learning Topics: Representing input data and output knowledge, Visualization techniques, Experiments with Weka , visualization. **COs – CO3**

UNIT- IV: **15 Hours**

Mining Frequent Patterns: Associations and correlations, Constraint based Association mining. Data mining algorithms: association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.

Self Learning Topics: Constraint based Association mining. Graph Pattern Mining, SPM.

COs – CO4

UNIT-V: **15 Hours**

Data mining algorithms: Classification Inferring rudimentary rules: 1R algorithm, Decision trees, Experiments with Weka, decision trees, rules Data mining algorithms: The prediction task, Bayesian networks, Instance-based methods (nearest neighbor) Experiments with Weka, Prediction.

Self Learning Topics: Spatial, Multimedia, Text and Web data, Spatial Data mining, Multimedia Data mining, Text Mining, Mining the World Wide Web. **COs – CO5**

Board of Studies: Computer Science and Engineering

Approved in BOS No: 01, 30th July, 2024

Approved in ACM No: 01, 30th July, 2024

Text Books:

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA Mc GrawHill 3rd Edition
2. "Database Systems: The Complete Book" by Hector Garcia-Molina, Jeffrey Ullman, and Jennifer Widom
3. "Data Warehousing: Concepts, Techniques, Products and Applications" by Arun K. Pujari

Reference Books:

1. Database System Concepts" by Abraham Silberschatz, Henry Korth, and S. Sudarshan.
2. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei
3. "Data Mining: Practical Machine Learning Tools and Techniques" by Ian H. Witten, Eibe Frank, and Mark A. Hall.

Web Reference:

1. https://www.geeksforgeeks.org/datamining/
2. http://nptel.ac.in/courses/datamining/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)

L1	30	--
L2	30	--
L3	40	30
L4	--	40
L5	--	30
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What are the key historical developments in database systems?
2. What is the Entity-Relationship (ER) model, and how is it used in database design?
3. How does the relational model differ from other data models?
4. What are integrity constraints in the context of relational databases?
5. What is functional dependency, and why is it important in database normalization?
6. What is the difference between materialized and pipelined processing?
7. What are the ACID properties of database transactions?
8. What is a multidimensional data model, and how is it used in OLAP operations?
9. What is graph pattern mining, and what are its applications?
10. How are Bayesian networks used for prediction in data mining?

L2: Understand

1. How do database systems improve upon traditional file systems?
2. What are some examples of other data models besides the ER and relational models?
3. What is the role of views in a relational database, and how are they created or altered?
4. What are multi-valued dependencies, and how do they affect database design?
5. How do time-stamp based protocols and isolation levels influence concurrency control?
6. What is two-phase locking (2PL), and how does it work?
7. What is a multidimensional data model, and how is it used in OLAP operations?
8. What is correlation analysis in data mining?
9. What is the role of instance-based methods like nearest neighbour in classification?

L3: Apply

1. What are the differences between active-active and active-passive database architectures, and in what scenarios would each be preferable?
2. Discuss techniques for optimizing complex queries involving large datasets and multiple joins.
3. Discuss the challenges and solutions implemented in mining algorithms.

L4: Analysing

1. What are the various constraints based on Association rule mining?
2. classify various clustering methods
3. How to represent Frequent itemset in Compact format

L5: Evaluating

1. Briefly describe data mining Functionalities
2. Decision tree Experiments with Weka

Chairperson
Board of Studies (CSE)

MTCM12031 **Problem Solving Methods in AI** **3 0 0 3**

(Computer Science and Engineering (AI&ML))

Course Objectives:

1. To understand foundational AI concepts and search methodologies
2. To apply game theory and logic in AI
3. To employ probabilistic reasoning and models
4. To gain proficiency in data mining and machine learning methods
5. To explore advanced topics in AI

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PS 01	PS O2	PS0 3	
MTCM120 31.1	Understand the historical and philosophical perspective on artificial intelligence	3	2	-	3	-	-	-	2	2	L1, L2
MTCM120 31.2	Demonstrate domain independent search-based problem-solving algorithms	3	-	3	3	2	-	2	2	2	L1, L2, L3
MTCM120 31.3	Explain the foundations of problem decomposition and rule-based methods	-	2	2	-	3	2	-	3	2	L2, L3
MTCM120 31.4	Understand the relation between search methods and other with other formulations including planning, constraints and logical reasoning	2	-	2	-	3	-	2	-	2	L2, L3 L4
MTCM120 31.5	Analyze stochastic, local, and population-based search algorithms.	-	-	3	3	1	-	3	2	1	L4, L5

SYLLABUS

UNIT-I: **15 Hours**

Introduction to AI, Administrivia, Search- Evaluation Functions, Heuristic Search, A*-Advanced search: Goal Reduction, MEA, B*- Deliberative Planning, Abstraction.

