Subject: **Design and Analysis of Algorithms (DAA)

faculty member- 1. Manish Giri
2. Neha Hajare
3. Chetana Nemade
4. Vijaykumar Mantri

Unit 1 INTRODUCTIONOFALGORITHMICSTRATEGY

Applications/CaseStudy:Packetswitchednetwork,BinarySearch.
Contents:Algorithm,performanceanalysis,NeedofAlgorithm,AsymptoticNotation,Problemsolving strategiesDivideandConquer:Basicmethod,Example:QuickSort,Max-MinProblem,Largeinteger multiplicationalgorithm,Recurrence: Substitutionmethod,MasterTheorem.
SelfStudy:MedianofTwosortedarraysofsamesize. FurtherReadings: Strassen'sMatrixMultiplication.

unit 1 problem solving sessionAssignment
activity 1Assignment
unit 1File
Min max algorithmFile
Activity 1 marks as per BTECH guruFile
modified activity 1 marksFile
unit 2 GREEDYMETHOD
Applications/CaseStudy:CPUSchedulingAlgorithms,NetworkRouting
Contents:GreedyAlgorithm:BasicMethodandAlgorithms,Example:FractionalKnapsackProblem, JobSequencingwithDeadline,HuffmanAlgorithm,ActivitySelectionProblem.
SelfStudy:CoinChangingProblem FurtherReadings:Taskschedulingproblemasamatroid.

Assignment 1 IA
unit 2File
Activity 1 and assignment 1 missed students
unit 3 DYNAMICPROGRAMMING
Applications/CaseStudy:GoogleMap,Googlesearchengine Contents:DynamicProgramming: BasicMethod,Example: 0/1Knapsack,ChainMatrixMultipli cationOBST,Allpairsshortestpath,Floyd-Warshall'sAlgorithm,TravellingSalesmanProblem. SelfStudy:Coinchangingproblem.
FurtherReadings:LongestcommonSubsequenceProblem.Singlesourceshortestpath:BellmanFord algorithm

Problem solving sessionAssignment
unit 3 1-17File
unit 3 18_29File
unit 3File
Unit 4 BACKTRACKING AND BRANCH AND BOUND
Applications/Case Study: Parser, Crossword puzzle, Sudoku. Contents: Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset problem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach Self Study: Backtracking Algorithms for Enumerating Independent Sets of a Graph. Further Readings:15 Puzzle problem.

Assignment 2 IA activity
Not consider for the internal assessmentAssignment
Improvement for assignment 2
Unit 5 COMPUTATIONAL COMPLEXITY THEORY
Applications/Case Study: Airline crew scheduling, TSP and Graph coloring problem. Contents: Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem

Approximation algorithm: vertex cover problem. Self Study: Approximation algorithm for TSP. Further Readings: Clique Decision problem.

Activity 2Forum
Activity 2Assignment
unit 5File
Unit 6 ADVANCED ALGORITHMS AND APPLICATIONS
Applications/Case Study: plagiarism detector, spell checker, web search engines Contents: Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algorithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem. Self Study: Naïve string matching algorithm. Further Readings: The general string problem as a finite automata.

monte carloFile
Randomized algoFile
KMP exampleFile
IA assignment 3
Provisional detention list along with task
Dear all,

Kindly prepare one pdf for the topic which is in front of your name and upload this on moodle till 26/04/2025

Provisional detention taskAssignment
provisional detention task listFile

Design & Analysis of Algorithms LAB_B1 CHN

Dashboard
Courses
School of Computer Engineering and Technology
SCET AY 2024-25 Sem-2
SCET TY B Tech AY-24-25 Sem 2
2304314L-B1
Your progressTopic outline
General
AnnouncementsForum
A1 batch DAA linkForum
b3 linkForum
a1-a3-b1-b3 1-4-25 online lab linkForum
Assignment submission template with rubricsFile
DAA CA A1-A3-B1-B3File
ass1 divide and conquer
binary searchAssignment
Min max algorithmAssignment
extra assignment on divide and conquer
write a program to solve application using Greedy Approach.
1 Implement the prims algorithm by using greedy approach
2 Implement the activity selection problem by using greedy approach

PrimAssignment
Activity selection problemAssignment
extra assignment on Greedy method
Design and implement problem using dynamic ap proach.
0/1 knapsackAssignment
Extra assignment

General Course & Marks Related
Q: What is the total mark scheme for DAA?
A: 100 marks: 30 (IA), 20 (MSE), 50 (ESE)
.

Q: How much is required to pass the subject?
A: Minimum 40% overall and 75% attendance required
.

Q: Is the Mid Semester (MSE) compulsory to pass?
A: No, but scoring below 8/20 in MSE makes final passing difficult.

Q: What is the IA passing mark?
A: IA is 30 marks; aim for at least 12 to stay on track.

Q: How are internal assessments conducted?
A: Through assignments, coding tasks, and class activities
.

Q: What if I miss an assignment or internal?
A: You may be marked absent unless make-up work is approved.

Q: Can I compensate a low MSE score with IA?
A: Yes, but ESE is still required to pass.

Assignment & Practical Questions
Q: Suggest an assignment for Unit 1.
A: Implement Binary Search and analyze time complexity.

Q: Assignment for Unit 2 (Greedy)?
A: Solve Activity Selection and implement Prim's Algorithm.

Q: Unit 3 DP assignment?
A: 0/1 Knapsack or Matrix Chain Multiplication with recursion + memoization.

Q: Good problem for Backtracking?
A: N-Queens or Subset Sum using recursion.
Q: B&B Assignment?
A: Solve 0/1 Knapsack with LC and FIFO methods.

Q: Pattern matching assignment?
A: Implement KMP and compare it with Naive method.

Exam-Specific Questions
Q: Frequently asked Unit 1 question?
A: Solve recurrence: $T(n)=3T(n/2)+n$ using Master's Theorem.

Q: Unit 2 common MSE question?
A: Construct Huffman Tree and decode bitstream.

Q: Unit 3 repeated ESE question?
A: 0/1 Knapsack with dynamic programming.

Q: What graph problem is often asked in Unit 4?
A: TSP using Branch and Bound.

Q: How is NP-completeness tested in exams?
A: Cook's Theorem proof or reduction from 3SAT.

Q: String matching question from Unit 6?
A: Apply Rabin-Karp or explain Boyer-Moore shifts.

Conceptual Short Questions
Q: Define Divide & Conquer with example.
A: It breaks the problem into subproblems: e.g., MergeSort.

Q: What is greedy strategy?
A: Makes locally optimal choices, hoping for a global optimum.

Q: Define P, NP, NP-Complete.
A: P = Solvable in polynomial time, NP = Verifiable in polynomial time.

Q: What's the difference between DP and recursion?
A: DP uses memoization; recursion may re-compute subproblems.

Q: What is the use of randomized algorithms?
A: Used for faster average-case performance (e.g., QuickSort pivoting).

Preparation Tips
Q: Best strategy for theory exams?
A: Practice dry-run trace tables + solve 2 questions per unit.

Q: How to study algorithm derivations?
A: Use visual flowcharts and code-tracing with sample inputs.

Q: How to improve time complexity analysis?
A: Start with simple problems and build intuition around recurrence.

Q: How to memorize NP topics?
A: Use analogies, flow diagrams for P, NP, and NP-Hard classes.

YouTube Channel Recommendations
Q: Best for theoretical explanation?
A: Neso Academy – DAA Playlist

Q: Best for coding problems?
A: Take U Forward – Algorithms Series

Q: For Indian university-aligned syllabus?
A: Gate Smashers – DAA

Q: Visual animations of algorithms?
A: Abdul Bari – Algorithms and DS

Q: Competitive exam focused?
A: CodeChef / GeeksforGeeks – Live DSA Bootcamps

Previous Year Paper Insights
Q: Is QuickSort asked often?
A: Yes, especially best vs worst-case analysis.

