Course Structure
&
Detailed Syllabus

M. Tech.
Computer Science and Engineering

Academic Regulations - R24

Applicable for the Batches Admitted from 2024 - 2025

AVANTHI
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

(Approved by AICTE., New Delhi, & Permanently Affiliated to JNTU-GV, Vizianagaram)

NAAC "A+" Accredited Institute

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Vision and Mission of the Institute

Vision:

To develop highly skilled professionals with ethics and human values.

Mission:

1. To impart quality education with industrial exposure and professional training.
2. To produce competent and highly knowledgeable engineers with positive approach.
3. To develop self confidence among students which is an imperative pre-requisite to face the challenges of life.

Quality Policy:

Avanthi Institute of Engineering and Technology, Emphasizes the ethical ideals to impart advanced training by creating the best possible infrastructure engaging and activity oriented teaching. It also uses the most updated information an communication technology to promote a critical approach among the students and aims for an effective ambitious administration which is responsible in all the aspects.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
Programme: M.Tech CSE Regulation: R24

Vision and Mission of the Department

Vision:

To emerge as recognized center through strong research and teaching environment to address technological needs of the stakeholders.

Mission:

M1: Provide quality education in both the theoretical and applications of computer science and apply education to solve real-world problems.

M2: Conduct research to advanced the state of the art in computer science and integrate research results and innovation into other scientific disciplines.

M3: Graduates with ability to solve complex problems that address societal needs and develop appropriate computer programs with latest tools and technologies.

M4: Graduates with ability to pursue advanced education, research, other creative and innovative efforts in computer science & engineering for successful career.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Programme: M.Tech CSE Regulation: R24

Program Outcomes

PO1: Demonstrate knowledge with ability to select, team and apply appropriate techniques, skills and modern engineering tools to solve engineering problems appropriate to the relevant discipline.

PO2: Analyze engineering problems critically, conceptualize, design .Implement and evaluate potential solutions to contribute to the development of scientific / technological solutions in the context of relevant discipline.

PO3: Independently carry out research investigation and development work to solve practical problems.

PO4: Function effectively as an individual and in a team to possess knowledge and recognize opportunities for career progression and research.

PO5: Communicate effectively in professional practice through verbal and written formats.

PO6: Recognize the need for self motivated pursuit of knowledge to know commitment and competence in the broadest context of technological change.

Program Educational Objectives (PEOs):

PEO1: Graduates are prepared to apply analysis, predictions, optimization, decision making and develop skills in order to formulate and solve complex problems in the area of Data Science.

PEO2: Graduates are prepared to take up higher studies, research & development and other creative efforts in the area of Data Science which drives scientific and societal advancement through technological innovation and entrepreneurship.

PEO3: Graduates are prepared to use their skills and abilities in an ethical & professional manner.

Program specific Outcomes (PSOs):

PSO1: Latest tools and techniques of computer engineering so that they can analyze, design and create computing.

PSO2: Learn life skills and interpersonal development activities to face dynamically changing technology.

PSO3: Solve interdisciplinary activities, with professional attitude and ethics, communicate to work under team to ability to solve social issues through their employment higher studies and research.

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www.aietta.ac.in, principal@aietta.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025 to 2026-2027)

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 MTCS11033	**Professional Elective-1** 1. Cloud Computing 2. Computer Networks and Security 3. Information Retrieval Systems	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

Proposed Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025 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 MTCS12033	**Professional Elective-3** 1. Soft Computing and Techniques 2. Advanced Database and Mining 3. High Performance Computing	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)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Structure: Program– M.Tech Computer Science & Engineering

(Applicable from the academic year 2024-2025 to 2026-2027)

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

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	
1	PE	MTCS2101 MTCS2102 MTCS2103	**Professional Elective-5** 1. Block Chain Technology. 2. Natural Language Processing. 3. MOOCs-1 (NPTEL/SWAYAM) (12 Week Program related to the program which is not listed in the course structure)	3	0	0	3
2	OE	MTCS2104	**Open Elective** 1. MOOCs-2 (NPTEL/SWAYAM)-Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department) 2. Course offered by other departments in the college	3	0	0	3
3	PJ	MTCS2105	**Dissertation-I / Industrial Project #**	0	0	20	10
			Total	6	0	20	16

#Students going for Industrial Project / Thesis will complete these courses through MOOCs

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

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	
1	PJ	MTCS2201	Dissertation-II	0	0	32	16
			Total Credits	**0**	**0**	**32**	**16**

Open Electives offered by the Department of CSE

1) Python Programming 2) Principles of Cyber Security 3) Internet of Things
4) Machine Learning 5) Digital forensics 6) Next Generation Databases

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MTCS1101 **Mathematical Foundations of Computer Science** **3 0 0 3**

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	
MTCS1203.1	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
MTCS1203.2	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
MTCS1203.3	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
MTCS1203.4	Design various ciphers using number theory.	-	3	1	-	-	2	-	-	1	L4
MTCS1203.5	Apply graph theory for real time problems like network routing problem.	3	-	-	-	3	-	1	-	-	L4, L5

SYLLABUS

UNIT-I: **10 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. **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. 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, The Chi-Square Test for Goodness of Fit Contingency TablesYates Correction for Continuity Coefficient of Contingency. **COs–CO3**

UNIT- IV: **10 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, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem). **COs-CO4**

UNIT-V: **10 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). **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, MurrayR.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	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. 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 or 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

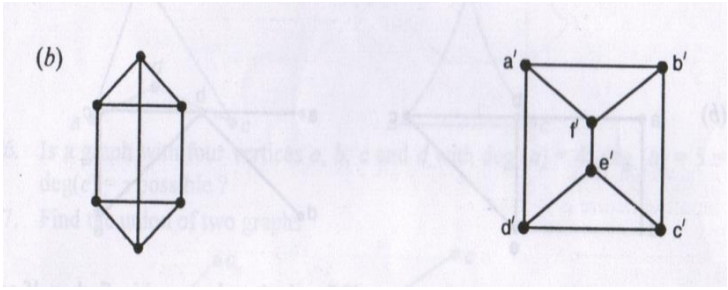
1. Design a Turing Machine for proper subtraction **m-n i**s defined to be **m-n** for **m >=n** and **Zero** for **m<n.**
2. Design a PDA for the Language L={WW^R / W ∈ $(a,b)^*$ }
3. Given the following data

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

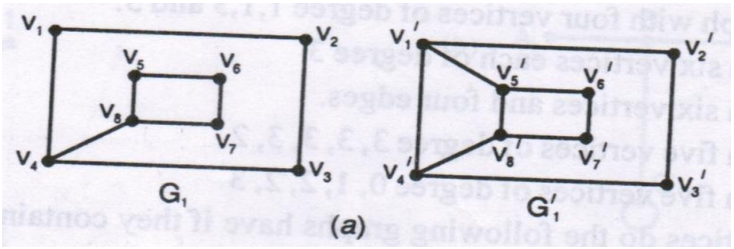
Find the parabola of best fit by the method of moments.

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

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MTCS1102 ADVANCED DATA STRUCTURES & ALGORITHMS 3 0 0 3

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	-	-	L3, L4, L5
MTCS1102.2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation	3	-	3	1	-	-	3	-	-	L3, L4, L6
MTCS1102.3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	-	3	-	2	-	-	3	-	-	L3, L5
MTCS1102.4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs andsearch trees	3	1	2	-	-	-	2	1	-	L3, L4, L6
MTCS1102.5	Ability to compare various search trees andfind solutions for ITrelated problems	-	3	2	2	-	-	3	-	-	L3, L4, L5

SYLLABUS

UNIT I: Introduction to Data Structures **10 Hours**

Singly Linked Lists, Doubly Linked Lists, Circular Lists Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists. **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.**COs–CO2**

UNIT III: Dictionaries **10 Hours**

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

COs–CO4

UNIT V: Search Trees **10 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. **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, Algorithms and Applications in java, 2/e, Sartaj Sahni, UniversityPress

Reference Books:

1. Data Structures and Algorithm Analysis,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

Cognitive Level	Internal Assessment#1(%)	Internal Assessment#2(%)
L1	30	20
L2	30	30
L3	40	30
L4	--	10
L5	--	10
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 Double 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, postfix expressions?

L3: Apply

1. Implement stack ADT using c?
2. Implement queue ADT using c?
3. Explain about HashTable 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 AVLTree? Explain how to find the height of AVLtree?
2. Explain about Redblack 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.

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MTCS11031 CLOUD COMPUTING 3 0 0 3

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 **12 Hours**

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

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. **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 **COs–CO3**

UNIT- IV: Resource Management and Security In Cloud **12 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 , 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, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, 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	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. 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

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MTCS11032 COMPUTER NETWORKS AND SECURITY 3 0 0 3

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	-	-	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	-	-	-	3	1	-	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.	2	-	3	-	-	-	2	3	-	L2, L3
MTCS 11032.4	configure and manage firewalls and intrusion detection systems, implement VPNs and secure communication protocols, and design advanced security measures to ensure robust	3	-	2	-	-	-	3	2	-	L3, L4

	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	-	-	-	-	1	2	-	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. **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, 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. **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, 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. **Voice-over-IP (VoIP):** Limitations

of Best-Effort IP Service (Jitter, Packet Loss, 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?

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MTCS11033 INFORMATION RETRIEVAL SYSTEMS 3 0 0 3

Course Objectives:

1. Giving idea about the existing problems and potentials of current IR systems.
2. Learn and use different retrieval algorithms and systems.
3. Giving idea about k-gram indexes for spelling correction.
4. Giving idea about Dictionary compression.
5. Giving idea about Parametric and zone indexes.

Course Code	Course Outcomes	Mapping with POs and PSOs							Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PS02	
MTCS 1103 3.1	Understand the retrieval of rel evant information from a text database.	3	2	-	1	-	-	2	-	L2, L3
MTCS 1103 3.2	Apply and understand the Ter m Vocabulary and Postings Li sts.	-	2	3	-	-	-	3	-	L3, L4, L5
MTCS 1103 3.3	Understand and Identify the In dex Construction.	-	1	3	-	-	-	3	-	L2, L4
MTCS 1103 3.4	Explain the Index Compressio n.	1	2	-	3	-	-	3	-	L2, L5
MTCS 1103 3.5	Provide the appropriate the Ve ctor Space Model.	-	3	3	-	-	-	2	-	L3, L4, L5

SYLLABUS

UNIT-I: Boolean Retrieval **12 Hours**

An example information retrieval problem, a first take at building an inverted index, processing Bo olean queries, the extended Boolean model versus ranked retrieval.

The Term Vocabulary and Postings Lists:

Document delineation and character sequence decoding, Obtaining the character sequence in adocu ment, choosing a document unit, determining the vocabulary of terms, Tokenization, dropping com mon terms: stop words, Normalization (equivalence classing of terms) stemming and lemmatization , Faster postings list intersection via skip pointers, Positional postings, and phrase queries, Biword i ndexes, Positional indexes, Combination scheme. **COs–CO1**

UNIT-II: Dictionaries and to Lerant Retrieval **12 Hours**

Search structures for dictionaries, Wildcard queries, General wildcard queries, k gram indexes for wildcard queries, Spelling correction, Implementing spelling correction, Forms of spelling correction, Edit distance, kgram indexes for spelling correction, Context sensitive spelling correction, Phonetic correction **IndexConstruction:** Hardware basics, Blocked sort-based indexing, single-pass in memory indexing, distributed indexing, Dynamic indexing, other types of indexes. **COs–CO2**

UNIT– III: Index Compression: **15 Hours**

Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blo cked storage, Postings file compression, Variable byte codes, ã codes.

Scoring, Term Weighting: Parametric and zone indexes, Weighted zones coring, Learning weight s, The optimal weight, Term frequency and weighting, Inverse document frequency, Tf-IDF weighting. **COs– CO3**

UNIT-IV: Efficiency: **12 Hours**

The Vector Space Model: The vector space model for scoring, Dot products, Queries as vectors, C omputing vector scores, Variant tf-idf functions, Sublinear tf scaling, Maximum tf normalization, Document and query weighting sche mes ,Pivoted normalized document length **COs– CO4**

UNIT-V: Evaluation in Information Retrieval: **15 Hours**

Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, Critiques and justifications of the c oncept of Relevance, A broader perspective: System quality and user utility, System issues, User uti lity, Refining a deployed system, Results snippets. **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. Christopher D.Manning, Prabhakar Raghavan, HinrichSchütze,"AnIntroductionto Informat ion Retrieval", 1st Edition, Cambridge University Press, 2008.

Reference Books:

1. G.G. Chowdhury,"Introduction to Modern Information Retrieval", 3rd Edition, neal schuman publishers, 2010. GeraldJ.Kowalski, MarkT.Maybury, "Information storage and R etrieval systems: theory and implementation", 2nd Edition, kluwer academic publishers, 20 09.