Self Learning Topic: CBR- Moore\Constraint Satisfaction & Scheduling **CO's-CO1**

UNIT-II: **16 Hours**

Game-tree Search, Minimax, A-B-pruning- Game Theory, Zero-sum and asymmetric- Logic: Propositional and First-order- Unification and Resolution in Logic- Beyond FOL,

Self Learning Topic: Semantic Nets, Frames **CO's-CO2**

UNIT- III: **18 Hours**

Probabilistic Reasoning and Methods- Markoff Decision Processes- Bayesian Models and Networks- Knowledge-Engineering and Rule-Based Systems- Naive Bayes & Regression models- Logistic Regression.

Self Learning Topic: Nets-Overfitting and Model Selection **CO's-CO3**

UNIT – IV **15 Hours**

Wireless LANS: Data Mining: KNN& KD-trees- Reinforcement Learning- Optimization: Multivariate HC, Simulated Annealing- Real-world optimization,.

Self Learning Topic: Simulated Annealing -Case study **CO's-CO4**

UNIT–V: **15 Hours**

Information Retrieval: Vector Space Model- Natural Language Processing (Parsing)- Real-time problem-solving systems- Enrichment lecture: Speech Understanding- Enrichment lecture: Autonomous Agents

Self Learning Topic: Applications in IR **CO's-CO5**

Board of Studies : Computer Science and Engineering
Approved in BOS No: 02, 9th May, 2025
Approved in ACM No: 02

Text Books:

1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013

References Books:

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2 editions, 2004.
4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.
5. Judea Pearl. Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984.
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill, 1991.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009

Web References:

1. https://onlinedegree.iitm.ac.in/course_pages
2. https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pd

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-
L2	30	10
L3	25	30
L4	-	30
L5	-	30
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is Goal Reduction in AI?
2. Define Constraint Satisfaction with examples.
3. What is Propositional Logic?
4. What is First-Order Logic (FOL)?
5. What are Markov Decision Processes?
6. What are Bayesian Networks?
7. What is Simulated Annealing?
8. Define Multivariate Hill Climbing.
9. What is the Vector Space Model?

L2: Understand

1. Differentiate between Means-End Analysis (MEA) and Blind Search.
2. How does Abstraction help simplify AI problems?
3. Explain Unification with a logic example.
4. Describe how Alpha-Beta Pruning optimizes Minimax.
5. Explain the concept of Logistic Regression in classification.
6. What are the dangers of Overfitting in AI models?
7. Describe how KD-Trees help in nearest neighbor search.
8. Explain Reinforcement Learning with an example.
9. Explain how VSM is used for document ranking.

L3: Apply

1. Implement a simple knowledge-based agent to navigate a grid.
2. Apply Game Theory to a business negotiation problem.
3. Train a Neural Network to recognize handwritten digits.
4. Use Simulated Annealing to minimize a function.
5. Apply speech-to-text conversion in an AI app.
6. Create an Autonomous Agent for household automation.

L4: Analysing

1. Compare A* and Best-First Search algorithms.
2. Evaluate Semantic Nets vs. Frames in knowledge modeling.
3. Analyze effects of Overfitting in model predictions.
4. Compare Logistic Regression with Decision Trees.
5. Compare rule-based and statistical parsing.
6. Analyze limitations of speech understanding in noisy environments.

L5: Evaluating

1. Evaluate the effectiveness of abstraction in reducing problem complexity.
2. Justify the use of Game Theory in real-world strategy systems.
3. Evaluate performance trade-offs in Overfitting vs Underfitting.
4. Justify your choice of optimization method for a problem.
5. Assess the future role of Autonomous Agents.
6. Evaluate speech understanding advancements in assistive technology.