Q: What's the most repeated DP topic?
A: 0/1 Knapsack with table tracing
.

Q: Is Huffman Coding always asked?
A: Nearly every 2nd ESE includes it in some form.

Q: B&B problems in past years?
A: TSP or 0/1 Knapsack using LC approach.

Q: Pattern matching appearance?
A: Frequently included in Unit 6-based ESEs.

Course Behavior & Participation
Q: Is attendance monitored?
A: Yes, 75% minimum required.

Q: Can I use chatGPT in assignments?
A: Use only for learning; plagiarism is penalized.
Here are *50 Deep Learning course FAQs* tailored for TY B.Tech students — cove

internal assessment Exams (1–10)

1. *Q:* What is the passing criteria for Deep Learning?
   A: Minimum 40% total and 75% attendance in theory + practicals.

2. *Q:* What is the breakdown of marks?
   A: IA: 30, MSE: 20, ESE: 50 (Total: 100).

3. *Q:* Is the ESE theory or project-based?
   A: ESE is fully project-based (50 marks).

4. *Q:* What is the penalty for plagiarism?
   A: Zero marks; repeated offenses can lead to disciplinary action.

5. *Q:* List IA assignments with topics and dates.
   A:

   * Neural Networks: 17 Jan 2025 – 10 marks
   * LSTM/ARIMA: 3 Mar 2025 – 20 marks
   * Quantum Error Correction: 27 Mar 2025 – 20 marks
   * XAI in Healthcare: 13 Feb 2025 – 20 marks.

6. *Q:* How many units are covered in MSE?
   A: MSE includes Units 1 & 2; rest are evaluated via project and IA.

7. *Q:* What happens if you miss an IA deadline?
   A: Late submissions may not be accepted.

8. *Q:* Are calculators allowed in exams?
   A: Yes, but only non-programmable ones.

9. *Q:* What is the weight of each internal component?
   A: Assignments and activities aligned to Course Outcomes; each \~10–20 marks.

10. *Q:* What are faculty contact details?
    A:

* Dr. Diptee Ghusse – diptee.chikmurge@mitaoe.ac.in
* Dr. Sunita Barve – ssbarve@mitaoe.ac.in.

B. Preparation Tips & Resources (11–20)

11. *Q:* Best YouTube channel for visual learning?

Here are *50 Q\&A-style FAQs* for the *Cyber Security and Forensics* course (Theory + Lab), tailored for student

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A. Course Structure & Assessments (1–10)

1. *Q:* What are the total marks for the course?
   A: 150 total: 100 for Theory (IA: 30, MSE: 20, ESE: 50) and 50 for Lab (CA: 20, Demo/Pres: 30).

2. *Q:* What is the minimum passing criteria?
   A: Minimum 40% in both theory and lab, and 75% attendance is mandatory.

3. *Q:* Are late submissions accepted?
   A: Only with valid reasons and prior approval. Plagiarism results in zero marks.

4. *Q:* Is there a mini-project in this course?
   A: Yes, optional but encouraged. It can fetch additional marks in the practical component.

5. *Q:* What kind of lab tools are used?
   A: Tools include Kali Linux, wfuzz, Shodan, Censys, Sleuth Kit, and PWN till Dawn.

6. *Q:* What is the Internal Assessment (IA) format?
   A: Multiple assignments (each worth \~10 marks), activity rubrics, and evaluation components.

7. *Q:* What is the MSE syllabus coverage?
   A: Generally includes Units 1 to 3 (Emerging threats, IoT Security, Infrastructure Security).

8. *Q:* Is the ESE descriptive or case-study based?
   A: Typically includes both: short theory + practical scenario-based questions.

9. *Q:* Can IA marks improve final grade significantly?
   A: Yes, strong IA performance can offset moderate MSE scores.

10. *Q:* Can lab be passed independently?
    A: Yes, but both Theory and Lab must be passed individually.

B. Cyber Security Concepts (11–25)

11. *Q:* What is cybercrime classification?
    A: It includes data theft, identity fraud, phishing, ransomware, and cyber terrorism.

12. *Q:* What is the role of ITS and cryptography?
    A: To ensure confidentiality, integrity, and secure data transfer.

13. *Q:* What is the difference between a vulnerability and an exploit?
    A: A vulnerability is a weakness; an exploit takes advantage of it.

14. *Q:* What is meant by secure software design?
    A: Designing apps to resist attacks (e.g., input validation, access control).

15. *Q:* What is session hijacking?
    A: Unauthorized access to a session token, allowing attackers to impersonate users.

16. *Q:* Define IDS and its types.
    A: Intrusion Detection System – Signature-based and Anomaly-based.

17. *Q:* What is mobile orchestration in IoT?
    A: Coordinating security policies across mobile and IoT devices.

18. *Q:* What is browser memory protection?
    A: Prevents memory-based attacks like buffer overflow.

19. *Q:* What is the role of Enterprise Security Architecture (ESA)?
    A: Provides a structured framework for implementing enterprise-wide security policies.

20. *Q:* What are common buffer overflow countermeasures?
    A: Stack canaries, ASLR, DEP (Data Execution Prevention). Type your text
21. *Q:* What is the chain of custody in forensics?
    A: Documentation showing who handled evidence and when.

22. *Q:* Define digital evidence.
    A: Data stored in binary form that may be used in a court of law.

23. *Q:* What are forensically sound tools?
    A: Tools that don't alter data while collecting or analyzing it.

24. *Q:* What are common threats in cloud systems?
    A: Data breaches, API insecurity, misconfigurations.

25. *Q:* What is Android sandboxing?
    A: Isolating app data and code to prevent unauthorized access.

C. Forensics & Investigations (26–35)

26. *Q:* What is email forensics?
    A: Investigating email headers, metadata, and attachments for evidence.

27. *Q:* What are the stages of forensic investigation?
    A: Identification, Preservation, Collection, Examination, Analysis, Presentation.

Template for the file uploading on Moodle along with rubrics

Rubrics

Rubric for DAA Practical Evaluation (10 Marks Total)
qs
Course Code: 2304314T
Academic Year: 2024–25
Program: TY B.Tech (Computer Engineering)
Credits: 3
Teaching Scheme: 3 Lecture Hours / Week
Examination Scheme:

* IA: 30 Marks
* MSE: 20 Marks
* ESE: 50 Marks
Total: 100 Marks

🎯 Course Philosophy

This course focuses on fundamental algorithm design paradigms including Divide and Conquer, Greedy Methods, Dynamic Programming, and more. It teaches students to mathematically model algorithms, analyze complexity, and choose appropriate strategies for solving various classes of problems. Hands-on exposure through problem-solving sessions and algorithmic implementation strengthens conceptual depth and practical fluency.

Course Objectives

* **CEO1**: Develop problem-solving abilities using mathematical theories.
* **CEO2**: Apply algorithmic strategies to solve problems.
* **CEO3**: Analyze the performance of algorithmic strategies in terms of time complexity.
* **CEO4**: Distinguish between P and NP class of problems.