Web References:

1. Chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf
2. http://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf

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 an inverted index in information retrieval?
2. Define the term "Boolean retrieval."
3. Explain the concept of normalization in text processing.

4. Defined it distance in the context of spelling correction.
5. What is blocked sort-based indexing?
6. List the types of dictionary compression techniques.
7. What are variable byte codes used for in postings file compression?
8. Explain the concept of tf-idf weighting.
9. Explain pivoted normalized document length.
10. What are standard test collections used for in information retrieval evaluation?

L2: Understand

1. How does the extended Boolean model differ from ranked retrieval?
2. Describe the process of building an inverted index from a set of documents.
3. Explain the use of skip pointers in postings list intersection.
4. Explain the process of context-sensitive spelling correction.
5. Describe the hardware basics necessary for index construction.
6. How does single-pass in-memory indexing work?
7. How does Heaps 'law help in estimating the number of terms in a document?
8. Explain how dictionary as a string helps in compression.
9. Discuss the advantages of using variable byte codes for postings file compression.
10. Describe the process of computing vector scores for a given query.

L3: Apply

1. Demonstrate how to process a Boolean query using an inverted index.
2. Apply to kenization to a given document and list the resulting tokens.
3. Use normalization techniques to preprocess a given set of terms.
4. Construct a basic blocked sort-based index from a set of documents.
5. Demonstrate the process of distributed indexing on a small dataset.
6. Use dynamic indexing to update an existing index with new documents.
7. Apply Zipf's law to model the distribution of terms in a sample text.
8. Implement a basic dictionary compression technique on a given set of terms.
9. Demonstrate the use of variable byte codes for compressing a sample postings file.
10. Use the vector space model to score a set of documents for a given query.

L4: Analyze

1. Compare and contrast Boolean retrieval with ranked retrieval models.
2. Analyze the advantages of context-sensitive spelling correction over basic spelling correction.
3. Discuss the trade-offs between maximum if normalization and other normalization techniques.

4. Examine the limitations of the vector space model in handling complex queries.
5. Discuss the trade-offs between system quality and user utility in information retrieval evaluation.

L5: Evaluate

1. Critique the extended Boolean model in terms of its practical applicability.
2. Evaluate the performance of blocked sort-based indexing compared to distribute indexing.
3. Evaluate the performance of different postings file compression methods.
4. Judge the importance of term weighting schemes in improving search result relevance.
5. Evaluate the impact of relevance assessments on user satisfaction.

Chairperson
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MTCS11041 BIG DATA ANALYTICS 3 0 0 3

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	-	-	-	-	2	2	2	-	L1,L2
MTCS11O41.2	Analyze Hadoop Framework and eco systems	3	3	-	-	-	-	3	-	-	L4
MTCS11O41.3	Analyze MapReduce and Yarn, Work on NoSQL environment	3	3	-	-	-	-	-	-	-	L4
MTCS11O41.4	Work on NewSQL environment, MongoDB and Cassandra	3	3	-	-	-	-	-	-	-	L3
MTCS11O41.5	Apply the Big Data using Map-reduce programming in Both Hadoop and Spark framework.	3	3	-	-	-	-	-	-	-	L3,L6

SYLLABUS

UNIT- I:Introduction to Big Data: 12 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 – 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: **12 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, 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 12 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.

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 12 Hours

Hive: Introduction, Architecture, Data Types, File Formats, Hive Query Language Statements, Partitions, Bucketing, Views, Sub, Query, Joins, Aggregations, Group by and having, RCFile 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, User-Defined Functions, Parameter Substitution, Diagnostic Operator, Word Count Example using Pig - Pig at Yahoo!, Pig Versus Hive **COs– CO4**

UNIT-V: Introduction to Data Analytics with R Machine Learning: **12 Hours**

Introduction, Supervised Learning, Unsupervised Learning, Machine Learning Algorithms: Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, Decision Tree, Big Data Analytics with Big, Data Model, Examples, Cassandra Clients, Hadoop Integration.

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	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 Big Data?
2. List the various dimensions of growth of Big Data
3. Why domain expertise is required for any type of DataAnalytics?
4. What is Bigdata? 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. Listthe 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. Listthe aggregate data models.

L2: Understand

1. Differentiate Big Data and Conventional Data
2. Give the structure of big data.
3. Summarizehow the analytical scalability is handled in big data
4. Differentiate the Analysis and reporting methods and tools
5. What is Hadoop YARN?
6. Whatare the advantages of HDFS?
7. Discuss the various core components of the Hadoop.
8. Summarize briefly on
   (i) Algorithms using MapReduce. (ii) Advantages of MapReduce
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 does Map-Reduce computation execute.
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. Summarizewhat 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

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	-	-	3	-	2	1	-	2	1	L4

	optimizing 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 **10 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. **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. **COs-CO2**

UNIT III- Instant Based Learning **10 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, Linear Soft Margin Classifier for Overlapping Classes, Nonlinear Classifier, and Regression by Support vector Machines. **COs-CO3**

UNIT IV - Neural Networks and Genetic Algorithms **10 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**

UNIT V- Advanced Learning **12 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, FOCL Algorithm , Reinforcement Learning , Task , Q-Learning , Temporal Difference 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), 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	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. 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

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	2	-	-	-	1	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	3	3	-	-	-	-	-	-	L3, L4, L6
MTCS 11043.3	Analyze and Resolve Consistency and Concurrency Issues	-	3	2	3	-	-	3	-	-	L5, L6
MTCS 11043.4	Evaluate and Implement Fault Tolerance and Recovery Mechanisms	-	3	3	2	-	-	3	-	-	L3, L5, L6
MTCS 11043.5	Understand and Implement Object-Oriented Data Models	3	3	2	-	-	-	3	-	-	L3, L5, L6

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. **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. 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 andSylvain L. Frey.
6. Object-Oriented Databases: Concepts and ApplicationsDavid 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.
12. Assess the trade-offs between using an OODBMS versus an ORDBMS for a system that requires both complex data management and high performance.

Chairperson
Board of Studies (CSE)

MTCS1105 Research Methodology and IPR 3 0 0 3

Course Objectives:

1. To give an overview of the research methodology and explain the technique of defining a research problem.
2. To explain the functions of the literature review in research and guide the process of conducting a literature search, reviewing it, and writing a review.
3. To explain various research designs, their characteristics, and the details of sampling designs, measurement and scaling techniques, along with different methods of data collection.
4. To explain several parametric tests of hypotheses, including the Chi-square test, and their application in research.
5. To explain various forms of intellectual property, its relevance, business impact, and leading international instruments concerning Intellectual Property Rights in the global business environment.

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

Course Code	Course Outcomes	Mapping with POs			Dok
		PO1	PO2	PO12	
MTCS1105.1	Analyze the intensity variation of light due to interference, diffraction and classify various types of lasers.	3	2	1	L1,L4
MTCS1105.2	Identify various crystal systems and analyze the crystalline structure.	3	2	1	L1,L4
MTCS1105.3	Summarize various types of polarization of dielectrics and classify the magnetic materials.	2	2	1	L1,L3
MTCS1105.4	Explain fundamentals of quantum mechanics and apply to one dimensional motion of particles.	3	2	2	L1,L3
MTCS1105.5	Outline the properties of charge carriers in semiconductors	3	2	1	L1,L4

SYLLABUS

UNIT-I: Research Methodology **10 Hours**

Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Technique Involved in Defining a Problem, an Illustration. **COS-CO1**

UNIT-II: Reviewing the literature **8 Hours**

Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected Literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good

Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **COS-CO2**

UNIT-III: Design of Sample Surveys **12 Hours**

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data, Selection of Appropriate Method for Data Collection, Case Study Method. **COS-CO3**

UNIT-IV: Testing of Hypotheses **12 Hours**

Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Goodness of Fit, Cautions in Using ChiSquare Tests. Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **COS-CO4**

UNIT-V: Interpretation and Report Writing: **12 Hours**

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. **COS-CO5**

Board of Studies : Management Science
Approved in BOS No: 05, August, 2024
Approved in ACM No: 01,

Textbooks:

1. Research Methodology: Methods and Techniques - C.R. Kothari, Gaurav Garg, New Age

International, 4th Edition, 2018.
2. Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module2)- Ranjit Kumar SAGE Publications Ltd, 3rdEdition, 2011
3. Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice,The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books:

1. Research Methods: The concise knowledge base- Trochim, Atomic Dog Publishing, 2005
2. Conducting Research Literature Reviews: From the Internet to Paper–Fink, Sage Publications, 2009.

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	30
L2	30	30
L3	20	20
L4	20	20
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

Module-1: Research Methodology

1. What is the primary objective of research?
2. Describe the difference between basic and applied research.
3. Explain the significance of using the scientific method in research.
4. Differentiate between research methods and research methodology.
5. Outline the steps in the research process.
6. What are the criteria for good research?
7. Identify common problems encountered by researchers in India.
8. What are the main research approaches, and how do they differ from one another?
9. Discuss the significance of defining a research problem clearly.
10. Provide an example of how to define a research problem, including the steps involved.

Module-2: Reviewing the Literature & Research Design

1. What is the role of a literature review in a research study?
2. How does reviewing literature help in clarifying the research problem?
3. What is the difference between a theoretical framework and a conceptual framework?
4. List and describe the key features of a good research design.
5. Why is research design crucial for the validity of a study?
6. Explain the different types of research designs and their applications.
7. What are the basic principles of experimental designs?
8. How can a literature review improve research methodology?

9. Describe the process of searching and reviewing existing literature.
10. Illustrate how a well-developed theoretical framework can guide a research study.

Module-3: Design of Sample Surveys, Measurement, and Scaling

1. What is the difference between sampling errors and non-sampling errors?
2. Discuss the advantages and disadvantages of sample surveys compared to census surveys.
3. Explain the concept of sample design and its importance in research.
4. What are the classifications of measurement scales, and how are they used?
5. Describe the sources of error in measurement and techniques to minimize them.
6. Differentiate between qualitative and quantitative data.
7. What is multidimensional scaling, and how is it applied in research?
8. Explain the process of developing a measurement tool.
9. How does scaling affect data collection and analysis?
10. Discuss the role of the case study method in data collection.

Module-4: Testing of Hypotheses

1. Define hypothesis and its role in research.
2. What is the procedure for hypothesis testing?
3. Differentiate between Type I and Type II errors in hypothesis testing.
4. Explain the concept of the critical value and its role in decision-making.
5. How do you test hypotheses for differences between two means or proportions?
6. Describe the P-value approach and its significance in hypothesis testing.
7. What is the power of a test, and why is it important?
8. Discuss the limitations of hypothesis testing.
9. Explain how the chi-square test is used for goodness of fit and its cautions.
10. Describe the different test statistics used in hypothesis testing for variances.

Module-5: Interpretation, Report Writing, and Intellectual Property

1. What is the meaning of interpretation in research, and why is it important?
2. Discuss the techniques used for interpreting research data.
3. What are the key steps in writing a research report?
4. How should a research report be structured?
5. What precautions should be taken while writing a research report?
6. Explain the concept of intellectual property and its types.
7. Discuss the TRIPS Agreement and its impact on intellectual property laws.
8. What is the role of the World Intellectual Property Organization (WIPO)?
9. How do national and international IP laws intersect?
10. Describe the protection mechanisms for patents and copyrights under Indian law.

Chairperson
Board of Studies (MBA)

MTCS1106 Advanced Data Structures & Algorithms Lab 0 0 4 2

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
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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

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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

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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

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AUDIT 1 and 2: DISASTER MANAGEMENT

MTAC1108 **2 0 0 0**

Course Objectives: -

Students will be able to:

1.Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

2.Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

3. Develop an understanding of standards of humanitarian response and practical relevance in specifictypes of disasters and conflict situations.

4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard AndDisaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss OfHuman And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods,Droughts And Famines, Landslides And Avalanches, Man- made disaster:Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's	4

	Participation In Risk Assessment. Strategies for Survival.	
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royalbook Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

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Board of Studies (Chemistry)
Avanthi Inst. of Engg. & Tech. (Autonomous)
Cherukupally (V), Near Tagarapuvalasa Bridge,
Bhogapuram (M), Vizianagaram (Dist)-531162

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 specia
2. l emphasis on IP, TCP & UDP and Routing algorithms.
3. Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation LANs/WANs, internetworking technologies, Routing and Addressing.
4. Provide the mathematical background of routing protocols.
5. Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Course Code	Course Outcomes	Mapping with POs and PSOs									Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2	PS03	
MTCS 1201.1	Illustrate reference models with layers, protocols and interfaces.	3	2	1	-	2	-	-	2	1	L1, L2
MTCS1 201.2	Define the routing algorithms, Sub netting and Addressing of IP V4and IPV6.	-	3	-	2	-	1	-	2	-	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	-	2	-	2	1	-	2	2	L1, L2, L3
MTCS1 201.4	Demonstrate the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks	1	-	2	2	-	1	3	-	-	L4
MTCS1 201.5	Explain the emerging trends in networks-MANETS and WSN	-	3	-	2	-	-	3	2	1	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, 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, internetworking, 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, 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, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, **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 802.11 Project: 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.