Chairperson
Board of Studies (CSE)

MTCS12041 **Deep Learning Techniques** **3 0 0 3**

(Common to CSE and CSE-(AI&ML))

Course Objectives:

1. Learn deep learning methods for working with sequential data,
2. To explore feed forward networks and Deep Neural networks
3. Learn deep recurrent and memory networks,
4. To mathematically understand the deep learning approaches and paradigms
5. Learn deep Turing machines,
6. Apply such deep learning mechanisms to various learning problems.
7. Know the open issues in deep learning, and have a grasp of the current research directions.

Course Code	Course Outcomes	Mapping with POs and PSOs								Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS 12041.1	Demonstrate the basic concepts fundamental learning techniques and layers.	3	2	-	2	2	-	3	2	1	L1, L2, L3
MTCS 12041.2	Discuss the Neural Network training, various and ommodels.	-	3	1	-	2	-	-	2	1	L1, L2
MTCS 12041.3	Explain different types of deep learning network models.	3	3	-	2	2	-	-	-	1	L2, L3
MTCS 12041.4	Classify the Probabilistic Neural Networks.	1	-	2	2	2	-	3	2	-	L3, L4
MTCS 12041.5	Implement tools on Deep Learning techniques.	3	3	-	3	2	-	3	2	-	L4, L5

SYLLABUS

UNIT-I: Introduction to various paradigms of learning and Basics **15 Hours**

Introduction to learning problems:

Introduction: Various paradigms of learning problems, what is Deep Learning? – Perceptron and Multi-layer Perceptron –and Issues in deep learning frame work, review off undamental learning techniques.

Self Learning Topics: Artificial Neural Network, activation function, multi-layer neural network.

COs–CO1

UNIT- II: Introduction to feed forward Networks and Deep Neural Networks **15 Hours**

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.
Self Learning Topics: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. **COs–CO2**

UNIT – III: Training of Neural Networks **15 Hours**

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.
Self Learning Topics: CNNs, RNNs, and Deep Belief Networks. Generative Adversarial Networks (GANs) **COs–CO4**

UNIT- IV: Recurrent Neural Networks and Convolutional Neural Networks **15 Hours**

Probabilistic Neural Network: Hop field Net, Boltzmann machine, RBMs, Sigmoidnet, Auto encoders.
Self Learning Topics: NLP, vision, and multimodal learning, **COs–CO4**

UNIT-V: Recent trends and Applications **15 Hours**

Applications: Object recognition, sparse coding, computer vision, natural language processing.
Introduction to Deep Learning Tools: Caffe, Theano, Torch.
Recent trends- Variational Autoencoders, Generative Adversarial Networks.

Self Learning Topics: Multi-task Deep Learning, Multi-view Deep Learning

Board of Studies : Computer Science and Engineering
Approved in BoS No : 01, 30th July, 2024
Approved in ACM No: 01

Text Books:

1. Goodfellow, I., Bengio,Y.,andCourville,A.,DeepLearning,MITPress,2016..
2. Bishop, C., M.,Pattern Recognition and Machine Learning, Springer,2006.

Reference Books:

1. Artificial Neural Networks, Yegnanarayana , B., PHI Learning Pvt. Ltd,2009.
2. Matrix Computations, Golub, G.,H., andV anLoan, C.,F, JHUPress,2013.
3. Neural Networks: AClassroomApproach,SatishKumar, TataMcGraw-HillEducation,2004.

Web References:

1. NOC | Deep Learning - Part 1(IIT Ropar) (nptel.ac.in)
2. Mastering Deep Learning - Course (swayam2.ac.in)
3. Deep Learning _ Part 1(IIT Ropar) – NPTEL+

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-
L2	30	-
L3	40	40
L4	--	30
L5	--	30
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Explain in detail about supervised learning
2. List and explain the various activation functions used in modeling of artificial neuron
3. explain various activation functions used in modeling of artificial neuronsuitability with respect to applications
4. Compare and contrast single layered model and multi layered perceptron model
5. Explain various perception models
6. Explain Back propagation with its algorithm

L2: Understand

1. Explain briefly about gradient descent algorithm.
2. Explain the working of gradient descent algorithm.
3. Discuss the working of back propagation.
4. Explain the architecture of pre trained CNN Models.
5. Illustrate the operation of pooling layer in CNN with simple example.
6. Explain the operation of deep learning feed forward neural networks.