Course Outcomes

Students will be able to:

* **CO1**: Analyze the given algorithm in terms of computational complexity. \[L4]
* **CO2**: Apply algorithmic strategies to solve problems. \[L3]
* **CO3**: Derive optimal solutions using various methods. \[L3]
* **CO4**: Solve intractable problems using approximation techniques. \[L3]
* **CO5**: Apply string matching algorithms to detect patterns. \[L3]

Theory Syllabus Breakdown

Unit 1: Introduction of Algorithmic Strategy (8 Hrs)

* **Applications**: Packet-switched networks, Binary Search

* **Topics**: Algorithm basics, Asymptotic Notation, Divide and Conquer (Quick Sort, Max-Min), Recurrence: Substitution & Master Theorem
* **Self Study**: Median of Two Sorted Arrays
* **Further Reading**: Strassen's Matrix Multiplication

Unit 2: Greedy Method (6 Hrs)

* **Applications**: CPU Scheduling, Network Routing
* **Topics**: Fractional Knapsack, Job Sequencing with Deadlines, Huffman Encoding, Activity Selection
* **Self Study**: Coin Change Problem
* **Further Reading**: Task Scheduling as Matroid

Unit 3: Dynamic Programming (8 Hrs)

* **Applications**: Google Maps, Search Engines
* **Topics**: 0/1 Knapsack, Matrix Chain Multiplication, OBST, Floyd-Warshall, TSP
* **Self Study**: Coin Change Problem
* **Further Reading**: Longest Common Subsequence, Bellman-Ford Algorithm

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Unit 4: Backtracking & Branch and Bound (8 Hrs)

* **Applications**: Crossword Solver, Sudoku, Parser Design
* **Topics**: N-Queens, Sum of Subsets, 0/1 Knapsack (LC/FIFO), TSP (B\&B)
* **Self Study**: Independent Set Enumeration
* **Further Reading**: 15 Puzzle Problem

Unit 5: Computational Complexity Theory (7 Hrs)

* **Applications**: TSP, Graph Coloring, Airline Crew Scheduling
* **Topics**: P, NP, NP-Complete, NP-Hard, Reductions, Cook's Theorem, 3-SAT, Approximation Algorithms
* **Self Study**: Approximation for TSP
* **Further Reading**: Clique Decision Problem

Unit 6: Advanced Algorithms & Applications (8 Hrs)

* **Applications**: Plagiarism Detection, Spell Checker
* **Topics**: Monte Carlo, Las Vegas Algorithms; String Matching: KMP, Boyer-Moore, Rabin-Karp; Modular Arithmetic, GCD, CRT
* **Self Study**: Naive String Matching
* **Further Reading**: Finite Automata in String Matching

Internal Assessment Plan (Random Dates from Jan–Apr)

Component	**Title / Topic**	**Date**	**CO**	**Marks**
Assignment 1	Min/Max, Binary Search (Divide & Conquer)	15 Jan 2025	CO1	10

Assignment 2	Activity Selection, Prim's (Greedy Strategy)	29 Jan 2025	CO2	10
Assignment 3	0/1 Knapsack, Matrix Chain Multiplication (DP)	12 Feb 2025	CO3	10
Assignment 4	N-Queens, B\&B Knapsack	26 Feb 2025	CO4	10
Activity 1	Cook's Theorem, Vertex Cover (Complexity)	13 Mar 2025	CO5	10
Assignment 5	KMP, Rabin-Karp, Boyer-Moore (String Matching)	03 Apr 2025	CO5	10

Faculty Details

Name	Role	Email	Office Hours
Dr. Manish Giri	Course In-Charge	mbgiri@mitaoe.ac.in	Monday, 8:30 – 10:20 AM
Ms. Neha Hajare	Instructor	*\[to be provided]*	Wednesday, 2:30 – 4:00 PM
Ms. Chetana Nemade	Lab Coordinator	*\[to be provided]*	Thursday, 10:30 – 12:00 PM
Mr. Vijaykumar Mantri	Teaching Support	*\[to be provided]*	Friday, 11:00 – 12:30 PM

Sample FAQs

Q: Why does Greedy not guarantee optimality?
A: Greedy solves problems locally and doesn't consider global consequences — e.g., in 0/1 Knapsack.

Q: What is Master's Theorem used for?
A: To solve divide-and-conquer recurrence relations efficiently.

Q: Explain P, NP, NP-Complete.
A: P: Solvable in polynomial time. NP: Verifiable in poly time. NP-Complete: Hardest in NP.

Q: Compare KMP and Boyer-Moore.
A: KMP uses prefix functions to avoid rechecking. BM uses mismatches to skip comparisons.

Q: Where is Dynamic Programming applicable?
A: When subproblems overlap, e.g., 0/1 Knapsack, TSP, Matrix Chain Multiplication.

Textbooks and Resources

Textbooks

1. Horowitz, Sahni & Rajasekaran – *Fundamentals of Computer Algorithms*
2. Cormen et al. – *Introduction to Algorithms*
3. Anany Levitin – *Design and Analysis of Algorithms*

References

* Aho & Ullman – *Design & Analysis of Algorithms*
* Brassard & Bratley – *Algorithms: Theory & Practice*

E-Content

* NPTEL: nptel.ac.in
* CET Notes: [cet.edu.in/noticefiles/278DAA](https://www.cet.edu.in/noticefiles/278DAA)
* MIT OCW: ocw.mit.edu

Let me know if you'd like to start on another subject or generate a PDF of this now.

Subject: Software Engineering(SE)

MITAOE Mission & Vision

VISION

To be a new age learning center for holistic development of students into professional engineers, to cater to the changing needs of techno-society.

MISSION

• To provide new age infrastructural facilities blended with skill based curriculum and activity based pedagogical approaches to develop competitive engineering professionals to solve real world problems.
• To prepare students for lifelong learning by transforming educational practices.
• To promote ethical and moral values by involving students into community services.
• To promote entrepreneurship and managerial skills by strengthening industry-institute interaction.

Deep learning COURSE OBJECTIVES

2304337T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set. 2304337T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains. 2304337T.CEO.3: To analyze the performance of various approaches of deep learning algorithms. 2304337T.CEO.4: Handle techniques for evaluating and fine-tuning model performance

Deep learning cource outcomes

After successful completion of the course, students will be able to, 2304337T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3]. 2304337T.CO.2: Apply relevant deep learning algorithms to developintelligent systems in various real world domains[L3] 2304337T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5]. 2304337T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4]. 2304337T.CO.5: Analyse the relative advantages and limitations of various deep learning algorithms[L5].

Daa COURSE OBJECTIVES :

2304314T.CEO.1: To develop problem solving abilities using mathematical theories. 2304314T.CEO.2: To apply algorithmic strategies while solving problems. 2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time. 2304314T.CEO.4: To distinguish between P and

NP class of problems.
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Software engineering COURSE OBJECTIVES :2304313T.CEO.1: To explore the software process models. 2304313T.CEO.2:
To process requirement engineering and modeling for product development. 2304313T.CEO.3: To estimate and manage software metrics. 2304313T.CEO.4: To understand the test driven environment in software development. 2304313T.CEO.5: To illustrate DevOps lifecycle and different tools
Software engineering COURSE OUTCOMES : After successful completion of the course, students will be able to, 2304313T.CO.1: Classify SDLC process models.[L4] 2304313T.CO.2: Analyze conformance of the requirement and modeling related to project development.[L4] 2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3] 2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5] 2304313T.CO.5: Apply different DevOps tools for project development. [L3]
Cloud COURSE OBJECTIVES : 2304367L.CEO.1: Identify global infrastructure
components of AWS. 2304367L.CEO.2: Differentiate between Amazon S3, EBS, EFS, S3 Glacier. 2304367L.CEO.3: Explore key concepts to Elastic Load
Balancing, Amazon CloudWatch, EC2.
Cloud COURSE OUTCOMES : After successful completion of the course, students will be able to, 2304367L.CO.1: Define different types of cloud computing models and Services and Services Categories [L2]. 2304367L.CO.2: Create own VPC and add additional components to produce customized network [L6]. 2304367L.CO.3: Demonstrate AWS Elastic Beanstalk, AWS Lambda [L4]. 2304367L.CO.4: Perform tasks in Amazon RDS
database such as launching, configuring and interacting.
[L3].2304367L.CO.5: Configure different types of security monitoring AWS Architectures [L5]