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

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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

Weblinks :

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	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 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 if 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 to IPV6.
3. Explain the protocol Stack Issues in Mobile Computing Environment.
4. Explain the importance of the Ad Hoc networks security.
5. For a given IP address 172.16.10.22 and 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	
MTCS1202.1	After the completion of the course, student will be able to design web pages.	2	2	-	-	-	-	2	-	-	L3, L4
MTCS1202.2	Identify the Basic Concepts of Web & Markup Languages.	2	-	-	-	-	2	2	-	-	L1, L2
MTCS1202.3	Develop web Applications using Scripting Languages & Frameworks.	3	3	-	-	-	-	3	3	-	L4, L6
MTCS1202.4	Make use of Express JS and Node JS frameworks	3	3	-	-	-	-	3	2	-	L3, L4
MTCS1202.5	Illustrate the uses of web services concepts like restful, react js.	3	2	-	-	-	2	3	3	-	L2,L5, L6

SYLLABUS

UNIT I: Introduction to Web: 12Hours

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. **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, 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 , 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, 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, 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.

COs-CO5

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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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MTCS12031 SOFT COMPUTING AND 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**

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**

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**

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**

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**

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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. 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

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 1203	Demonstrate the basic elements of a relational database management system	3	-	1	-	2	1	-	1	1	L1, L2
MTCS 1203	Familiarize with the basic issues of transaction processing and concurrency control.	-	3	-	-	-	1	-	-	2	L1, L2,L3
MTCS 1203	Design and Modeling of Data Warehouse	-	3	-	2	-	-	3	1	-	L1, L2, L3
MTCS 1203	Discover interesting pattern from large amount of data	2	-	3	-	2	3	-	2	-	L4
MTCS 1203	Evaluating a range of data mining algorithms using data mining tools effectively	3	-	3	1	-	-	3	2	-	L4, L5

SYLLABUS

UNIT-I: **10 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; Multi valued Dependency; Loss-less Join and Dependency Preservation. **COs – C01**

UNIT- II: **13 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, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees. **COs –C02**

UNIT- III: 11 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: Representing input data and output knowledge, Visualization techniques, Experiments with Weka , visualization. **COs – CO3**

UNIT- IV: 8 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, Constraint based Association mining. Graph Pattern Mining, SPM. **COs – CO4**

UNIT-V: 10 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.Advanced topics: Spatial, Multimedia, Text and Web data, Spatial Data mining, Multimedia Data mining, Text Mining, Mining the World Wide Web. **COs – CO5**

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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

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MTCS12033 High Performance Computing 3 0 0 3

Course Objectives:

1. Understand the fundamentals and design principles of parallel programming platforms.
2. Grasp basic communication operations and heterogeneous computing concepts, including Open CL.
3. Comprehend message passing and shared address space programming paradigms, focusing on MPI and Open MP.
4. Study dense matrix algorithms, parallel sorting, and graph algorithms.
5. Introduce and apply general-purpose GPU programming using CUDA.

Course Code	Course Outcomes	Mapping with POs and PSOs								Dok
		PO1	PO2	PO3	PO4	PO5	PO6	PS01	PSO2	PS03	
MTCS 12033.1	Understand the parallel programming platforms and parallel algorithms on parallel computer systems.	3	1	-	-	1	-	3	2	-	L1, L2
MTCS 12033.2	Analyze the working group communication operations of MPI	2	-	2	-	1	1	3	-	1	L1, L2 L3
MTCS 12033.3	Understand the accelerator technologies of GPGPU‘s with CUDA, OpenCL.	-	2	-	2	-	-	3	-	1	L1, L2, L3
MTCS 12033.4	Implement algorithms for Matrix, Sorting and Graphs	3	-	2	-	-	-	3	2	-	L4
MTCS 12033.5	Implement algorithms for using Open MP, Pthreads, MPI and CUDA Language / Library.	1	-	3	-	2	-	3	2	2	L4, L5

SYLLABUS

UNIT-I: Overview of Parallel Programming Platforms **12 Hours**

Parallel Programming Platforms: Implicit parallelism: Trends in Microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, Routing mechanisms for inter connection networks.

Principles of Parallel Algorithm Design: Preliminaries, decomposition Techniques, Characteristics of tasks and interactions, mapping techniques for load balancing, parallel algorithm models. **COs–CO1**

UNIT-II **15 Hours**

Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather.

Analytical modeling of parallel programs: sources of overhead in parallel programs, performance metrics for parallel systems.

Introduction to Heterogeneous Computing: Introduction to OPenCL, Platform and Devices, the Execution Environment, Memory Model, Writing Kernels. **COs–CO2**

UNIT-III **15 Hours**

Programming using the message passing paradigm: Principles of Message passing programming, the building blocks: Send and Receive Operations, MPI: the message passing interface, collective communication and computation Operations.

Programming shared address space platforms: Thread Basics, why Threads, The POSIX Thread API, Thread Basics: Creation and Termination, OpenMP: a standard for Directive based Parallel Programming. **COs– CO3**

UNIT-IV **9 Hours**

Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix– Matrix Multiplication.

Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble sort and its variants.

Graph Algorithms: Minimum Spanning Tree: Prim‘s Algorithm, Single Source shortest paths: Dijkstra ‘s Algorithm. **COs– CO4**

UNIT-V **9 Hours**

Introduction to General Purpose GPU programming (CUDA): The age of parallel processing, The Rise of GPU computing, CUDA, Applications of CUDA, Development Environment, Introduction to CUDAC, Parallel Programming in CUDAC. **COs– CO5**

Text Books:

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar: Introduction toParallel Computing, Second Edition Pears on Education, 2016.(Chapters:1-10)
2. Jason Sanders, Edward Kandrot, CUDA By Example – An Introduction toGeneral-Purpose GPUProgramming, Addison Wesley,2011.(Chapters:1-4)
3. Benedict R Gaster, Lee Howes, David R KaeliPerhaad Mistry Dana Schaa, Heterogeneous Computing with Open CL McGraw-Hill, Inc.NewYork, 2012. (Chapters-2)

Reference Books:

1. MichaelJ. Quinn, Parallel Programming in C with MPI and OpenMP McGraw-Hill International Editions, Computer Science Series, 2004.
2. David B.Kirk, Wen-meiW.Hwu, Programming Massively Parallel Processors A Hands-on Approach, Third Edition, Morgan Kaufmann,2016.

WEB REFERENCE:

1. nptel.ac.in/courses/106108055/
2. http://www.nvidia.com/object/cuda_home_new.html
3. http://www.icrar.org/research/postgraduuate/igh-performance-computing-honours-course
4. http://www.openCL.org

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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

Unit I: Overview of Parallel Programming Platforms

Remember:

1. Define implicit parallelism in microprocessor architectures.
2. List the trends in microprocessor architectures.
3. List the types of all-reduce operations.
4. Describe the prefix-sum operation.
5. List the functions of the POSIX Thread API.
6. Define Open MP and its purpose.
7. What is CUDA?
8. Define general-purpose GPU programming.
9. Illustrate how bubble sort can be adapted for parallel computation.
10. Explain the process of finding a minimum spanning tree using Prim's Algorithm.

Understand:

1. Explain the concept of implicit parallelism with examples.
2. Discuss the impact of memory system limitations on parallel computing.
3. Illustrate the concept of prefix-sum operations with an example.
4. Describe the scatter and gather operations in parallel programming
5. What are the thread basics in shared address space platforms?
6. List the functions of the POSIX Thread API.
7. Discuss the concept of single-source shortest paths and how Dijkstra's Algorithm solves it.
8. Interpret the importance of efficient graph algorithms in parallel computing environments.
9. Discuss the benefits of using CUDA for parallel programming.
10. Interpret the importance of the development environment in CUDA programming.

Apply:

1. Apply the concept of implicit parallelism to optimize a given algorithm.
2. Demonstrate the effect of memory limitations on a specific parallel computing task.
3. Use prefix-sum operations to solve a specific computational problem.
4. Design a scatter-gather operation for a given parallel task.
5. Develop a method to measure the overhead in a parallel program.
6. Use performance metrics to evaluate the efficiency of a parallel system.
7. Apply sorting network principles to sort a given list of numbers.
8. Implement a parallel version of bubble sort for a set of data.
9. Develop a CUDA kernel for an image processing task.
10. Implement a parallel algorithm using CUDA for sorting a large dataset.

Analyze:

1. Analyze the trends in microprocessor architectures and their implications for parallel computing.
2. Compare the overhead sources in different parallel systems.
3. Analyze the computational complexity of matrix-vector multiplication in parallel systems.
4. Analyze the computational complexity of matrix-vector multiplication in parallel systems
5. Analyze the memory model of CUDA and its impact on program performance.

Evaluate:

1. Evaluate the significance of implicit parallelism in modern computing architectures.
2. Judge the impact of overhead on the efficiency of parallel programs.
3. Evaluate the practicality of implementing sorting networks in hardware versus software.
4. Assess the impact of parallelism on the efficiency of graph algorithms.
5. Critique the current state of GPU computing and its future prospects.

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

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 1204.1	Demonstratetheba sicconceptsfunda mentallearningtec hniquesandlayers.	3	2	-	2	2	-	3	2	1	L1, L2, L3
MTCS 1204.2	Discuss the Neural Network training, various and ommodels.	-	3	1	-	2	-	-	2	1	L1, L2
MTCS 1204.3	Explain different types of deep learning network models.	3	3	-	2	2	-	-	-	1	L2, L3
MTCS 1204.4	Classify the Probabilistic Neural Networks.	1	-	2	2	2	-	3	2	-	L3, L4
MTCS 1204.5	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 **10 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.

Feed for ward neural network:

Artificial Neural Network, activation function, multi-layer neural network. **COs–CO1**

UNIT- II: Introduction to feed forward Networks and Deep Neural Networks **10 Hours**

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.

Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. **COs–CO2**

UNIT – III: Training of Neural Networks **12 Hours**

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

UNIT- IV: Recurrent Neural Networks and Convolutional Neural Networks **10 Hours**

Probabilistic Neural Network: Hop field Net, Boltzmann machine, RBMs, Sigmoidnet, Auto encoders. **COs–CO4**

UNIT-V: Recent trends and Applications **10 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, Multi-task Deep Learning, Multi-view Deep Learning

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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	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. 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.

Chairperson
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MTCS12042 Cyber Security and Digital Forensics 3 0 0 3

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: 10 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 **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. **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. **COs-CO3**

UNIT- IV: **10 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, PyFLAG, Fiwalk, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition. **COs-CO4**

UNIT-V: **10 Hours**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC, Electronic Communication Privacy ACT, Legal Policies **COs-CO5**

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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	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. 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?

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MTCS12043 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	PO 6	PS0 1	PS0 2	PS 03	
MTCS12 04.1	Ability to design and develop semantic web related applications	3	-	3	2	-	1	3	2	-	L6
MTCS12 04.2	Ability to represent knowledge using ontology	-	3	3	2	2	-	2	2	-	L6
MTCS12 04.3	Ability to extract and evaluate the web community	3	3	-	-	2	-	3	2	-	L3, L4
MTCS12 04.4	Ability to predict human behavior in social web and related communities	-	1	2	-	2	-	3	2	2	L4, L5
MTCS12 04.5	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**

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

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**

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**

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**

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.

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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

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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

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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

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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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AUDIT 1 and 2: CONSTITUTION OF INDIA

MTAC1208 **2 0 0 0**

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolutionin 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus		
Units	**Content**	**Hours**
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and DisqualificationsPowers and Functions ExecutivePresident Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat.	4

	Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

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AUDIT 1 and 2: PEDAGOGY STUDIES

MTAC1209 **2 0 0 0**

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus		
Units	**Content**	**Hours**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminologyTheories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.**Overview of methodology and Searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formaland informal classrooms in developing countries. Curriculum, Teacher education.	4
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculumand guidance materials best support effective pedagogy?	4
4	Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
5	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community.Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
6	**Research gaps and future directions** Research, design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	4

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationresearch project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basicmaths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms indeveloping countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, andwith what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidancematerials best support effective pedagogy?