L3: Apply

1. Justify the advantage of auto encoder over principal component analysis for dimensionality reduction
2. What are the challenges in neural network optimization?
3. Discuss about bi directional recurrent neural network.
4. Explain Deep forward network
5. Explain the working of Gated Recurrent Unit
6. Explain different deep unsupervised learning methods

L4: Analysing

1. Demonstrate the basic framework of reinforcement learning.
2. Describe the role of boot strapping for value function learning.
3. Compare and contrast state ful and stateless LSTMS.
4. Explain different performance metrics used for classification problem.

L5: Evaluating

1. Explain objective recognition.
2. Compare and contrast LSTM and gated recurrent units.
3. Explain competitive learning using self-organizing maps
4. Explain different types of back propagation networks.
5. Explain different performance metrics used for classification problem.
6. What is Natural Language Processing?
7. Explain different types of speech recognition techniques.

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Board of Studies (CSE)

MTCS12042 Cyber Security and Digital Forensics 3 0 0 3

(Common to CSE and CSE-(AI&ML))

Course Objectives:

1. Learn the security issues involving information stored in computers
2. Learn about the investigations related to the information theft and attacks related to it. Learn computer forensics. Be familiar with forensics tools.
3. Learn to analyze and validate forensics data. Provides an in–depth study of the rapidly changing and fascinating field of computer forensics.

Course Code	Course Outcomes	Mapping with POs and PSOs								Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PSO3	
MTCS 12042.1	Gain knowledge on the nature of threats and cyber security management goals and framework	3	-	2	-	2	3	-	2	-	L1, L2
MTCS 12042.2	Gain knowledge on the nature of threats and cyber security management goals and framework	-	3	-	2	-	1	-	2	-	L1, L2 L3
MTCS 12042.3	Gain knowledge on the nature of threats and cyber security management goals and framework	3	-	-	2	-	3	3	-	2	L1, L2, L3
MTCS 12042.4	Analyze and validate forensics data	-	3	-	-	2	-	3	2	-	L4
MTCS 12042.5	Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC, Electronic Communication Privacy ACT, Legal Policies.	2	-	-	2	-	3	2	-	3	L4, L5

SYLLABUS

UNIT-I: 15 Hours

Introduction, Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control and Cryptography, Web User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks

Self Learning Topics: Advanced Cryptography, Incident Response and Digital Forensics, Advanced Authentication Mechanisms. **COs-CO1**

UNIT- II: 15 Hours

Security in Operating Systems, Security in the Design of Operating Systems, Root kit, Network security attack, Threats to Network Communications, Wireless Network Security, Denial of Service Distributed Denial–of–Service.

Self Learning Topics: Operating System Security, Rootkits and Malware in Operating Systems, **Network** Security and Threats **COs-CO2**

UNIT – III: **15 Hours**

Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management, Databases, Security Requirements of Databases, Reliability and Integrity, Database Disclosure, Data Mining and Big Data.

Self Learning Topics: Advanced Cryptography in Network Security, Advanced Firewall Concepts

COs-CO3

UNIT- IV: **15 Hours**

Introduction to Digital Forensics, Open Source Examination Platform, Using Linux and Windows as the Host, Disk and File System Analysis, Media Analysis Concepts, Sleuth Kit, Partitioning and Disk Layouts, Special Containers, Hashing, Forensic Imaging, Internet Artifacts, Browser & Mail Artifacts, File Analysis, Image, Audio, Video, Archives, Documents, Graphical Investigation Environments.

Self Learning Topics: PyFLAG, Fiwalk, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition.

COs-CO4

UNIT-V: **15 Hours**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC, Electronic Communication Privacy ACT, Legal Policies

Self Learning Topics: Cybercrime Laws and Regulations, Digital Evidence and Digital Forensics

COs-CO5

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01

Text Books:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition, Pearson Education, 2015
2. Cory Altheide and Harlan Carvey, ―Digital Forensics with OpenSource Tools ‖ Elsevier publication, April 2011.

Reference Books:

1. The Cyber Security Management System: A Conceptual Mapping, John Dexter, SANS Institute Information Security Reading Room 2002
2. John Sammons, The Basics of Digital Forensics, Elsevier, 1st Edition, 2015.