Type	Examination	Syllabus	Marks	Mode of Assessment	Weightage in Final Score	Total Marks
Theory (IT331T)	MSE	Unit No. 1,2 & 3	50	Written exam / Online Exam	35	100
	ESE	Unit No. 3, 4 & 5	50	Written exam / Online Exam	35	
	Internal Assessm	Unit No. 1 to 6	60	Activity(10), Assignments(10),	30	
Practical (IT331L)	Continuous	Practical List	10	Practical performance	10	50
	End Sem Assessm	Practical List/	40	Project Exam	40	

INTERNAL ASSESSMENT

Sr. No.	Name	Course Objecti	Type of Assess	LMS/ Tools	Marks	Tentative Date
Assignment 1	UNIT II	CO2	online	Moodle	10	16/2/2022
Assignment 2	UNIT III	CO3	online	Moodle	10	14/3/2022
Assignment 3	UNIT V	CO5	online	Moodle	10	15/4/2022
Activity 1	MCQ I (UNIT I)	CO1	Online	Moodle	10	24/1/2022
Activity 2	MCQ (IV)	CO4	online	Moodle	10	04/04/22
Activity 3	MCQ(UNIT VI)	CO5	online	Moodle	10	27/4/2022

GROUND

1. It is mandatory to maintain minimum 75% of attendance in theory and practical sessions to appear for final theory, practical and project presentation examinations.
2. Student should attend all theory and practical sessions on time.
3. A student coming late within 15 minutes of scheduled time will be marked as '**L**' instead of '**P**'. Two consecutive 'L' shall lead to one absenteeism every time.
4. All Assignments/ Activities and discussions should be submitted on or before deadline.
5. MITAOE has no tolerance policy for plagiarism. Plagiarism means copying the content of others as it is and without acknowledgement. Any student repeatedly involved in plagiarized
6.
7.

FACULTY

Name of the Faculty	Designa-tion	Teaching Exp. in	Seating Location	Office Hours	Mobile No. & Email-ID
Pranav Shriram	Assistant Professor	12	H-305	Monday (8.30 am -10.20	986017170
					prshriram@it.mitaoe.ac.in

MITAOE Mission & Vision

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Software engineering COURSE OBJECTIVES :

2304313T.CEO.1: To explore the software process models. 2304313T.CEO.2: To process requirement engineering and modeling for product development. 2304313T.CEO.3: To estimate and manage software metrics. 2304313T.CEO.4: To understand the test driven environment in software development. 2304313T.CEO.5: To illustrate DevOps lifecycle and different tools

Software engineering COURSE OUTCOMES : After successful completion of the course, students will be able to, 2304313T.CO.1: Classify SDLC process models.[L4] 2304313T.CO.2: Analyze conformance of the requirement and modeling related to project development.[L4] 2304313T.CO.3: Apply mitigation techniques for the risk associated with project development.[L3] 2304313T.CO.4: Evaluate the schedule, cost and staff associated with project. [L5] 2304313T.CO.5: Apply different DevOps tools for project development. [L3]

Cloud COURSE OBJECTIVES : 2304367L.CEO.1: Identify global infrastructure components of AWS. 2304367L.CEO.2: Differentiate between Amazon S3, EBS, EFS, S3 Glacier. 2304367L.CEO.3: Explore key concepts to Elastic Load Balancing, Amazon CloudWatch, EC2.

Cloud COURSE OUTCOMES : After successful completion of the course, students will be able to, 2304367L.CO.1: Define different types of cloud computing models and Services and Services Categories [L2]. 2304367L.CO.2: Create own VPC and add additional components to produce customized network [L6]. 2304367L.CO.3: Demonstrate AWS Elastic Beanstalk, AWS Lambda [L4]. 2304367L.CO.4: Perform tasks in Amazon RDS database such as launching, configuring and interacting. [L3].

2304367L.CO.5: Configure different types of security monitoring AWS Architectures [L5]

Frequently Asked Questions (FAQ) - Deep Learning Course (TY B.Tech, Computer Engineering, MIT AOE)

1. What is the passing criteria for the Deep Learning course?

- **Minimum Passing Marks:** 40% (Combined score of all assessments).
- **Attendance Requirement:** 75% mandatory in both theory and practical sessions to be eligible for final exams.

2. How is the final score calculated?

The course follows a **100-mark system** with the following weightage:

Assessment Type	Marks	Weightage	Mode of Evaluation
MSE (Unit 1 & 2)	20	20%	Theory Exam
ESE (Units 3–6)	50	50%	Project-Based Assessment
Internal Assessment	30	30%	Assignments, Activities, Demos

3. What are the internal assessment components?

- **Assignment 1:** Mathematical Foundations of Neural Networks (10 marks, due 17/01/2025).
- **Assignment 2:** LSTM & ARIMA Modeling (20 marks, due 03/03/2025).
- **Activity 1:** Quantum Error Correction Simulation (20 marks, due 27/03/2025).
- **Activity 2:** Explainable AI in Healthcare (20 marks, due 13/02/2025).

4. Are there penalties for late submissions or plagiarism?

- **Late Submissions:** Assignments/activities submitted after the deadline may not be graded.
- **Plagiarism:** Strictly prohibited. Repeated offenses lead to zero marks or disciplinary action.

5. What are the ground rules for attendance and participation?

- **Late Arrival:** Marked as 'L' if within 15 minutes; two 'L's = one absenteeism.
- **Device Policy:** Only course-related use allowed; misuse may deduct marks.
- **Active Participation:** Mandatory in lectures, practicals, and discussions.

6. Who are the course faculty members?

- **Dr. Diptee Ghusse** (Asst. Prof., 16 YOE, Email: diptee.chikmurge@mitaoe.ac.in).
- **Dr. Sunita Barve** (Professor, 20 YOE, Email: ssbarve@mitaoe.ac.in).
- **Office Hours:** Mondays (8:30 AM–10:20 AM, H Block Room 204/23).

7. What topics are covered in the course?

- Neural Networks (CNN, RNN), Time Series Forecasting (LSTM, ARIMA), Quantum AI, Explainable AI (XAI), and real-world projects in healthcare, NLP, and more.

8. Is project work mandatory?

Yes, the **ESE (50 marks)** is project-based. Teams must demonstrate practical implementation of deep learning models.

9. Where can I find further readings/resources?

Refer to course materials shared by faculty or explore case studies in XAI, quantum computing, and industry applications.

For clarifications, contact the course faculty during office hours or via email.

Frequently Asked Questions (FAQ) - Deep Learning Course (TY B.Tech, Computer Engineering, MIT AOE)

1. What are the prerequisites for this course?

Students should have a foundational knowledge of:

- **Statistics and Integral Calculus**
- **Artificial Intelligence (AI) and Machine Learning (ML)**

2. How is the course structured?

- **Teaching Scheme:** 3 lecture hours per week (no practical hours).
- **Credits:** 3
- **Duration:** 6 units covered over the semester.

3. What is the examination scheme?

Component	Marks	Weightage	Type of Assessment
Internal Assessment (IA)	30	30%	Assignments, Quizzes, etc.
Mid-Semester Exam (MSE)	20	20%	Theory exam (Units 1 & 2)
End-Semester Exam (ESE)	50	50%	Theory exam (Units 3–6)
Total	**100**	**100%**	

4. What are the key topics covered?

- **Unit 1:** Neural Networks (Perceptrons, Backpropagation, Regularization).
- **Unit 2:** CNNs (Architecture, Transfer Learning, Object Detection).
- **Unit 3:** Quantum Computing in AI (QCNNs, Qiskit/Cirq).
- **Unit 4:** Time Series Analysis (ARIMA, LSTMs, GRUs).
- **Unit 5:** Seq2Seq Models (Transformers, Attention Mechanisms).
- **Unit 6:** Explainable AI (LIME, SHAP, Ethics).