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MTCS2101 **Block Chain Technology** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

1. Understand the foundational concepts of block chain technology, including its history, structure, features, and applications.
2. Explain the working principles of block chain systems, including block creation, transaction management, consensus mechanisms, and cryptographic tools.
3. Analyze block chain architecture and apply development methodologies to design block chain-based solutions using platforms like Ethereal and Solidity, with reference to real-world use cases.
4. Develop and interact with smart contracts and decentralized applications (DApps) using tools such as Geth and Mist, while understanding best practices and design patterns for DApps.
5. Explore advanced block chain concepts such as fault tolerance, consensus algorithm comparisons, and privacy and security considerations.

Course Outcomes

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	DoK
MTCS2101.1	Describe the basic concepts, structure, features, and real-world uses of block chain technology.	3	2	1	1	2	2	3	2	2	L1, L2
MTCS2101.2	Explain how block chain works, including blocks, transactions, consensus mechanisms, and cryptographic tools	3	3	2	1	2	2	3	2	2	L2, L3
MTCS2101.3	Design block chain-based applications and understand Ethereum and Solidity for developing real-life use cases	3	3	3	2	2	2	3	3	3	L3, L4
MTCS2101.4	Develop and interact with smart contracts and DApps using Ethereum tools and understand their structure and patterns.	3	2	3	3	3	2	3	3	3	L4, L5
MTCS2101.5	Identify and discuss advanced block chain topics such as consensus models, security, privacy, and scalability issues.	3	3	3	2	2	3	3	3	3	L5, L6

SYLLABUS

UNIT I: **10 Hours**

Introduction to Block chain: What is Block chain, History and evolution, Basic structure and features, Real-world example of a block chain application, Layers of block chain (block chain stack), Pros and cons of using block chain.

Self-Learning Topics: **CO's-CO1**

Block chain Interoperability.

UNIT II: **15 Hours**

How Block chain Works: Basics of block chain and public ledgers, understanding blocks and transactions, Consensus mechanisms (how agreement is achieved), Key cryptographic tools: Hash functions, Merkle Trees, Basic game theory in block chain. **CO's-CO2**

Self-Learning Topic: Transaction Malleability & Replay Attacks, Harding and Parallelism.

UNIT III: **15 Hours**

Block chain Architecture & Use Cases: How to design block chain applications, Common templates and development methods, Introduction to Ethereum and Solidity programming, Real-life examples from different industries **CO's-CO3**

Self-Learning Topics: EVM Internals & Bytecode Analysis, Layer 2 Scaling Solutions, Cross-chain Communication & Interoperability.

UNIT IV: **10 Hours**

Smart contracts: Smart contract, structure of a contract, interacting with smart contracts using Geth client and Mist wallet, smart contract examples, smart contract patterns.

Decentralized applications (Dapps) Dapps, implementing Dapps, Ethereum Dapps, case studies related to Dapps. **CO's-CO4**

Self-Learning Topics: Contract Upgradeability, Smart Contract Auditing, Security-Focused Design

UNIT-V: **10 Hours**

Advanced Block chain Topics: Byzantine Fault Tolerance, Proof-of-Work vs Proof-of-Stake, Blockchain security and privacy, Common smart contract issues, Scalability challenges.**CO's-CO5**

Self-Learning Topics: Elliptic Curve Cryptography (ECC), Threshold Signatures & Multi-signature Wallets.

Board of Studies : Computer Science and Engineering

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

Approved in ACM No: 02

Expert Talk (To be Delivered by SMEs from Industries) **COs/ POs / PSOs**

1. Explain how blockchain operates, including cryptographic techniques and consensus CO2–PO1, PO4, PSO1.
2. Analyze blockchain application design and real-world implementations CO3-PO5, PO6, PSO2.
3. Explore industrial blockchain use cases and new business models CO5-PO3, PO6.

Text Books:

1. Blockchain applications: a hands-on approach, Bahga A., Madisetti V., VPT.

Reference Books:

1. Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress, 2018.
2. Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara and Paul R. Allen, McGraw Hill, 2018.
3. Blockchain enabled Applications Vikram Dhillon, David Metcalf and Max Hooper, Apress, 2017, The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology,William Mougayar, Wiley, 2016.
4. Blockchain Science: Distributed Ledger Technology, Roger Wattenhofer, Inverted Forest Publishing; 3rd edition, 2019**.**

Web References:

1. https://learning.oreilly.com/library/view/handbook-of-digital/9780123742674.

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is a blockchain and explain its applications?
2. When blockchain technology was first introduced?
3. List the layers of the blockchain stack?
4. Define a public ledger?
5. List any two cryptographic tools used in blockchain technology?
6. Define Solidity in the context of blockchain programming?
7. List any two industries using blockchain technology?

8. List any two tools used to interact with smart contracts?
9. Define DApp with an example?
10. What is Byzantine Fault Tolerance (BFT)?
11. Define Proof-of-Work and Proof-of-Stake
12. List two common vulnerabilities in smart contracts

L2: Understand

1. Explain how blockchain technology works in simple terms?
2. Describe the basic structure of a blockchain?
3. What are the key characteristics that differentiate blockchain from traditional databases?
4. Explain how a blockchain achieves distributed consensus?
5. Describe how transactions are stored in a block?
6. How do hash functions contribute to the security of blockchain?
7. Explain how Ethereum enables the development of blockchain applications
8. Describe a common template used in blockchain application development?
9. Explain the structure of a smart contract in Ethereum
10. Describe the role of Geth and Mist in smart contract deployment
11. Explain how Proof-of-Work differs from Proof-of-Stake.
12. What are the common scalability issues faced by blockchain networks?
13. Describe how blockchain ensures privacy of user data?
14. What are the common scalability issues faced by blockchain networks?

L3: Apply

1. Identify a real-world application where blockchain is currently used (e.g., cryptocurrency, supply chain, voting systems).
2. Demonstrate how a simple transaction is recorded in a blockchain?
3. Illustrate the structure of a block using a diagram?
4. Apply the concept of Merkle trees to validate a group of transactions?
5. Demonstrate how a hash function can detect tampering in a block.?
6. Apply Solidity to write a simple smart contract to store user data?
7. Demonstrate how a blockchain application can be developed using a provided template?
8. Write a simple smart contract using Solidity to store a number.
9. Demonstrate the steps to deploy a smart contract using the Geth client.
10. Apply Ethereum tools to build a basic DApp.
11. Illustrate how BFT is used in a blockchain network to handle faults?
12. Apply knowledge of PoS to propose an energy-efficient blockchain system?
13. Identify a real-world scenario where smart contract vulnerabilities caused loss?

L4: Analysing

1. Compare centralized and decentralized systems using examples?
2. Analyze the benefits and drawbacks of each layer in the blockchain stack?
3. Differentiate between permissioned and permissionless blockchains?
4. Analyze how the consensus mechanism prevents double-spending?
5. Compare the roles of hash functions and Merkle trees in data integrity?
6. Analyze the differences between centralized and decentralized application architectures?
7. Examine the challenges of implementing blockchain in the logistics industry?
8. Analyze the different components of a DApp and their interaction with the Ethereum blockchain.
9. Compare smart contract patterns such as withdraw vs send.
10. Examine the process of state change in Ethereum smart contracts.
11. Compare the energy efficiency of PoW and PoS consensus mechanisms?
12. Analyze the role of BFT in preventing malicious behavior in blockchain networks?

L5: Evaluating

1. Evaluate the pros and cons of using blockchain in government data management?
2. Do you think blockchain can completely replace traditional databases? Why or why not?
3. Judge the impact of blockchain evolution on financial industries?
4. Valuate the importance of consensus mechanisms in maintaining blockchain trust?
5. Assess the effectiveness of using game theory in motivating blockchain participants?
6. Evaluate the effectiveness of using blockchain in financial services?
7. Critically examine the readiness of the manufacturing sector to adopt blockchain applications?
8. Evaluate the benefits of using DApps over centralized apps
9. Assess the importance of choosing the right smart contract pattern for specific use cases
10. Justify the use of Ethereum as the preferred platform for deploying smart contracts
11. Design a decentralized voting system using smart contracts
12. Create a multi-function smart contract for a crowd funding platform using Solidity
13. Evaluate whether PoS is more secure than PoW?
14. Critically evaluate a smart contract hack and suggest what could have been improved?

L6: Create

1. Design a basic block chain-based system for student record verification?
2. Propose a new use case for blockchain in the healthcare sector?
3. Develop a visual model that represents the block chain stack and its function?

4. Design a simplified block structure showing how transactions and hashes are organized?
5. Create a flowchart showing how consensus is reached in a block chain network?
6. Design a basic block chain application for tracking product delivery using Ethereum?
7. Propose a block chain architecture model suitable for digital identity management?
8. Design a secure and scalable block chain protocol using BFT and PoS?
9. Propose a framework to audit smart contracts for security flaws?
10. Create a block chain architecture plan to handle millions of transactions per second?

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MTCS2102 **Natural Language Processing** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

- Learn introduction to classical and modern techniques in NLP.
- Understand Word level analysis.
- Learn how to employ literary-historical NLP-based analytic techniques named entity recognition.
- Understand sentiment analysis and topic modelling.
- To learn how to organize, visualize, and group text data, and understand how machines work with different languages to find and translate information.

Course Outcomes

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	DoK
MTCS2102.1	Describe the fundamental concepts and techniques of natural language processing.	3	2	1	1	1	2	3	2	1	L1, L2
MTCS2102.2	Apply and analyze text processing techniques such as N-grams, TF-IDF, and word embeddings, and implement part-of-speech tagging using rule-based and statistical methods.	3	3	2	1	1	2	3	2	1	L2, L3, L4
MTCS2102.3	Illustrate how to collect data from social media, web and other sources using APIs, web scraping.	3	3	2	1	1	2	3	2	1	L2, L3, L4
MTCS2102.4	Understand sentiment analysis, topic modeling, and stylometry, and learn how to apply them in real-world scenarios.	3	3	2	1	2	2	3	2	2	L2, L3, L4
MTCS2102.5	Design and implement robust machine translation systems, build multilingual question answering models, and develop cross-lingual information retrieval systems.	3	3	2	2	2	2	3	2	2	L5, L6

SYLLABUS

UNIT I: **13 Hours**

Introduction to NLP: History of NLP, applications and challenges of NLP, Language Modelling: Grammar-based language model, Statistical language model, Tokenization, Introduction to Morphology, Morphology fundamentals, Morphology Paradigms. **CO's-CO1**

Self-Learning Topics: The Role of Large Corpora in NLP, The Impact of the Internet and Big Data

UNIT-II: **15 Hours**

Word Level and Syntactic Analysis: N-grams Models of Syntax - Counting Words, Unsmoothed N-grams. Smoothing- Back-off Deleted Interpolation – Entropy - English Word Classes - Tag sets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging. **CO's-CO2**

Self-Learning Topics: Higher-order N-grams, Good-Turing Smoothing.

UNIT III: 14 Hours

Data Collection and Software tools: Introduction to Data Collection and Tools, Data Collection using API, Social Media, Web scraping, Text Mining: Software tools such as NLTK; Named Entity Recognition. Data analysis and Visualization. **CO's-CO3**

Self-Learning Topics: Structured vs. Unstructured data, Data Cleaning for Social Media Text

UNIT IV: 12 Hours

Fundamentals of sentimental analysis and topic modeling: Sentiment Analysis; Block diagram of sentiment analysis, Applications, Topic Modeling, Goals of topic modeling; Stylometry. **CO's-CO4**

Self-Learning Topics: Techniques for Sentiment Analysis, Challenges in Sentiment Analysis

UNIT V: 14 Hours

Introduction to text classification and visualization: Text classification, Text Visualization; Dendograms, PCA, Plotting the Text; Document Clustering;

Machine Translation: Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR). **CO's-CO5**

Self-Learning Topics: Text Preprocessing for Visualization, Evaluation Techniques for CLI

Board of Studies : Computer Science and Engineering

Approved in BoS No: 02, --, April, 2025

Approved in ACM No: 02

Text Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
2. Jacob Eisenstein. Natural Language Processing
3. Delip Rao and Brian McMahan. Natural Language Processing with PyTorch

Reference Books:

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning

Reference Links:

1. https://nptel.ac.in/courses/106/105/106105158/ A course on Nautrual Language Processing, by Prof. Pawan Agrawal, IIT Kharagpur.
2. https://nptel.ac.in/courses/106/106/106106211/ A course on Applied Nautral Laguage Processing, Prof. Rameseshan Ramchandran, IIT Madras.