Web References:

1.https://youtu.be/esNXUNG4U1k?si=7m6uTcur8KhP99Rs
2.https://youtu.be/o4TM--tauiA?si=lYjDKGsS-Dpyn2LS
3.https://youtu.be/trHox1bN5es?si=KgEV7ZgUUTg3GzSB
4.https://youtu.be/TkG4JqUcx_U?si=iqz8DtImDkGFOZcT
5.https://youtu.be/2x0dMysSW4E?si=vxy2FRlyndaEl-wL

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	-

L2	30	-
L3	40	30
L4	--	40
L5	--	40
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. List the properties of C-I-A traid.
2. Define Vulnerability.
3. Analyze the term "Wire Tapping".
4. Explain how TCB (Trusted Computing Base) works.
5. Define Cryptography.
6. List the two classes of Encryption
7. What is Digital Forensics?
8. What is computer Forensics?
9. Explain the term cyber terrorism.
10. What are the cyber laws in India?

L2: Understand

1. Explain about access control on reference monitors
2. List the components of the digital signature.
3. Discuss about Kernel and list its functions.
4. List the vulnerabilities in Wireless Networks.
5. Summarize two styles of Intrusion Detection.
6. Give the components of Databases.
7. Describe Media Analysis Concepts.
8. How will you find out the hidden data in forensics technology?
9. Explain the term cyber theft.
10. Write a note on Unauthorized Access.

L3: Apply

1. Explain Computer Security?
2. Write a note on RSA algorithm.
3. Define Hypervisor
4. Define Fence
5. Classify the types of IDS.
6. Discover the limitations of IDS.
7. Explain the three A's of digital forensics?
8. Differentiate master boot record (MBR) and master file table (MFT)
9. What is section 43 in cyber law?
10. Describe about Digital Evidence and its characteristics.

L4: Analysing

1. Analyze Risk Management.
2. Analyze about Object Sanitization.
3. Analyze Select-Project-Join query.

4. What are Browser Artifacts?
5. What is Indian Evidence ACT.

L5: Evaluating

1. Write a note on working of virus detectors.
2. Brief about Sandbox
3. Assess the various types of Disclosures.
4. Explain the rules for computer forensics in investigation.
5. What is section 66C and 66D in cyber law?

Chairperson
Board of Studies (CSE)

MTCS1204 SOCIAL NETWORK ANALYSIS 3 0 0 3

Course Objectives:

1. To understand the concept of semantic web, social network and related applications.
2. To learn knowledge representation using ontology.
3. To learn extraction and evaluation of web community
4. To understand human behavior in social web and related communities.
5. To learn visualization of social networks.

Course Code	Course Outcomes	Mapping with POs and PSOs								DoK
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	PS03	
MTCS1204.1	Ability to design and develop semantic web related applications	3	-	3	2	-	1	3	2	-	L6
MTCS1204.2	Ability to represent knowledge using ontology	-	3	3	2	2	-	2	2	-	L6
MTCS1204.3	Ability to extract and evaluate the web community	3	3	-	-	2	-	3	2	-	L3, L4
MTCS1204.4	Ability to predict human behavior in social web and related communities	-	1	2	-	2	-	3	2	2	L4, L5
MTCS1204.5	Ability to visualize social networks	3	2	-	-	3	2	-	2	2	L6

SYLLABUS

UNIT-I:INTRODUCTION **12 Hours**

Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web , Social Network analysis: Development of Social Network Analysis, Key concepts and measures in network analysis , Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities , Web-based networks , Applications of Social Network Analysis. **COs–CO1**

Self Learning Concepts: Social Network analysis: Development of Social Network Analysis, Key concepts of Network Analysis.

UNIT- II: Modelling, Aggregating and Knowledge Representation **14 Hours**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation, Ontology languages for the Semantic Web: Resource Description Framework, Web Ontology Language, Modeling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced representations.

COs–CO2

Self Learning Concepts: Ontology languages for the Semantic Web, State-of-the-art in network data representation.

UNIT–III:Extraction and Mining Communities in Web Social Networks **12 Hours**

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Decentralized online social networks, Multi-Relational characterization of dynamic social network communities. **COs– CO3**

Self Learning Concepts: Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms.