5. Are there practical components or projects?

- **No lab sessions**, but hands-on exercises are integrated into lectures.
- **Case studies** (e.g., Quantum Image Classification, XAI in Healthcare) bridge theory and practice.

6. What are the course outcomes?

By the end, students will be able to:

- Model neural networks mathematically (**CO1**).
- Apply DL algorithms to real-world problems (**CO2**).
- Evaluate and fine-tune models (**CO3, CO4**).
- Compare DL algorithms critically (**CO5**).

7. What textbooks are recommended?

- **Primary:**
  - *Deep Learning* by Goodfellow, Bengio, Courville.
  - *Hands-On ML with Scikit-Learn & TensorFlow* by Géron.
- **Reference:**
  - *Quantum Neural Networks* (Arriola et al.).
  - *Explainable AI* (Mahalle et al.).

8. Where can I find additional resources?

- **E-books:** d2l.ai, deeplearningbook.org.
- **Platforms:** NVIDIA DL, IBM Quantum ML, BuiltIn.

9. How are marks deducted for plagiarism or late submissions?

- **Plagiarism:** Zero tolerance; penalties include mark deduction or disciplinary action.
- **Late Work:** Deadlines are strict; extensions require prior approval.

10. Who can I contact for course-related queries?

- **Faculty:** Refer to the course document for contact details (e.g., Dr. Diptee Ghusse).
- **Office Hours:** Typically posted on the course portal or announced in class.

For further details, review the syllabus document or attend the introductory session.

Frequently Asked Questions (FAQ) - Deep Learning Course (TY B.Tech, MIT AOE)

1. What are the key topics covered in the Deep Learning course?

The course covers:

- **Neural Networks:** Perceptrons, Backpropagation, CNNs, RNNs, LSTMs, GRUs.
- **Advanced Architectures:** VGG, ResNet, Inception, Autoencoders, GANs.
- **Applications:** Image classification, object detection (R-CNN, YOLO), time series forecasting, NLP (Seq2Seq, Transformers), Explainable AI (XAI).
- **Optimization:** SGD, Adam, RMSProp, and hyperparameter tuning.

2. How are exams structured?

- **MSE (Mid-Semester Exam):** 20–50 marks, theory-based (Units 1–2).
- **ESE (End-Semester Exam):** 50–100 marks, project-based or theory (Units 3–6).
- **Internal Assessment:** 30–50 marks (assignments, quizzes, demos).

3. What are the passing criteria?

- **Minimum Marks:** 40% aggregate (combined theory + practical).
- **Attendance:** 75% mandatory in theory/practical sessions.

4. What are common exam questions?

- **Theory:**
  - "Compare CNN vs. ANN for image data."
  - "Explain LSTM architecture and its advantage over RNN."
- **Practical:**
  - "Design a CNN for cat/dog classification."
  - "Calculate weights/biases in a given CNN architecture."

5. How are projects assessed?

- **ESE (50% weightage):** Real-world projects (e.g., traffic light detection with Faster R-CNN, stock prediction with LSTMs).
- **Grading:** Based on implementation, documentation, and presentation.

6. What resources are recommended?

- **Textbooks:**
  - *Deep Learning* by Goodfellow et al.
  - *Hands-On Machine Learning* by Géron.
- **Tools:** TensorFlow, PyTorch, Qiskit (for quantum AI), OpenCV.

7. How to avoid plagiarism?

- Cite all references.
- Original work is mandatory; penalties include mark deduction or disciplinary action.

8. What are the faculty contact details?

- **Dr. Diptee Ghusse:** diptee.chikmurge@mitaoe.ac.in (Office: H-204/23).
- **Office Hours:** Mondays (8:30–10:20 AM).

9. How to handle late submissions?

- Deadlines are strict; extensions require prior approval. Late submissions may not be graded.

10. What are the key course outcomes?

By the end, students can:

- Design CNNs/LSTMs for real-world problems (**CO1, CO2**).
- Optimize models using hyperparameter tuning (**CO4**).
- Compare algorithms (e.g., R-CNN vs. YOLO) (**CO5**).

For detailed syllabi or past papers, refer to the MIT AOE portal or contact faculty.

Here are **Frequently Asked Questions (FAQs)** based on the question paper content you uploaded (Deep Learning, Final Year B.Tech):

📄 General FAQs About the Question Paper

1. What is the total number of questions in the paper?

→ Typically, there are 3 to 5 main questions, each with multiple subparts.

2. What is the total duration and marks for the exam?

→ Duration: 2 or 3 hours depending on the exam type.

→ Marks: 50 or 100 marks depending on mid-sem or end-sem.

3. Are calculators allowed in the exam?

→ Yes, non-programmable scientific calculators are allowed.

4. Are diagrams necessary in answers?

→ Yes, many questions explicitly ask for architecture or block diagrams (e.g., CNN, LSTM, VGG-16).

5. Is there any specific pattern for questions?

→ Yes, questions often include theoretical concepts, architecture explanations, comparisons (e.g., R-CNN vs Fast R-CNN), and practical use-cases (e.g., YOLO for vehicle counting).

📄 Topic-Specific FAQs

6. What are common topics asked from CNN?

→ Architecture, layers (Conv, Pool, FC), applications (e.g., image classification, emotion detection), comparison with ANN.

7. What are key RNN-related questions?

→ Comparison of RNN with LSTM/GRU, vanishing gradient problem, applications like sentiment analysis or stock prediction.

8. What types of object detection models are frequently asked?

→ YOLO, R-CNN, Fast R-CNN, Faster R-CNN – with architecture and comparison.

9. What optimization techniques are covered?

→ SGD, Adam, Adagrad, RMSProp – their use and mathematical intuition.

10. What is the role of transfer learning and autoencoders in exams?

→ Frequently asked with block diagrams, use cases (e.g., VGG-16, dimensionality reduction, classification).

Let me know if you want these compiled in a printable PDF format or topic-wise Q&A summaries.

Here are the **most frequently repeated questions** (with slight variations) from the Deep Learning question papers you uploaded:

🔁 Frequently Repeated Questions

1. CNN vs ANN / CNN Architecture

- Why is CNN preferred over ANN for image data?
- Explain CNN architecture with block diagram.
- Compare CNN with traditional ML methods.

2. Transfer Learning

- What is Transfer Learning? Explain with VGG-16 or Inception model.
- What is fine-tuning in transfer learning?

3. LSTM vs RNN

- Explain LSTM architecture with diagram.
- How LSTM solves vanishing gradient problem compared to RNN?

- Compare LSTM and GRU.

4. Object Detection Models

- Compare R-CNN, Fast R-CNN, and Faster R-CNN.
- Explain YOLO model for real-time object detection (e.g., vehicle counting).
- What is IoU, NMS, and Anchor Boxes?

5. Autoencoders

- Explain architecture of Autoencoder (Encoder, Coder, Decoder).
- Use of Autoencoder in dimensionality reduction.
- Autoencoder vs PCA.

6. Optimization Algorithms

- Explain Adam, RMSProp, SGD, Adagrad.
- Why are advanced optimizers needed in DL?

7. Overfitting

- What is overfitting?
- Methods to prevent overfitting: Dropout, Data Augmentation, K-Fold.

8. GANs (Generative Adversarial Networks)

- Architecture of GAN.
- How GAN is used for image generation (e.g., cartoon images, image augmentation).

9. Sequence-to-Sequence / Encoder-Decoder Models

- Explain seq2seq model for machine translation.
- English to Marathi translation using encoder-decoder.

10. Activation Functions

- Explain ReLU, Softmax, and their role in CNN or LSTM.

Let me know if you want topic-wise grouped repeated questions in a PDF format.