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Describe the major milestones in the development of Natural Language Processing (NLP) from the 1950s to the modern era of deep learning.
2. Define tokenization and list different types of tokenizers used in NLP.
3. What are morphemes? Define the different types with examples.
4. Define N-gram models. Explain the concept of unigram, bigram, and trigram models with examples.
5. List and describe the major English word classes (noun, verb, adjective, etc.) with suitable examples.
6. What is data collection in NLP? Describe different sources of text data used in NLP tasks.
7. What is Named Entity Recognition? List common entity types detected by NER systems.
8. What is sentiment analysis? Define its types and explain common use cases.
9. What is stylometry? List the common features used in stylometric analysis.
10. What is text classification? List its types and applications in NLP.
11. What is document clustering? Mention key clustering techniques used in NLP.
12. What is Cross-Lingual Information Retrieval (CLIR)? List its key components.

L2: Understand

1. Discuss five real-world applications of NLP and explain the role of NLP techniques in each.
2. Explain the difference between a grammar-based language model and a statistical language model with examples.
3. Explain the concept of morphological paradigms in NLP. Provide examples of paradigm generation.
4. Describe how counting words is useful in building N-gram models. Include an example of calculating N-gram probabilities from a sample corpus.
5. What is smoothing in language modeling? Explain the concepts of Back-off and Deleted Interpolation smoothing with examples.
6. Define entropy in the context of NLP. How is it used to measure the uncertainty of language models?

7. Explain the importance of data collection tools in NLP. How do they influence model training and performance?
8. Describe how data can be collected from social media platforms using APIs. Include steps involved and mention tools or libraries used.
9. What is web scraping? Explain how tools like BeautifulSoup and Selenium are used for extracting web data.
10. Explain the architecture (block diagram) of a sentiment analysis system. Describe the role of each component in detail.
11. Explain the goals and working of Latent Dirichlet Allocation (LDA) with the help of an example.
12. Explain how stylometry is used in author identification and plagiarism detection.
13. Explain the role of dimensionality reduction techniques like PCA and t-SNE in text visualization.
14. Describe the architecture of a multilingual QA system. How does it handle language detection and answer retrieval?
15. Explain how document and query translation approaches work in CLIR systems.

L3: Apply

1. Analyze how NLP is applied in sentiment analysis, machine translation, and chatbots with suitable examples.
2. Apply tokenization techniques to the sentence: "NLP is amazing!" using both whitespace and subword tokenization methods.
3. Apply the bigram model to compute the probability of the sentence: "NLP is interesting" using the given corpus data.
4. Apply rule-based POS tagging to a given sentence and explain each rule used during tagging.
5. Using Python and the Twitter API, explain how you would collect tweets related to a trending topic. Include code structure and important considerations like authentication.
6. Write and explain a Python script to scrape news headlines from an online news website. Describe the HTML parsing process involved.
7. Demonstrate the use of NLTK for basic text mining tasks such as tokenization, stemming, and stopword removal using Python code.
8. Describe how you would build a simple sentiment classifier using a dataset of product reviews. Include preprocessing and classification steps.
9. Apply topic modeling using LDA on a dataset of news articles and explain how topics are extracted and interpreted.
10. Apply TF-IDF and Naive Bayes classifier to classify spam vs. non-spam messages. Explain each step and tool used.
11. Plot a 2D visualization of clustered documents using PCA. Explain how you prepared the data for visualization.
12. Apply a pre-trained multilingual transformer model (like XLM-RoBERTa) to a QA task in two languages. Explain the preprocessing and evaluation steps.

L4: Analysing

1. What are the main challenges in processing natural language? Categorize these challenges into linguistic, computational, and ethical issues.
2. Analyze the impact of morphology on various NLP tasks such as machine translation, POS tagging, and lemmatization.
3. Analyze the limitations of unsmoothed N-gram models when applied to real-world datasets. How does data sparsity affect their performance?
4. Compare and contrast Back-off and Deleted Interpolation techniques. Under what conditions would one perform better than the other?
5. Analyze the differences between fine-grained and coarse-grained POS tagging using examples from

different tag sets.

6. Analyze the challenges involved in collecting and preparing unstructured text data for NLP applications. Include examples from real-world use cases.
7. Analyze the role of text preprocessing (normalization, tokenization, stopword removal) in the overall NLP pipeline. Why is it necessary before model training?
8. Analyze the challenges involved in performing sentiment analysis on social media content. Discuss aspects such as sarcasm, emojis, and domain dependency.
9. Analyze the impact of sentiment analysis in election forecasting and political opinion mining.
10. Analyze the difference between lexical, syntactic, and structural features used in stylometric analysis.
11. Analyze how dendrograms can be used to understand text similarity and clustering hierarchy.
12. Analyze the challenges of scaling MT to low-resource languages. How can transfer learning or multilingual models help?
13. Analyze the difficulties of building QA systems in code-switched or multilingual texts common in social media.

L5: Evaluating

1. Evaluate the performance and limitations of N-gram models. How do they compare to neural language models?
2. Critically evaluate the role of morphological paradigms in building language models for morphologically rich languages.
3. Evaluate the effectiveness of smoothing techniques in improving N-gram language models. Use examples to support your analysis.
4. Evaluate the usefulness of entropy in comparing different language models. What does a higher or lower entropy indicate?
5. Evaluate the strengths and weaknesses of rule-based, stochastic, and transformation-based POS tagging approaches.
6. Compare and contrast web scraping and API-based data collection in terms of reliability, structure, legality, and efficiency.
7. Evaluate the limitations of rule-based vs. machine learning-based NER systems. Which one is more suitable for domain-specific tasks?
8. Design a mini data pipeline for collecting, cleaning, analyzing, and visualizing sentiment from user reviews using tools like NLTK, Pandas, and Matplotlib.
9. Compare and evaluate lexicon-based and machine learning-based approaches to sentiment analysis. Discuss their accuracy and use cases.
10. Evaluate the effectiveness of stylometry in detecting fake reviews and AI-generated text.
11. Evaluate the performance of deep learning models (like BERT) vs. traditional ML models for text classification tasks.
12. Evaluate the effectiveness of different text visualization methods in improving the interpretability of NLP models.
13. Evaluate different MT models (Statistical, RNN-based, Transformer-based) in terms of accuracy, scalability, and language support.
14. Evaluate embedding-based retrieval approaches vs. traditional translation-based CLIR methods.

L6: Create

1. Design a hybrid POS tagging system that combines rule-based and statistical methods. Explain how it would improve tagging accuracy.

2. Design a mini data pipeline for collecting, cleaning, analyzing, and visualizing sentiment from user reviews using tools like NLTK, Pandas, and Matplotlib.
3. Design a mini topic modeling system for automatically grouping academic papers by research themes. Explain your methodology and evaluation criteria.
4. Design a robust and scalable MT system for translating regional languages into English. Explain the architecture, data sources, and tools you'd use.

Chairperson
Board of Studies (CSE)

MTCS2106 **Python Programming** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these.

Course Outcomes:

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
MTCS2106.1	Understand and apply the core programming concepts of Python, including syntax, variables, data types, control structures, and operators.	3	2	1	1		2	3	2	L1, L2
MTCS2106.2	To create and manipulate functions, handle textual data using string operations, and manage collections using lists, thereby enabling modular, readable, and data-driven Python programming.	3	3	2	2		2	3	2	L2, L3
MTCS2106.3	To develop the ability to effectively use data structures—dictionaries, tuples, and sets—for storing, accessing, and manipulating complex and diverse data types.	3	3	2	2		2	3	2	L3, L4
MTCS2106.4	To enable students to perform efficient file operations involving text, binary, and structured data formats, and to design and implement object-oriented programs.	3	3	3	2	1	2	3	2	L4, L5
MTCS2106.5	To introduce essential data science tools and techniques using Python, work with structured data formats like JSON/XML, and perform numerical and data analysis using NumPy and Pandas.	3	3	3	2	1	3	3	3	L5, L6

SYLLABUS

UNTI I: **15 Hours**

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions,

Variables, Operators, Precedence and Associatively, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement. **CO's-CO1**

Self-Learning Topics: Memory Management and Garbage Collection, Exception Hierarchy and Custom Exception Handling

UNIT II: 10 Hours

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement. **CO's-CO2**

Self-Learning Topics: Lambda Functions and Functional Programming in Python, List Comprehensions and Generator Expressions

UNIT-III: 15 Hours

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Self-Learning Topics: Dictionary Comprehensions and Nested Dictionaries, Advanced Tuple Usage and Named Tuples, Set Operations and Real-World Applications **CO's-CO3**

UNIT IV: 10 Hours

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os. Path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Self-Learning Topics: Working with JSON and XML File Formats, Advanced Object-Oriented Concepts: Magic Methods and Operator Overloading **CO's-CO4**

UNIT V: 10 Hours

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas. **CO's-CO5**

Self-Learning Topics: Data Wrangling and Cleaning Using Pandas, Using NumPy for Vectorized Operations and Broadcasting

Board of Studies : Computer Science and Engineering

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

Approved in ACM No: 02

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Internal Assessment Pattern

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Explain the history and evolution of Python programming language.
2. Define identifiers and keywords in Python with examples.
3. What are built-in functions in Python? Provide examples.
4. What are the different ways to create and store strings in Python?
5. Define a dictionary in Python. How is it different from a list or tuple?
6. What is a tuple in Python? Explain how tuples differ from lists.
7. What are the different types of files in Python? Explain with examples.
8. Define classes and objects in Python. Provide an example of each.
9. What is functional programming? Explain its principles in Python.
10. What is JSON? Explain how Python handles JSON data with an example.

L2: Understand

1. Explain operator precedence and associativity with suitable examples.
2. Explain type conversion functions in Python with examples.
3. Explain basic string operations such as concatenation, repetition, and membership checking.
4. Discuss basic list operations such as indexing, appending, and extending lists in Python.

5. Explain how to access and modify key-value pairs in a dictionary with an example.
6. Explain the role of the tuple() function in Python and provide an example.
7. How are classes created in Python? Explain with an example.
8. Explain the concept of encapsulation in object-oriented programming with an example in Python.
9. Explain the concept of first-class functions in Python with an example.
10. How is XML data represented in Python? Discuss the different ways to handle XML data.

L3: Apply

1. Write a program to read two numbers from the user and print their sum.
2. Write a Python program to check whether a given number is even or odd.
3. Write a Python program to access characters in a string using indexing and slicing.
4. Write a Python program to slice a list and print its sublist.
5. Write a Python program to demonstrate how to use built-in functions like `len()`, `keys()`, `values()`, and `items()` on dictionaries.
6. Write a Python program that demonstrates the use of set methods like `add()`, `remove()`, and `clear()`.
7. Explain how binary files are handled in Python. Provide an example of reading and writing binary data.
8. Write a Python program to create a class with a constructor and multiple objects.
9. Write a Python program to demonstrate the use of `map()`, `filter()`, and `reduce()`.
10. Write a Python program to parse a JSON string and convert it to a Python dictionary.

L4: Analysing

1. Analyze the role of indentation and comments in Python program structure.
2. Differentiate between == and `is` operators in Python.
3. Discuss the scope and lifetime of variables in Python with examples.
4. What are the differences between `append()`, `extend()`, and `insert()` methods in lists?
5. Compare tuples and lists in terms of performance, immutability, and use cases.
6. Compare the differences between `frozenset` and `set` in Python.
7. Discuss various file methods in Python for reading and writing data.
8. Differentiate between class attributes and data attributes with an example.
9. Discuss the importance of higher-order functions in Python with examples.
10. Discuss the usage of `json` and `xml.etree.ElementTree` modules for working with JSON and XML in Python.

L5: Evaluating

1. Evaluate Python's dynamic and strongly typed nature with relevant examples.
2. Evaluate the importance of exception handling in developing robust Python programs.
3. Evaluate the performance difference between string concatenation using + and `.join()`.
4. Evaluate the usage of `del` statement in removing elements from a list.
5. Analyze the time complexity of dictionary operations (access, insertion, deletion).
6. Evaluate the advantages of using sets in Python for membership testing and removing duplicates.

7. Evaluate the advantages and limitations of functional programming in Python.
8. Compare JSON and XML in terms of performance, readability, and usage in data science.
9. Evaluate the use of functional programming in Python compared to object-oriented programming for data manipulation tasks.
10. Critically analyze the performance and efficiency of `map()`, `filter()`, and `reduce()` functions in Python for large datasets.

L6: Create

1. Create a Python program to demonstrate type conversion and use of type() and is.
2. Develop a Python program using while loop to print prime numbers below 100.
3. Create a Python program that formats a string using dynamic placeholders.
4. Create a Python program that performs various list operations like sorting, filtering, and modifying elements.
5. Create a Python program that merges two dictionaries and handles duplicate keys.
6. Create a Python program that uses zip() to combine two lists into a tuple of pairs.
7. Demonstrate how to use the pickle module to serialize and deserialize Python objects.
8. Create a Python program that demonstrates inheritance and polymorphism.
9. Create a Python program that uses NumPy to perform statistical operations such as mean, median, and standard deviation.
10. Create a Python program that performs data cleaning and aggregation tasks using Pandas.