UNIT- IV:Predicting Human Behavior and Privacy Issues **12 Hours**

Understanding and predicting human behavior for social communities, User data management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, Trust models based on subjective logic, Trust network analysis, Trust transitivity analysis, Combining trust and reputation, Trust derivation based on trust comparisons, Attack spectrum and counter measure. **COs– CO4**

Self Learning Concepts: Inference and Distribution, Trust models based on subjective logic.

UNIT-V: **10Hours**

Graph theory, Centrality, Clustering , Node-Edge Diagrams, Matrix representation, Visualizing online social networks, visualizing social networks with matrix-based representations, Matrix and Node-Link Diagrams, Hybrid representations , Applications, Cover networks, Community welfare, Collaboration networks, Co-Citation networks. **COs– CO5**

Self Learning Concepts: Visualizing online social networks, Collaboration networks.

Board of Studies: Computer Science and Engineering

Approved in BOS No: 01, 30 July, 2024

Approved in ACM No: 01

TextBooks:

1. S. Wasserman and K. Faust. “Social Network Analysis: Methods and Applications”, CambridgeUniversityPress.
2. D. Easley and J. Kleinberg, “Networks, Crowds and Markets: Reasoning about a highly connected world” , Cambridge University Press, 1st edition,2010

ReferenceBooks:

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences) by Stanley Wasserman, Katherine Faust, 1994
2. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st Edition, MGH, 2011.

Web References:

1. GitHub - gokulkarthik/NPTEL-Social-Networks: NPTEL Course "Social Networks" by Dr. S. R. S. Iyengar, IIT Ropar - Notes, Data sets and Programs
2. Social Network Analysis - Course (nptel.ac.in)
3. Types of Social Networks Analysis - GeeksforGeeks

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	30	20
L2	30	30

L3	40	40
L4	--	05
L5	--	05
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is meant by semantic web?
2. What is social network analysis?
3. Enlist the characteristics of social relationships.
4. Define Instant Messaging.
5. Write the usage of Web Crawlers.
6. Write short notes on Graph Theory.
7. Define Flink.
8. What is context awareness?
9. What constitutes trust network analysis?
10. Explain co-citation networks.

L2: Understand

1. Briefly explain the electronic sources for network analysis.
2. Explain in detail about the development of Social Network Analysis with example.
3. Explain the emergence of Web with example in detail.
4. Elaborate on how semantic web reduce the knowledge gap between human and machine
5. Explain what you understand the technologies that make up the core of today's web services
6. Define ontology and list its features. Explain in detail the role of ontology in semantic web
7. Describe the characteristics of Random network model
8. Explain in detail about the modeling and aggregating Social Network data with examples.
9. Define community. Why community detection is important? Explain in detail about various methods for community detection
10. What is visualization? What is its purpose? Explain the visual representation employed in visualizing social networks

L3: Apply

1. Elaborate on various challenges for decentralized online social networks
2. Explain in detail with a diagram the human behavior understanding and prediction process.
3. Elaborate on online social network visualizations based on different views of social relationships.
4. Discuss in detail about the Core methods for community detection and mining.
5. Write a brief notes on categorization of Twitter messages and Categorization of Twitter messages on the TASS corpus.
6. Briefly explain the various levels of Social Media Optimization.
7. Discuss in detail about the importance of Social media with examples.
8. Explain in detail about (i) detecting communities in Social networks (ii) Evaluating communities with neat diagram.
9. Explain in detail about the reporting tools for Social media analysis.

L4: Analysing

1. Analyze visualizing social networks with matrix based representations.
2. Analyze the community welfare collaboration networks and Co-criterion networks.
3. Explain trust network analysis and trust transitivity analysis with an example.

L5: Evaluating

1. Evaluate the relational characterization of dynamic social network communities.
2. Evaluate trust derivation based on trust comparisons.

Chairperson
Board of Studies (CSE)

MTCS1205 Advanced Network Programming Lab 0 0 4 2

Course Objectives:

1. Learn main protocols comprising the Internet.
2. Get skills in network programming techniques.
3. Learn to implement network services that communicate through the Internet.
4. Learn apply the client-server model in networking applications.
5. Practice networking commands available through the operating systems.