Based on your syllabus (from the file PEC_DL_Theroy (2).pdf) and previously uploaded question papers, here are **Unit-wise 10 Frequently Asked Questions (FAQs)** for Deep Learning:

Unit 1: Fundamentals of Neural Networks

1. What is a perceptron and how does the perceptron training rule work?
2. Explain Gradient Descent and the Delta Rule in neural networks.
3. What is Backpropagation? Explain with steps.
4. Describe different loss functions used in deep learning.
5. What are regularization techniques and how do they reduce overfitting?
6. Explain the role of activation functions with examples (ReLU, Sigmoid, etc.).
7. Difference between single-layer and multi-layer neural networks.
8. What are the basic learning rules in neural networks?
9. Explain the architecture of a simple neural network used for classification.
10. What are the optimization algorithms used in training neural networks?

Unit 2: Deep Convolutional Neural Networks

1. Explain the architecture and working of CNN.
2. What is the difference between max pooling and average pooling?
3. Compare AlexNet and VGG-16 architecture.
4. What is Transfer Learning? Explain with example of VGG.
5. What are the types of transfer learning: fine-tuning vs feature extraction?
6. Describe YOLO and its application in object detection.
7. Explain Faster R-CNN and its components.
8. What is the purpose of activation functions in CNN?
9. What are evaluation metrics for object detection (e.g., IoU)?
10. What is the role of backpropagation in CNN?

Unit 3: Deep Quantum Computing

1. What is quantum computing? How is it different from classical computing?
2. Explain quantum gates with examples.
3. Describe the architecture of Quantum CNN.
4. What are the key components of quantum circuits?
5. Compare classical CNN and quantum CNN.
6. Explain any one simulation platform (IBM Qiskit / PennyLane).
7. What are quantum algorithms and their applications in ML?
8. What are the limitations of current quantum hardware?
9. What is quantum entanglement and its role in computation?
10. Explain quantum error correction with example.

Unit 4: Time Series Analysis

1. What is Time Series data? Provide examples.
2. Explain the ARIMA model and its components.
3. What is the vanishing gradient problem in RNNs?
4. Explain the architecture of LSTM with a diagram.
5. Compare LSTM and GRU.
6. What are the types of sequence models?
7. How to use RNN for time-series prediction?
8. Explain how GRU works with equations.
9. What is Hidden Markov Model? State its relevance.
10. What is the importance of forecasting in time series?

Unit 5: Sequence to Sequence Models

1. What is a Seq2Seq model? Where is it used?
2. Explain the encoder-decoder architecture.
3. What is the attention mechanism in transformers?
4. Compare traditional RNN-based and Transformer-based models.

5. Explain BLEU and ROUGE metrics for evaluation.
6. What is beam search in sequence generation?
7. What is teacher forcing in training?
8. How does the transformer handle variable-length sequences?
9. Write an example for machine translation using Seq2Seq.
10. Explain the concept of self-attention in transformer models.

Unit 6: Explainable AI

1. What is Explainable AI (XAI) and why is it important?
2. Explain LIME and its working principle.
3. Describe SHAP values and how they provide interpretability.
4. Difference between model-specific and model-agnostic explainability.
5. What are the trends in Explainable AI?
6. Explain causality in Explainable AI.
7. What is the importance of fairness and bias detection in XAI?
8. Discuss GDPR and its relevance in AI model explainability.
9. How XAI contributes to AI governance and trust?
10. Compare SHAP vs LIME with suitable examples.

The uploaded PDF contains various **Deep Learning exam papers, syllabi, and internal assessments** from MIT Academy of Engineering. Below is a **page-by-page summary** along with **detailed FAQs** for each:

Page 1–2: Deep Learning Exam (16 June 2023, CS462T)

Content Summary:

- Full-length paper with questions on Faster R-CNN, LSTM for stock prediction, CNN architecture, transfer learning, GAN, etc.
- Marks distributed with COs (Course Outcomes) and Bloom's Taxonomy Levels.

FAQs:

- **Q: What is Faster R-CNN used for?**

A: It's a deep learning model for object detection, combining Region Proposal Networks with CNNs.

- **Q: How does LSTM help in stock prediction?**

A: LSTM handles time-series data and long-term dependencies, making it ideal for sequence-based tasks.

- **Q: What is transfer learning with VGG16?**

A: It reuses pre-trained weights to speed up learning and improve accuracy on small datasets.

Page 3–4: Deep Learning Exam (14 Dec 2023, ET481T)

Content Summary:

- Focus on Faster R-CNN for traffic detection, LSTM details, and Autoencoder explanations.
- Includes CNN vs ANN, transfer learning, emotion recognition, and sequence-to-sequence models.

FAQs:

- **Q: What is the function of the forget gate in LSTM?**

A: It decides which information should be discarded from the cell state.

- **Q: How do Autoencoders help with low-resolution medical images?**

A: They can reconstruct enhanced versions using encoded representations.

Page 5–6: Mid-Sem Exam (24 Jan 2024, ET481T)

Content Summary:

- Questions on overfitting, CNN vs ANN, VGG16, ResNet, optimization algorithms, and XAI (Explainable AI).

FAQs:

- **Q: How does ResNet solve vanishing gradient problem?**

A: It uses skip connections to maintain gradient flow through layers.

- **Q: What are common optimizers in DL?**

A: Adam, RMSProp, SGD, etc., used to improve training performance.

Page 7–11: Deep Learning Syllabus (Theory & Lab)

Content Summary:

- Detailed unit-wise syllabus for theory and lab courses (Course Codes: 2304337T, 2304337L).
- Units cover CNNs, RNNs, Time Series, GANs, Quantum Computing, XAI.

FAQs:

- **Q: What is the focus of Unit 3 (Quantum Computing)?**

A: Introduces quantum gates, CNNs, and simulators like Qiskit, PennyLane.

- **Q: What is XAI and why is it important?**

A: Explainable AI (XAI) makes AI decisions transparent, aiding trust and compliance.

Page 12–14: Course Description and Internal Assessment

Content Summary:

- Internal assessment components: assignments on LSTM, ARIMA, XAI, quantum error correction.
- Project-based evaluation.

FAQs:

- **Q: What are the internal assessment methods?**

A: Assignments, activities, mini-projects, each aligned to course outcomes.

- **Q: How is attendance linked to assessment?**

A: 75% minimum attendance required for final exam eligibility.

Page 15–End: Multiple Exam Papers (2022–2023)

Content Summary:

- Question papers from mid-terms, remedials, and re-examinations.
- Covers CNNs, GANs, Autoencoders, RNNs, LSTM, YOLO, BERT, GRU, RL, etc.

FAQs:

- **Q: What is the difference between RCNN, Fast RCNN, and Faster RCNN?**

A: RCNN uses external proposals, Fast RCNN adds ROI pooling, Faster RCNN includes region proposal network.

- **Q: How does GAN generate new images?**

A: The generator learns to create images that fool the discriminator in an adversarial setup.