Chairperson
Board of Studies (CSE)

MTCS2107 **Principles of Cyber Security** **3 0 0 3**

(Computer Science & Engineering)

Course Objectives:

The main objectives of the course are to

- To provide a foundational understanding of cyber security concepts, threats, and risk management.
- To explore various forms of cyber crimes and their impact on individuals and organizations.
- To understand national and international legal frameworks governing cyber laws.
- To introduce data privacy and protection principles along with global regulatory frameworks.
- To develop knowledge of cyber security management practices, compliance standards, and governance mechanisms.

Course Outcomes

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
MTCS2107.1	Demonstrate an understanding of fundamental cyber security concepts, terminologies, and the evolving threat landscape.	3	2				2	3	2	L1,L2
MTCS2107.2	Identify and analyze various types of cyber crimes, their impact on individuals and organizations, and the techniques used to perpetrate them.	3	3			1	2	3	2	L4,L5
MTCS2107.3	Interpret and evaluate the legal frameworks related to cyber law, including the IT Act 2000, and assess legal and ethical implications of emerging technologies.	2	3		1	3	3	2	2	L4,L5
MTCS2107.4	Explain principles of data privacy and data protection, and compare global data protection regulations like GDPR and PIPEDA.	2	3		1	3	3	2	2	L1,L3
MTCS2107.5	Design a basic cyber security management plan incorporating risk assessment, compliance requirements, and national cyber security strategies.	3	3	3	3	3	3	3	3	L5,L6

SYLLABUS

Unit I : Overview of Cyber security **10 Hours**

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure,

Cyber war fare, Case Studies. **CO's-CO1**

Self-Learning Topics: Cyberspace and the Role of Attack Vectors

UNIT-II: Cyber crimes **15 Hours**

Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online frauds, Cyber bullying, website defacement, Cyber squatting, Crypto jacking, Dark net- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

Self-Learning Topics: Understanding Various Types of Cyber Crimes **CO's-CO2**

UNIT III: **Cyber Law** **15 Hours**

Cyber crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Block chain, Dark net and Social media, Cyber Laws of other countries, Case Studies. **CO's-CO3**

Self-Learning Topics: Understanding Cyber Crime Laws and Legal Landscape in the Digital Era

UNIT IV: Data Privacy and Data Security **10 Hours**

Defining data, meta-data, big data, and non personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues. **CO's-CO4**

Self-Learning Topics: Understanding and Implementing Data Privacy and Security Regulations

UNIT-V: Cyber security Management, Compliance and Governance **10 Hours**

Cyber security Plan- cyber security policy, cyber crises management plan. Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy. **CO's-CO5**

Self-Learning Topics: Developing a Comprehensive Cyber security Governance Framework

Board of Studies : Computer Science and Engineering

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

Approved in ACM No: 02

Text Books:

1. Cyber Crime and Information Technology Act, 2000 by Shweta Thakur Jaswal & Vikram Singh Jaswal.
2. Cyber Security and Cyber Laws by Dr. S. S. Rattan.

Reference Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.

2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Online Learning Resources/Virtual Labs:

1. **https://www.balbix.com/insights/attack-vectors-and-breach-methods/**
2. **https://cag.gov.in/uploads/icisa_virtual_publishing/Journal-with-cover-DG-message-08-10-2024-06704c77f434894-25842653.pdf**

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is the protection of end-user machines in cybersecurity?
2. What do you understand by the term “Critical IT Infrastructure”?
3. What is National Critical Infrastructure in the context of cybersecurity?
4. What is Cyber Warfare, and how does it impact national security?
5. Provide a brief description of a case study where a cyber attack led to a major breach in security.
6. What is data in the context of data privacy and security?
7. Define meta-data and give an example.
8. What is big data, and how is it different from traditional data?
9. Explain what non-personal data is and provide an example.

L2: Understand

1. Compare and contrast "risk" and "threat" in the context of cyber security.
2. Given a scenario, identify the potential attack vectors that hackers might exploit.
3. How can non-state actors impact national security through cyber terrorism? Provide a recent example.
4. Analyze the role of hackers in the modern cyber security landscape and how they contribute to the growing threat of cyber attacks.
5. Consider a situation where a nation-state initiates a cyber attack against critical infrastructure. How would this affect the target nation's economy and security?

L3: Apply

1. Consider an organization that handles sensitive customer data. How would you differentiate between data privacy and data security measures that the organization must implement?
2. Evaluate the effectiveness of current data security measures (e.g., encryption, access controls) in protecting personal data from unauthorized access.
3. Analyze how an organization could ensure compliance with the Personal Data Protection Bill while still using big data analytics to drive business decisions.
4. Evaluate how the principle of transparency in data protection applies to online services like social media platforms. How can companies ensure they are transparent about the data they collect and process?
5. Discuss how the principle of data subject rights impacts companies' handling of personal data and the processes for individuals to exercise their rights.

L4: Analysing

1. Evaluate the impact of spyware on a mobile device. How can users protect their devices from spyware attacks?
2. Compare and contrast the nature of DoS and DDoS attacks. Which one poses a greater risk to an organization's infrastructure and why?
3. Analyze the different ways in which Advanced Persistent Threats (APTs) are carried out and the measures organizations should adopt to detect and mitigate them.
4. Evaluate the effectiveness of antivirus software in detecting and removing viruses, Trojans, and ransomware. Are there better ways to protect systems against these threats?
5. Evaluate the role of Cyber Police stations in combating cyber crime. How effective is the current crime reporting procedure in addressing cyber crime?
6. Critically evaluate the use of artificial intelligence in combating cyber crime. What are the ethical concerns associated with AI in cyber policing?
7. Evaluate the amendments made to the IT Act, 2000. How have these changes improved the law's ability to address new forms of cyber crime?
8. Critically analyze the limitations of the IT Act, 2000 in dealing with emerging technologies such as AI/ML, IoT, and Blockchain. What legal reforms would you suggest to improve the law?

L5: Evaluating

1. Create an action plan for a company that has experienced a ransomware attack, including steps for communication, recovery, and long-term prevention.

2. Propose a new methodology for detecting Advanced Persistent Threats (APTs) that uses both traditional defense mechanisms and emerging technologies (e.g., AI, machine learning).
3. Develop a detailed training program for employees that educates them on the risks and mitigation strategies for common cyber crimes like phishing, smishing, and vishing.
4. Create a policy proposal for combating cyber bullying in schools, including measures for monitoring online activities and providing support for victims.
5. Design a strategy for preventing website defacement attacks in high-traffic websites. Consider both technical and non-technical measures in your approach.
6. Develop a comprehensive plan for tackling cyber squatting, including both legal measures and technical solutions for identifying and addressing domain name abuse.
7. Propose a new legal framework to regulate social media platforms and combat cyber bullying, impersonation, and misinformation. What steps would you take to balance free speech with legal accountability?
8. Develop a legal strategy for addressing cyber crimes involving blockchain and cryptocurrencies. How can legislation ensure the safe use of blockchain technologies while preventing illegal activities like money laundering?
9. Design an innovative cyber crime prevention system using AI and machine learning to detect and predict cyber threats. How would the legal system interact with this technological framework to protect citizens' rights while using AI/ML for law enforcement?

L6: Create

1. Evaluate the effectiveness of a cybersecurity policy for an organization after it has faced a major cyber attack. How would you assess its strengths and weaknesses, and what improvements would you recommend for future resilience?
2. Critically assess the role of a Cyber Crisis Management Plan during a ransomware attack on a large corporation. What improvements could be made to ensure quicker recovery and reduced financial losses?
3. Analyze the business continuity strategies of a multinational company in the event of a cyber attack that disrupts global operations. How would you balance the business continuity plan with the need for secure data recovery?
4. Assess the strengths and weaknesses of a security control framework implemented in an organization that deals with large-scale customer data. How would you evaluate the success of these controls in preventing breaches and ensuring data privacy?
5. Critically evaluate the effectiveness of different types of security controls in an organization that uses cloud-based infrastructure. How would you assess their impact on preventing data breaches and unauthorized access?

Chairperson
Board of Studies (CSE)

MTCS2108 **INTERNET OF THINGS** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

Course Outcomes:

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
MTCS2108.1	Summarize on the term 'internet of things in different contexts.	3	2	1	1	2	2	2	2	L1,L2
MTCS2108.2	Analyze various protocols for IoT.	3	3	2	1	1	2	3	2	L2,L3
MTCS2108.3	Design a PoC of an IoT system using Rasperry Pi/Arduino.	3	3	3	2	1	2	3	2	L3,L4
MTCS2108.4	Apply data analytics and use cloud offerings related to IoT.	3	3	3	2	2	3	3	3	L4,L5
MTCS2108.5	Analyze applications of IoT in real time scenario.	3	3	2	2	2	3	3	3	L5,L6

SYLLABUS

UNIT I: Fundamentals of IoT: **10 Hours**

Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. **CO's-CO1**

Self Learning Concepts: History and milestones in IoT development, Wireless technologies: Wi-Fi, ZigBee, LoRa, NB-IoT, Bluetooth Low Energy (BLE)

UNIT II: IoT PROTOCOLS **15 Hours**

IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Self Learning Concepts: Time Division Multiple Access, IPv4 vs IPv6 **CO's-CO2**

UNIT III: Design and Development **10 Hours**

Design and Development: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming. **CO's-CO3**

Self Learning Concepts: IoT solution design workflow, AVR, ARM Cortex-M, Types of Arduino boards

UNIT IV: Data Analytics and Supporting Services **15 Hours**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG. **CO's-CO4**

Self Learning Concepts: Semi-structured data (JSON, XML in IoT), Edge ML vs Cloud ML RDDs vs DataFrames vs Datasets

UNIT V: Case Studies/Industrial Applications**:** **10 Hours**

Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control. **CO's-CO5**

Self Learning Concepts: Network, Data Security, Management, and Application layers, Predictive maintenance, asset tracking, quality control

Board of Studies : Computer Science and Engineering

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

Approved in ACM No: 02

Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David I Year - I Semester L T P C 3 0 0 3 Internet of Things (MTCSE11YY) Boyle and Elsevier, 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

Text Books

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Online Learning Resources Links:

1. https://www.coursera.org/specializations/iot

2. https://www.coursera.org/learn/iot
3. https://www.coursera.org/articles/internet-of-things

Web References:

1. https://en.wikipedia.org/wiki/Internet_of_things
2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
3. https://www.tutorialspoint.com/internet_of_things/index.htm

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define the term "Internet of Things (IoT)."
2. What is a smart object in the IoT ecosystem?
3. What is the purpose of 6LoWPAN in IoT networks?
4. List any two application layer protocols used in IoT.
5. What does LoRaWAN stand for?
6. List any two embedded development boards used in IoT.
7. Define structured and unstructured data.
8. What is the Hadoop ecosystem?
9. What is CPwE in industrial IoT?
10. Define Grid Blocks Reference Model.

L2: Understand

1. Explain the evolution of IoT with examples.
2. Differentiate between fog, edge, and cloud computing.
3. Discuss the IoT World Forum architecture model.
4. Describe the MAC layer role in IEEE 802.15.4.
5. Explain the structure of a Low Power and Lossy Network (LLN).
6. Explain the basic design methodology used in developing IoT devices.
7. What is embedded computing logic? Explain with examples.

8. Describe the function of Apache Kafka in real-time data streaming.
9. Explain the layered architecture of smart and connected cities.
10. Describe the architecture of Cisco IoT System.

L3: Apply

1. Apply the simplified IoT architecture to a smart city application.
2. Apply IoT functional blocks in a real-time weather monitoring system.
3. Apply MQTT in a smart home automation scenario.
4. Implement RPL protocol in a basic IoT temperature monitoring network.
5. Use Arduino IDE to build a simple LED blinking project.
6. Apply the Django framework to display IoT sensor data on a webpage.
7. Use Spark to analyze sensor data from a smart city.
8. Apply IBM Watson IoT platform in a healthcare monitoring solution.
9. Demonstrate the use of CPwE in an industrial plant network.
10. Apply smart parking architecture to an urban area.

L4: Analysing

1. Compare oneM2M and IoT World Forum architectures.
2. Break down the interaction between sensors and smart objects.
3. Analyze the differences between IEEE 802.15.4e and 802.11ah.
4. Examine how routing over LLNs differs from traditional IP routing.
5. Compare the architectural differences between Arduino and Raspberry Pi.
6. Break down the hardware requirements for a smart irrigation system.
7. Analyze the differences between SQL and NoSQL in IoT use cases.
8. Examine the role of machine learning in anomaly detection for IoT.
9. Analyze the differences between Cisco and IBM IoT platforms.
10. Compare traditional utility grids with IoT-based smart grids.