Course Code	Course Outcomes	Mapping with POs and PSOs			
		PO1	PO2	PO3	Dok
MTCS1205.1	Understand and explore the basics of Computer Networks and Various Protocols and Understand and explore the basics of Computer Networks and Various Protocols	2	2	2	L1, L2
MTCS1205.2	Administrate a network and schedule flow of information and Examine the network security issues in Mobile and ad hoc networks.	3	3	3	L2,L3
MTCS1205.3	Evaluate the shortest path by using Routing algorithms. Design the Application layer protocols	3	3	3	L2, L3

Board of Studies : Computer Science and Engineering
Approved in BOS No: 02, 9th May, 2025
Approved in ACM No: 02

Developing the following programs:

Experiment 1: Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.

Experiment 2: Configuration of IP addressing for a given scenario for a given set of topologies.

Experiment 3: Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

Experiment 4: Configure, implement and debug the following: Use open source tools for debugging and diagnostics.

a. ARP/RARP protocols
b. RIP routing protocols
c. BGP routing
d. OSPF routing protocols
e. Static routes (check using net stat)

Experiment 5: Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterize traffic when the DNS server is up and when it is down.

Experiment 6: Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of

700mb.Use aTFTP client and repeat the experiment.

Experiment 7: Configure a mail server for IMAP/POP protocols and write a simple SMTPclient in C/C++/Java client to send and receive mails.

Experiment 8: Implement Open NMS+ SNMPD for checking Device status of devices in community MIBof a linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

Text books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

Chairperson
Board of Studies (CSE)

MTCS1206 MEAN STACK TECHNOLOGIES LAB 0 0 4 2

Course Objectives:

1. Learn the core concepts of both the frontend and backend programming course.
2. Get familiar with the latest web development technologies.
3. Learn all about SQL and Mongo databases.
4. Learn complete web development process.

Course Code	Course Outcomes	Mapping with POs and PSOs			
		PO1	PO2	PO3	Dok
MTCS1206.1	Identify the Basic Concepts of Web & Markup Languages and Develop web Applications using Scripting Languages & Frameworks.	2	2	2	L1, L2
MTCS1206.2	Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng- form.	3	3	3	L2,L3
MTCS1206.3	Working with the Files in React JS and Constructing Elements with Data.	3	3	3	L2, L3

Board of Studies : Computer Science and Engineering
Approved in BOS No: 01, 30th July, 2024
Approved in ACM No: 01

Developing the following programs:

Experiment-1:

Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com. The website should consist of the following pages. Home page

- Registration and user Login
- User profile page
- Books catalog
- Shopping cart
- Payment by credit card Order Conformation

Experiment-2:

Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Experiment-3:

Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:

a) Input: Click on Display Date button using on click ( ) function Output: Display date in the textbox
b) Input: A number n obtained using prompt Output: Factorial of n number using alert
c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert
d) Input: A number n obtained using prompt and add another number using confirm

Output: Sum of the entire n numbers using alert

Experiment-4:

Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click.

Experiment-5:

Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

Experiment-6:

Develop and demonstrate PHP Script for the following problems:

a) Write a PHP Script to find out the Sum of the Individual Digits.
b) Write a PHP Script to check whether the given number is Palindrome or not

Experiment-7:

Implement the following in CSS

a) Implementation of 'get' and 'post' methods.
b) Implementation in colors, boarder padding.
c) Implementation button frames tables, navigation bars.

Experiment-8:

Implement the web applications with Database using

a) PHP,
b) Servlets and
c) JSP.

Experiment-9:

Write a program to design a simple calculator using

a) JavaScript
b) PHP
c) Servlet and
d) JSP.

Experiment-10:

Create registration and login forms with validations using Jscript query.

Experiment-11:

Jscript to retrieve student information from student database using database connectivity.

Experiment-12:

Implement the following in React JS

a) Using React Js creating constructs data elements.
b) Using React Js implementations DoM.

Experiment-13:

Implement the following in Angular JS

a) Angular Js data binding.
b) Angular JS directives and Events.
c)Using angular Js fetching data from MySQL.

Experiment-14:

Develop and demonstrate Invoking data using Jscript from Mongo DB.

Experiment-15:

Create an Online fee payment from using JSCript and MangoDB.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Pro Mean Stack Development, ELadElrom, Apress
4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly

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