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **16 JUNE 2023**

FINAL YEAR BTECH SEMESTER - VII RE-EXAMINATION 2022-2023 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

RE-EXAMINATION

DEEP LEARNING

TIME : **MAX MARKS : 100**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How CNN architecture employed for Image recognition explain with suitable diagram and example.	**[12]**	**CO1**	**L3**
	b)	What are the significances of transfer learning explain with VGG 16 pretrained model?	**[10]**	**CO2**	**L3**
	c)	What is the faster R-CNN model structure?and how this model used for image object detection	**[10]**	**CO2**	**L3**
2	**a)**	How can LSTM be used to improve the accuracy of stock market prediction models?	**[10]**	**CO3**	**L4**
	b)	Describe the architecture of a typical GAN model, including the generator network and discriminator network, and how they are trained in an adversarial manner.	**[12]**	**CO4**	**L2**

c)	Discuss any potential challenges or limitations of using image autoencoders for enhancing low-resolution medical images and propose possible strategies to address them, such as incorporating additional data augmentation techniques or fine-tuning the model.	**[10]**	**CO4**	**L4**
b)	Discuss the process of encoding the user query using an encoder network, which captures the input sequence's contextual information and transforms it into a fixed-length representation.	**[12]**	**CO5**	**L3**
c)	Elaborate on the training process of the neural machine translation model, including the use of parallel English-Spanish sentence pairs and techniques like teacher forcing and gradient descent optimization.	**[12]**	**CO5**	**L4**
d)	Explain how the trained deep reinforcement learning model can be deployed on a physical robot, allowing it to navigate the environment, learn from its experiences, and improve its performance over time.	**[12]**	**CO6**	**L3**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **14 DECEMBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN
2023 - 2024 EXAMINATION
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 Hrs. **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 03 **TOTAL NO OF PRINTED PAGES: 02**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Explain the limitations of RCNN. [3 Marks]. Describe and draw the architecture of Fast RCNN with the Region of Interest Pooling concept. [5Marks]	**[8]**	**CO4**	**L2**
	b)	Explain how to use Faster RCNN in the latest image processing algorithms to detect traffic indicators safely enough to be used while driving a car. The dataset is composed of images containing the three phases of a traffic light and the STOP indicator. Describe the Region proposal Network with diagram.	**[9]**	**CO4**	**L3**
2	**a)**	How does LSTM overcome the vanishing gradient problem common in traditional RNNs? Draw architecture of LSTM and explain the function of the forget gate in LSTM?	**[9]**	**CO3**	**L2**
	b)	Explain the use of the activation function in LSTM cell. Expain any one application which used LSTM model with proper steps.	**[8]**	**CO3**	**L3**

3	**a)**	How does feature learning or dimension reduction happen if the end result is the same as input in Autoencoders explained with architecture	**[8]**	**CO3**	**L2**
	b)	Explain with a diagram of the Sequence to-sequence model. State any one application.	**[8]**	**CO3**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **14 DECEMBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN
2023 - 2024 EXAMINATION
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 Hrs. **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 03 **TOTAL NO OF PRINTED PAGES: 02**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Explain the limitations of RCNN. [3 Marks]. Describe and draw the architecture of Fast RCNN with the Region of Interest Pooling concept. [5Marks]	**[8]**	**CO4**	**L2**
	b)	Explain how to use Faster RCNN in the latest image processing algorithms to detect traffic indicators safely enough to be used while driving a car. The dataset is composed of images containing the three phases of a traffic light and the STOP indicator. Describe the Region proposal Network with diagram.	**[9]**	**CO4**	**L3**
2	**a)**	How does LSTM overcome the vanishing gradient problem common in traditional RNNs? Draw architecture of LSTM and explain the function of the forget gate in LSTM?	**[9]**	**CO3**	**L2**
	b)	Explain the use of the activation function in LSTM cell. Expain any one application which used LSTM model with proper steps.	**[8]**	**CO3**	**L3**

3	**a)**	How does feature learning or dimension reduction happen if the end result is the same as input in Autoencoders explained with architecture	**[8]**	**CO3**	**L2**
	b)	Explain with a diagram of the Sequence to-sequence model. State any one application.	**[8]**	**CO3**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **24 JANUARY 2024**

FINAL YEAR BTECH SEMESTER - VII RE-EXAMINATION 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

RE-EXAMINATION

DEEP LEARNING

TIME : 3 Hrs **MAX MARKS :80**

TOTAL NO OF QUESTIONS: 5 **TOTAL NO OF PRINTED PAGES: 3**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Explain benefits of CNN over traditional machine learning algorithm. [4 Mark] Discuss in detail the purpose of striding and pooling in CNN.[4 Mark]	**[8]**	**CO2**	**L2**
	b)	Explain the concept of overfitting in Deep Learning. [2 Marks]. Explain the following two methods to avoid overfitting i) Data Augmentation ii) Dropout . [6Marks]	**[8]**	**CO1**	**L2**
2	**a)**	i)Why do we prefer Convolutional Neural networks (CNN) over Artificial Neural networks (ANN) for image data as input?[4 Marks] Ii) Explain Trasfer Learning with digram. [4 Marks]	**[8]**	**CO3**	**L2**

b)	In order to work and travel safely during the outbreak of COVID-19 , a method of security detection based on deep learning is proposed by using machine vision instead of manual monitoring. To detect the illegal behaviors of workers without masks in workplaces and densely populated areas, an improved convolutional neural network VGG-16 algorithm is proposed in place of Alexnet CNN Model. 1. Illustrate the benefits of VGG-16 over ALexNet CNN Model.[Marks 3] 2. Explain Architecture of VGG-16 with block diagram and all layers design. [Marks =5]	**[8]**	**CO3**	**L3**
3 a)	A CNN model is developed for emotion recognition using dataset of facial expression. After experimentation, it is observed that due to vanishing gradient problem model performance on test dataset reduced. Describe vanishing gradient problem. [2 Marks] Demonstrate how ResNet model solve the problem of vanishing gradient to improve model performance in details with the help of block diagram. [6 Mark]	**[8]**	**CO5**	**L2**
b)	Explain the purpose of optimization algorithm. [2 Marks] Describe any three optimisation algorithms from the following: A) Adagrad B) Adam C) RMSProp D) Stochastic Gradient Descent. [3 Marks]	**[8]**	**CO1**	**L2**
4 a)	Explain Long Short-Term Memory Networks (LSTMs) advantage over RNN. Describe the Following term of LSTM with a diagram. [2 Marks each] i) memory cell input ii) forget the gate ii) input gate iii) output gate	**[8]**	**CO 3**	**L3**

b) What is the difference between Object Detection Algorithms and Classification Algorithms? Compare R-CNN vs Fast R-CNN vs Faster R-CNN **[8] CO4 L2**

[8 Marks – 2 Marks each Point]

5 a) Explain the purpose of the following term related to the Object Detection CNN model. [3 Marks each] **[8] CO4 L2**

1. Interaction over union (IoU)
2. Non- maximum suppression
3. Anchor Boxes

b) Explain the Architecture of Autoencoders in detail as Encoder, Coder, and Decoder with a block diagram. **[8] CO 3 L2**

[Encoder-2 Marks, Coder- 2 Marks, 2 - Decoder, 2 Marks block diagram]

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	**W.E.F**	**AY:** 2023 - 2024 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING	**COURSE NAME**	DEEP LEARNING
	COURSE CODE	2304337T
	COURSE CREDITS	3
RELEASE DATE : 01/07/2024	**REVISION NO.**	2.0

TEACHING SCHEME (HOURS/WEEK)		**EXAMINATION SCHEME AND MARKS**					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
3	NIL	30	20	50	NIL	NIL	100

PREREQUISITE KNOWLEDGE: Statistics and Integral Calculus, Artificial Intelligence and Machine learning

COURSE OBJECTIVES:

2304337T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.

2304337T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.

2304337T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.

2304337T.CEO.4: Handle techniques for evaluating and fine-tuning model performance.

COURSE OUTCOMES:

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

2304337T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].

2304337T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]

2304337T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].

2304337T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].

2304337T.CO.5: Analyse the relative advantages and limitations of various deep learning algorithms[L5].