L5: Evaluating

1. Evaluate the advantages of fog computing over cloud computing in IoT.
2. Evaluate the scalability of 6LoWPAN in large-scale IoT deployments.
3. Critically evaluate the security mechanisms in IEEE 802.15.4.
4. Justify the use of CoAP for constrained IoT devices.
5. Assess the cost-effectiveness of Arduino-based designs for prototyping.
6. Evaluate the suitability of various IDEs for IoT prototyping.
7. Assess the scalability of Apache Kafka for real-time sensor networks.
8. Justify the use of NoSQL for real-time analytics over structured databases.
9. Justify the use of layered architecture in connected cities.
10. Evaluate the implementation of CPwE in real-world industrial use cases.

L6: Create

1. Design an IoT-based smart street lighting system using sensors and actuators.
2. Develop an IoT solution for waste management using edge and cloud computing.
3. Design a custom network stack for a smart parking system using LoRa and MQTT.
4. Create a simulation model showing RPL-based data routing for a smart agriculture setup.
5. Design a smart door-lock system using Raspberry Pi and Python.

6. Create a prototype of a wearable health monitoring device.
7. Design a data pipeline for a smart city traffic control system using Kafka and Spark.
8. Develop an edge-based system for real-time pollution monitoring.
9. Design a smart traffic control system using real-time data and IoT sensors.
10. Develop an integrated system combining smart lighting and smart parking.

Chairperson
Board of Studies (CSE)

MTCS2109 **Machine Learning** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

- Learn how to design a learning system and understand concept learning tasks.
- Understanding the concepts in statistical learning, including how to build, evaluate, and improve machine learning models using statistical methods.
- Learn how to use supervised learning methods to do classification and regression.
- Learn and apply ensemble methods and support vector machines for classification and regression.
- Learn the basics of unsupervised learning and reinforcement learning.

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

Course Code	Mapping with POs and PSOs										Dok
	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
MTCS2102.1	Understanding of machine learning algorithms and their use in data-driven knowledge discovery and program synthesis.	3	3	2	1	-	2	3	2	1	L1, L2
MTCS2102.2	Understand how to evaluate and improve machine learning models using basic statistical learning methods.	3	3	2	2	1	2	3	2	1	L2, L3
MTCS2102.3	Demonstrate on various regression techniques.	3	3	2	2	-	2	3	2	2	L3, L4
MTCS2102.4	Analyze and apply ensemble methods and support vector machines for classification and regression tasks.	3	3	2	1	2	2	3	2	2	L3, L4, L5
MTCS2102.5	Illustrate the clustering techniques and apply basic reinforcement learning algorithms to solve problems using data.	3	3	2	2	1	2	3	2	2	L5, L6

SYLLABUS

UNIT I: **14 Hours**

Introduction: Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Applications and Challenges of Machine Learning.

Concept Learning Task: Introduction, Hypothesis space, Find-S algorithm, Version space, Candidate Elimination algorithm, Overfitting and Underfitting. **CO's–CO1**

Self-Learning Topics: Instance based learning, Evaluation metrics

UNIT II: **13 Hours**

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Loss functions,

Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization. **CO's–CO2**

Self-Learning Topics: Model Evaluation and Selection, Generalized Models. .

UNIT III: **15 Hours**

Supervised Learning (Regression/Classification): Distance based Methods, Nearest Neighbors, Decision Trees, and Naive Bayes.

Linear Models: Linear Regression, Logistic Regression.

Binary Classification: Multiclass/Structured outputs, MNIST, Ranking. **CO's–CO3**

Self-Learning Topics: Regularization Techniques, Feature Engineering and Selection.

UNIT- IV: **12 Hours**

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification, SVM Regression. **CO's–CO4**

Self-Learning Topics: Model Evaluation and Hyper parameter Tuning, Model Interpretability and Explain ability.

UNIT-V: **13Hours**

Unsupervised Learning: Types and Challenges, Clustering – K means, DBSCAN, Hierarchical, Association Rule Mining, Anomaly detection.

Reinforcement Learning: Introduction, The learning task Q learning. **CO's-CO5**

Self-Learning Topics: Anomaly Detection, Dimensionality Reduction Techniques.

Board of Studies: Computer Science and Engineering

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

Approved in ACM No: 02

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education (India) Private Limited, 2013.
2. Introduction to Machine Learning, Ethem Alpaydın, 3rd Edition, MIT press, 2014.
3. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020.

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.
2. MACHINE LEARNING - An Algorithmic Perspective, Stephen Marsland, 2nd Edition, 2015.

Web References:

1. Machine Learning Mastery
2. Machine Learning by Andrew Ng on Coursera
3. Principles of Machine Learning on edX
4. Kaggle Learn Machine Learning

Internal Assessment Pattern

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

L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define Artificial Intelligence, Machine Learning, and Deep Learning. Explain how are they related to each other?
2. What is a concept learning task? Define hypothesis space and version space.
3. Define supervised and unsupervised learning**.** Explain with an example.
4. What are loss functions in statistical learning? List and briefly describe any two commonly used loss functions.
5. Define regression and classification in the context of supervised learning. Give one real-world example of each.
6. What are decision trees and how are they used in classification?
7. What is a voting classifier? List the types of voting used in ensemble methods.
8. What are the different types of SVMs used for classification and regression tasks?
9. What is clustering in unsupervised learning? Name and define three popular clustering algorithms.
10. What is reinforcement learning? Define Q-learning in brief.

L2: Understand

1. Explain the different types of machine learning systems with suitable examples.
2. Explain the Find-S algorithm with a suitable example. What are its limitations?
3. Describe the concept of Empirical Risk Minimization (ERM). How does it relate to training data?
4. What is the tradeoff between bias and variance in statistical learning?Illustrate with a diagram or example.
5. Explain how the nearest neighbors algorithm works for classification tasks. What role does distance play?
6. Describe the working of Naive Bayes classifier. Why is it called "naive"?
7. Explain the difference between bagging and pasting. How does each approach reduce variance?
8. Describe how a Random Forest works. How does it improve upon individual decision trees?
9. Describe the key differences between K-Means, DBSCAN, and Hierarchical clustering.
10. Explain the components of a reinforcement learning system. Include agent, environment, reward, and policy.

L3: Apply

1. Identify a real-world problem and explain how machine learning can be applied to solve it. Mention the type of learning system suitable for it.
2. Apply the Candidate Elimination algorithm to a small dataset and show all intermediate steps.
3. Apply the Empirical Risk Minimization principle to a binary classification problem. Show the steps involved using a small dataset.
4. Given a sample dataset, compute the training and test loss using mean squared error (MSE) and interpret the results.
5. Apply a decision tree algorithm to a small dataset and demonstrate how it classifies new data points.
6. Train a logistic regression model on a binary classification problem and evaluate its performance using confusion matrix and accuracy.
7. Apply the Random Forest algorithm on a dataset and interpret the results in terms of accuracy and feature importance.
8. Train a linear SVM on a binary classification problem. Show the step-by-step process, including margin calculation and support vector identification.
9. Use association rule mining to extract patterns from a given transaction dataset. Interpret support, confidence, and lift for selected rules.
10. Implement Q-learning in a simple grid world environment. Show how the agent learns an optimal policy over time.

L4: Analysing

1. Compare and contrast supervised, unsupervised, and reinforcement learning in terms of goals, data requirements, and examples.
2. Analyze how the Candidate Elimination algorithm differs from Find-S in terms of the hypothesis space explored.
3. Analyze the effect of overfitting and underfitting in statistical models in the context of training and test loss.
4. Compare and contrast loss functions (e.g., squared loss vs. absolute loss). When would you prefer one over the other?
5. Compare and contrast distance-based methods (like k-NN) with probabilistic models (like Naive Bayes) for classification. Discuss their strengths and limitations.
6. Analyze how decision boundaries differ for linear models versus decision trees in classification problems.
7. Compare and contrast bagging, boosting, and stacking ensemble techniques**.** Discuss how each handles bias and variance.
8. Examine the impact of increasing the number of trees in a Random Forest**.** What are the benefits and potential drawbacks?
9. Analyze the suitability of clustering algorithms for anomaly detection tasks.
10. Examine the trade-offs between exploration and exploitation in reinforcement learning. How does Q-learning address this?

L5: Evaluating

1. Discuss the major challenges faced in implementing machine learning systems in practical applications. How would you prioritize solving them?

2. Evaluate the problem of overfitting and underfitting in the context of concept learning. How can these be mitigated?
3. Evaluate the importance of estimating risk statistics in model assessment. How does this impact model selection?
4. Discuss the role of the sampling distribution of an estimator in evaluating model performance. Why is it necessary to understand this concept?
5. Evaluate the effectiveness of logistic regression when applied to imbalanced datasets. What techniques can be used to improve performance?
6. Discuss the advantages and disadvantages of using structured outputs and multiclass classification over binary classification.
7. Evaluate the use of Random Forests versus boosting methods (like Gradient Boosting or AdaBoost) in real-world classification problems. Which would you prefer and why?
8. Assess the limitations of SVMs in large-scale datasets. What approaches or modifications can be used to overcome these challenges?
9. Evaluate the effectiveness of K-Means clustering when the dataset contains non-spherical clusters or outliers. Suggest improvements or alternatives.
10. Assess the performance of Q-learning in a dynamic environment where rewards change over time. What are its limitations?

L6: Create

1. Create a model ranking system to evaluate multiple classifiers for a given classification task. Define the evaluation criteria and decision logic.
2. Design an ensemble model using stacking that includes at least three base classifiers and one meta-classifier. Describe the full architecture and rationale behind your choices.
3. Create a simulation for a simple reinforcement learning task (e.g., robot navigation or game playing). Outline the learning process and how the Q-values are updated.
4. Propose a hybrid system that combines clustering with reinforcement learning for intelligent decision-making. Justify the use of both methods and describe the system flow.

Chairperson
Board of Studies (CSE)

MTCS2110 **Digital Forensics** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

The main objectives of the course are to

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes:

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	DoK
MTCS2110.1	Understanding the Computer forensics.	3	2	1		1	2	3	2	1	L1,L2, L3
MTCS2110.2	Understand relevant legislation and codes of ethics.	2	2		1	3	3	2	2	3	L1, L2,L3, L4
MTCS2110.3	Analyze the knowledge to investigate through the digital evidence.	3	3	3	1	2	3	3	2	3	L3,L4
MTCS2110.4	E-discovery, guidelines and standards, E-evidence, tools and environment.	3	3	2	1	2	2	3	2	3	L4,L5
MTCS2110.5	Email and web forensics and network forensics.	3	3	2	1	2	2	3	2	2	L4,L5, L6

SYLLABUS

UNIT I: **10 Hours**

Foundations: Basic Principles and methodologies for digital forensics, Design systems with forensic needs in mind. Phases of Digital Forensics. Introduction to Digital Forensics Tools, Life of a Digital Forensic Investigator. **CO's-CO1**

Self Learning Concepts: Basic Principles and Methodologies for Digital Forensics

UNIT II: **15 Hours**

Data Acquisition, Computer Crime and Scene Analysis: Computer Crime and investigative process, analysis of cyber criminalities area, discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Data Acquisition: Principles of Digital Forensic Acquisition, Evidence Handling and Processing Digital Forensic Data. **CO's-CO2**

Self Learning Concepts: Computer Crime and Investigative Process

UNIT III: **15 Hours**

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause. **CO's-CO3**

Self Learning Concepts: Create and Manage Shared Folders Using Operating Systems

UNIT IV: **10 Hours**

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case,

Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data. **CO's-CO4**

Self Learning Concepts: Understanding Computer Forensics Workstations and Software

UNIT V: **10 Hours**

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

Self Learning Concepts: Mobile Forensics Techniques **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. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.
3. Thomas J Holt , AdamM Bossler, Kathryn C Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge, 2016
4. Eoghan Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2017
5. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, III Edition, 2016.

Reference Books:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and DigitalForensics: An Introduction, Routledge.
3. Angus McKenzie Marshall, Digital Forensics: Digital Evidence in Criminal Investigations, Wiley- Blackwell, 2018.

Online Learning Resources/Virtual Labs:

1. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/2a54509d-b6bb-43d8-8250-eae26782c392/FORC%20Book%201.pdf

2. https://www.geeksforgeeks.org/digital-forensics-in-information-security/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. List the basic principles of digital forensics.
2. Name any three commonly used digital forensic tools.
3. What is the first phase in the digital forensic process?
4. State the purpose of designing systems with forensic needs in mind.
5. Who is a digital forensic investigator?
6. Identify any two methodologies used in digital forensics.
7. Mention one open-source and one commercial digital forensics tool.
8. What do you mean by forensic readiness in a system?
9. Identify who is responsible for initiating a cybercrime investigation.
10. What are retrieved communications in the context of digital forensics?

L2: Understand

1. Explain why maintaining the chain of custody is important in digital forensics.
2. Describe the phases involved in a typical digital forensic investigation.
3. How does a digital forensic tool assist an investigator during analysis?
4. Summarize the responsibilities of a digital forensic investigator during an investigation.
5. What is the significance of designing systems with forensic readiness?
6. Explain the steps involved in the computer crime investigative process.
7. Describe how court orders are used in digital forensic investigations.
8. Discuss the importance of understanding different types of cybercrime.

L3: Apply

1. Apply the phases of digital forensics to a scenario involving a suspected data breach.
2. How would you use a forensic tool to examine a compromised hard drive?
3. Demonstrate how to document evidence collection in a digital forensic report.

4. Given a simple case scenario, identify which tools and methods should be used.
5. How can forensic readiness be integrated into the design of a corporate IT system?
6. Apply the process of scene analysis in a hypothetical cybercrime case.
7. Demonstrate how to identify and preserve electronic evidence at a crime scene.
8. Use a scenario to show how a forensic investigator obtains and interprets a search warrant.
9. Demonstrate how probable cause is established in a real-world cybercrime investigation.
10. Apply the process of creating and managing shared folders in Windows/Linux to simulate a digital evidence storage structure.

L4: Analysing

1. Analyze different methods of forensic data acquisition and compare their effectiveness.
2. Examine a scenario where volatile and non-volatile data must be handled differently.
3. Break down the challenges faced during the acquisition of digital evidence in a live system.
4. Analyze the importance of maintaining a forensic mindset throughout the digital evidence lifecycle. How does it affect the integrity of the investigation?
5. Examine the key components of evidence gathering in a digital crime scene and identify potential points of failure in each step.
6. Compare and contrast the structure of a normal case with one involving highly encrypted or deleted data. How would the evidence handling process change?
7. Analyze the steps involved in preparing a case for computer forensic investigation. How do these steps help in the overall investigation process?
8. Examine the role of a computer forensics workstation. What features should it include to optimize forensic analysis?
9. Break down the process of starting a digital forensic investigation. What are the challenges a forensic investigator might face during this phase?
10. Analyze the process of creating and managing shared folders in an operating system. How does this process contribute to maintaining the integrity and security of digital evidence?

L5: Evaluating

1. Critique the mobile forensics tools currently available. How do they differ in terms of their capabilities to extract data from locked or encrypted devices?
2. Evaluate the effectiveness of various mobile forensics techniques in retrieving data from modern smartphones. Which technique do you think offers the highest success rate, and why?
3. Assess the limitations of mobile forensics when dealing with cloud storage or online backups. How does this challenge the investigator's ability to gather and preserve evidence?
4. Evaluate the impact of mobile forensics tools on the privacy of individuals. Do these tools strike a balance between effective evidence collection and respecting privacy?
5. Critically analyze a case where mobile forensics failed to retrieve crucial evidence. What factors contributed to this failure, and what improvements could be made to the tools or methods used?

L6: Create

1. Design a comprehensive mobile forensics investigation framework that addresses the specific needs of a high-profile criminal case involving multiple mobile devices.
2. Create a new mobile forensics tool that could help investigators bypass common limitations such as device encryption, deleted data, or cloud-based data storage. How would your tool address these challenges?
3. Propose a methodology for combining mobile forensics with other digital forensics domains (e.g., computer forensics, network forensics) to create a holistic investigation strategy.
4. Develop a procedure for mobile forensics investigators to follow when dealing with advanced mobile device security (such as biometric locks or advanced encryption). What legal and ethical considerations should be taken into account?
5. Create a detailed report outlining the evolution of mobile forensics techniques over the past decade. Include significant technological advances and their impact on investigative outcomes.

Chairperson
Board of Studies (CSE)

MTCS2111 **Next Generation Databases** **3 0 0 3**

(Computer Science and Engineering)

Course Objectives:

1. To understand the evolution of databases through different technological revolutions.
2. To explore modern database systems including NoSQL, Document, Graph, and Column databases.
3. To examine the architecture and applications of In-Memory and Object-Oriented databases.
4. To study Big Data technologies like Hadoop and Spark, and their role in modern data processing.
5. To analyze disruptive and futuristic database technologies including Blockchain and Quantum Databases.

Course Outcomes:

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	DoK
MTCS2111.1	Describe the evolution and revolution in database technologies and their architectural models.	3	2	1	-	-	2	3	2	L1, L2
MTCS2111.2	Analyze and differentiate various NoSQL database types such as document, graph, and column-oriented databases.	3	3	2	-	-	2	3	2	L2, L3
MTCS2111.3	Demonstrate the working principles and use-cases of In-Memory and Object-Oriented databases.	3	3	2	2	1	3	3	3	L3, L4
MTCS2111.4	Explain and implement Big Data tools such as Hadoop and Spark in database management.	3	3	2	2	2	2	3	3	L4, L5
MTCS2111.5	Evaluate emerging database technologies such as Blockchain and Quantum Computing and their implications for the future.	3	3	3	2	1	3	3	3	L5, L6

SYLLABUS

UNIT I: **10 Hours**

Database Revolution: Three Database Revolutions, Early Database Systems-The First Database Revolution, The Second Database Revolution- Relational theory, Transaction Models, The First Relational Databases, Client- server Computing, Object-oriented Programming and the OODBMS, The Relational Plateau, The Third Database Revolution, Google and Hadoop, The Rest of the Web, Cloud Computing, Document Database, The "NewSQL", The Non relational Explosion. Google, Big Data, and Hadoop

Google, Big Data, and Hadoop: The Big Data Revolution- Cloud, Mobile, Social, and Big Data, Google: Pioneer of Big Data, Google Hardware, The Google Software Stack, More about MapReduce, Hadoop: Open-Source Google Stack -Hadoop's Origins, The Power of Hadoop,

Hadoop's Architecture, HBase, Hive, Pig, The Hadoop Ecosystem.

Self Learning Concepts: Latest Revolution concepts in Google and Hadoop. **CO's-CO**

UNIT II: **15 Hours**

Document Databases: What is a document database, NoSQL databases, why choose NoSQL? Performance overview of different databases, why a document store, how does it work, Data storage, Data querying and the map/reduce paradigm, Inserting and Modifying, ACID, The different solutions -Open-source solution, Proprietary solution.

Examples - CouchDB, Why CouchDB, the storage, concurrency, managing the database, queries the database, Specificity of Couch DB. **CO's-CO2**

Self Learning Concepts: MongoDB, Why Mongo DB? The storage, concurrency, managing the database, querying the database, Specificity of Mongo DB.

UNIT III: **15 Hours**

Graph Databases & Column Databases: What is a Graph? RDBMS Patterns for Graphs, RDF and SPARQL, Property Graphs and Neo4j, Gremlin, Graph Database Internals, Graph Compute Engines. What are Column Databases, why it used? The Columnar Alternative - Columnar Compression, Columnar Write Penalty, Sybase IQ, C-Store, and Vertica, Column Database Architectures -Projections. **CO's-CO3**

Self Learning Concepts: Columnar Technology in Other Databases

UNIT- IV: **10 Hours**

In-Memory Databases & Object Databases: What is In-Memory Databases? The End of Disk? - Solid State Disk, The Economics of Disk, SSD- Enabled Databases, In-Memory Databases Examples Times Ten, Redis, SAP HANA, VoltDB, Oracle 12c "in-Memory Database", Berkeley Analytics Data Stack and Spark, Spark Architecture. Overview of object databases, Object Oriented Database, Object Relational Database, mapping of object relational mapping and standards of ODBMS, **CO's-CO4**

Self Learning Concepts: Objectivity DB, db4o and Gemstone features and advantages

UNIT V: **10 Hours**

Databases of the future: The revolution revisited counterrevolutionaries-have we come full circle? can we have it all? - consistency models, schema, database languages, storage, a vision for a converged database, other convergent databases, Disruptive database technologies-storage technologies, Blockchain-What it is? Understanding Technologies, when it is used? Quantum computing-Quantum Transaction, Quantum Search. Quantum Query Language.

Self Learning Concepts: Quantum Query Language **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. Next Generation Databases – NoSQL, NewSQL and Bigdata, Guy Harrison, Apress.
2. CouchDB, Document oriented Databases,Alain Issa, François Schiltz,ULB
3. Document stores and MongoDB, Kaïs Albichari , Tanguy d"Hose, ULB
4. MongoDB Architecture Guide, MongoDB university, white paper

5. Graph Databases-neo4j, Ian Robinson,Jim Webber & Emil Eifrem, 2nd edition ,Oreilly

Reference Books:

1. Oracle® Database,Database In-Memory Guide,12c Release, Lance Ashdown, Oracle Press
2. Fundamentals of Object Databases: Object-Oriented and Object-Relational Design,SuzanneW. Dietrich and Susan D. Urban, Morgan & cLaypool publishers
3. Blockchain basics, Technical Introduction in 25 Steps,Daniel Drescher, Apress

Web References:

1. couchdb.apache.org
2. CouchDB: The Definitive Guide:guide.couchdb.org/
3. Amazon DynamoDB vs. CouchDB vs. MongoDB Comparison
4. https://db-engines.com/en/system/Amazon+DynamoDB%3BCouchDB%3BMongoDB
5. https://university.mongodb.com/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35	--
L2	40	--
L3	25	20
L4	--	35
L5	--	35
L6	--	10
Total (%)	**100**	**100**

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What are the three major database revolutions?
2. Define relational theory and transaction models?
3. What is a document database?
4. List any two NoSQL databases?
5. What is a graph database?
6. Name two examples of column-oriented databases?
7. What is an In-Memory Database?
8. List any two object-oriented databases?
9. What is blockchain?
10. Define quantum transaction.

L2: Understand

1. Explain the difference between the first and second database revolutions.
2. Describe the role of Google in the Big Data revolution.
3. Describe the map/reduce paradigm used in document databases.
4. Explain how Mongo DB handles concurrency.
5. Explain RDF and SPARQL in the context of graph databases.
6. Describe how columnar compression works.
7. Explain the difference between SSD-enabled databases and fully in-memory databases
8. Describe object-relational mapping.
9. Explain consistency models in modern databases.
10. Describe the concept of converged databases.

L3: Apply

1. Illustrate how Hadoop architecture supports Big Data processing.
2. Apply MapReduce to a simple data summarization task.
3. Demonstrate how to insert and query data in CouchDB.
4. Apply ACID properties to a NoSQL database context.
5. Use a property graph model to represent a social network.
6. Apply Gremlin queries on a sample dataset.
7. Apply Redis in a caching use case in a web application
8. Use SAP HANA to perform basic analytics on real-time data.
9. Illustrate a blockchain-based database scenario.
10. Apply the concept of quantum search to data retrieval.

L4: Analysing

1. Compare client-server computing with early database systems.
2. Analyze the impact of cloud computing on modern databases
3. Analyze the performance of document databases compared to relational databases.
4. Differentiate between open-source and proprietary NoSQL solutions.
5. Compare Neo4j with traditional RDBMS for handling graph data.
6. Analyze the columnar write penalty and its implications.
7. Analyze the benefits and limitations of Times Ten.
8. Compare object DBMS with relational DBMS.
9. Analyze the impact of disruptive technologies on traditional databases.
10. Compare classical and quantum query languages.

L5: Evaluating

1. Evaluate the strengths and weaknesses of the OODBMS model.
2. Justify the rise of "NewSQL" in modern applications.
3. Assess why an organization might prefer MongoDB over CouchDB.
4. Evaluate the effectiveness of document stores in large-scale systems.
5. Compare Neo4j with traditional RDBMS for handling graph data.
6. Analyze the columnar write penalty and its implications.
7. Evaluate the suitability of VoltDB for high-throughput transaction systems.
8. Justify the use of object databases in scientific applications.
9. Assess the practicality of quantum databases in today's computing environment.
10. Evaluate the advantages of a schema-less design in modern databases.

L6: Create

1. Design a basic architecture for a scalable web application using Hadoop and NoSQL technologies.
2. Design a document database schema for an e-commerce website using MongoDB.
3. Create a mini-project plan that uses both graph and columnar databases for different modules.
4. Design an object-relational schema using ORM tools for a banking system.
5. Create a conceptual framework for integrating blockchain and quantum computing in a future-ready DBMS.

Chairperson
Board of Studies (CSE)