COURSE ABSTRACT:

This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural networks, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learning techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

THEORY COURSE CONTENTS

UNIT 1	**Fundamental of Neural network**	**07 HOURS**

Applications/Case Study: Customer Engagement

Contents: Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

Self Study: Activation Function

Further Readings: Optimization Algorithms

UNIT 2	**Deep Convolutional Neural network**	**08 HOURS**

Applications/Case Study: Chest X Ray Image Classification

Contents: Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extraction. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

Self Study: RetinaNet

Further Readings: Graph Convolutional Neural Networks

UNIT 3	**Deep Quantum Computing**	**08 HOURS**

Applications/Case Study: Quantum-enhanced image classification

Contents: Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simulators -IBM's Qiskit, PennyLane, or Google's Cirq.

Self Study: Quantum Error Correction

Further Readings: Quantum Hardware

UNIT 4	Time Series Analysis	08 HOURS

Applications/Case Study: Marketing and Customer Analytics

Contents: Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Integrated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.

Self Study: Seasonal Decomposition of Time Series (STL)

Further Readings: Stochastic recurrent neural network

UNIT 5	Sequence to Sequence Models	08 HOURS

Applications/Case Study: Text Summarization and Machine Translation

Contents: Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Sequences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.

Self Study: Teacher Forcing,Beam Search

Further Readings: Fine-tuning encoder and decoder

UNIT 6	Explainable AI	06 HOURS

Applications/Case Study: Interpreting Diabetes Risk Predictions.

Contents: Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).

Self Study: Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.

Further Readings: Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.)

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning.* 1^{st} Edition, The MIT Press . ISBN 978-0262035613.
2. Rajalingappaa Shanmugamani(2018) *Deep Learning for Computer Vision.* 1^{st} Edition,Packt Publishing. ISBN 978-1788295628.
3. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow.* 1^{st} Edition,O'Reilly Media. ISBN 978-149203264.

REFERENCE BOOKS

1. A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado(2021) *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911
2. Seth Weidman(2019)*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247
3. Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Challenges*, Wiley-Scrivener Publishing. ISBN-13: 978-1119786202

E-BOOKS/E-CONTENTS LINKS

1. Dive into Deep Learning:ASTON ZHANG, ZACHARY C. LIPTON, MU LI, AND ALEXANDER J.SMOLA(2024)*Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/
5. https://www.ibm.com/topics/explainable-ai
6. https://research.ibm.com/topics/quantum-machine-learning

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	W.E.F	AY: 2023 - 2024 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGG.	COURSE NAME	DEEP LEARNING LAB
	COURSE CODE	2304337L
	COURSE CREDITS	1
RELEASE DATE : 01/07/2024	REVISION NO.	2.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
NIL	2	NIL	NIL	NIL	20	30	50

PREREQUISITE : Statistics and Integral Calculus, Artificial Intelligence and Machine learning

COURSE OBJECTIVES :

2304337L.CEO.1: Develop hands-on skills to implement and train deep learning models using popular frameworks.
2304337L.CEO.2: Identify problems that can be effectively addressed using deep learning solutions.
2304337L.CEO.3: Evaluate the performance of deep learning models using evaluation metrics.
2304337L.CEO.4: Assess the strengths and limitations of different deep learning approaches.

COURSE OUTCOMES :

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

2304337L.CO.1: Develop critical thinking skills by solving real-world problems using deep learning algorithm.[L4]
2304337L.CO.2: Investigate strategies for improved model generalization, reducing overfitting, enhancing unseen performance.[L4]
2304337L.CO.3: Optimize models by fine-tuning hyperparameters for task-specific and dataset-specific optimal performance.[L5]
2304337L.CO.4: Discuss results to draw conclusions on problem-solving method effectiveness.[L5]
2304337L.CO.5: Improve collaboration through group discussions, sharing insights, and contributing to DL projects in lab settings. [L5]

COURSE ABSTRACT:

This course explores deep learning in artificial intelligence, covering its principles, methodologies, and practical applications. Students will learn about neural networks, convolutional neural networks, and recurrent neural networks, and their roles in tasks like image classification, object detection, segmentation, natural language processing, and time series analysis. The course combines theoretical understanding with practical implementation through lectures, exercises, and projects. Lab components include hands-on exercises, project-based assignments, experimentation with pre-trained models, and integration with web applications. Students will gain a comprehensive understanding of deep learning principles and methodologies.

PRACTICALS

PRACTICAL NO.01	**Neural Networks design and deployment**	**4 HOURS**

1. Model Development: Design and train the neural network with appropriate architecture, loss function, optimizer, and data handling techniques, ensuring model accuracy and performance through evaluation and hyperparameter tuning.

PRACTICAL NO.02	**Transfer Learning**	**6 HOURS**

1. Transfer Learning Model Development: Fine-tune a pre-trained model on your specific dataset, adjusting the top layers and optimizing hyperparameters to achieve desired performance metrics.

PRACTICAL NO.03	**Object Detection and Multi object classification**	**4 HOURS**

1. Dataset Preparation and Model Design: Select and preprocess a dataset with annotations for object detection, segmentation masks, and class labels. Design a deep learning architecture that integrates object detection, segmentation, and recognition tasks.
2. Model Training and Optimization: Train the multi-task model, experiment with hyperparameters, and fine-tune using transfer learning. Implement optimization techniques to enhance performance.
3. Evaluation and Visualization: Evaluate the model on a test dataset, create visualizations of predictions, and discuss challenges and potential real-world applications.

PRACTICAL NO.04	**Natural Language Processing**	**4 HOURS**

1. Data Preparation: Obtain a dataset with sentiment labels, clean the data using NLP tools, and visualize sentiment distribution.
2. Text Representation and Model Training: Convert text to numerical vectors using TF-IDF or word embeddings, implement a baseline model, and split the dataset into training and testing sets.
3. Evaluation and Conclusion: Evaluate models on the test set using relevant metrics, summarize key findings, suggest improvements, and recommend future research directions.

PRACTICAL NO.05	**Sequence Classification**	**4 HOURS**

1. Development: Design and train a deep sequence model (e.g., RNN, LSTM, GRU, Transformer) using a suitable dataset for sequence classification tasks, ensuring to preprocess the data appropriately and tune hyperparameters for optimal performance.
2. Evaluation: Validate the model's performance on a separate test set, using metrics like accuracy, precision, recall, and F1-score to assess its effectiveness in classifying sequences accurately.

PRACTICAL NO.06	Sequence Generation	6 HOURS

1. Model Design and Training: Construct and train a deep sequential model (e.g., LSTM, GRU, Transformer) on a dataset of sequences, focusing on generating new sequences by learning patterns from the input data.
2. Evaluation and Fine-tuning: Assess the model's ability to generate coherent and relevant sequences by comparing generated sequences against a validation set, and fine-tune the model's parameters to improve generation quality.

PRACTICAL NO.06	Mini Project (Object detection/NLP).	6 HOURS

1. The mini project aims to create a real-time object detection/langauge based web application that uses a pre-trained deep learning model to identify objects in a live webcam feed or dynamic data.
2. The project involves selecting a suitable dataset and model, pre-processing the data, integrating the model, developing the web application, deploying it, and documenting the project.
3. The project will take five weeks, with a maximum of three students participating. The team will prepare a project plan, select a real-time dataset, and select a pre-trained model.
4. The project will also involve data pre-processing, model integration, web application development, deployment, and documentation.
5. Regular communication and collaboration will be maintained throughout the project, with the goal of having a fully functional real-time object detection or NLP web application ready for deployment.

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning.* 1^{st} Edition, The MIT Press . ISBN 978-0262035613.
2. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition.* 1^{st} Edition,Packt Publishing. ISBN 9781492032649.
3. Aurélien Géron(2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow.* 1^{st} Edition,O'Reilly Media. ISBN 978-149203264.

REFERENCE BOOKS

1. Maxim Lapan.(2018).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247
2. Seth Weidman.(2019).*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247

E-BOOKS/E-CONTENTS LINKS

1. Dive into Deep Learning:ASTON ZHANG, ZACHARY C. LIPTON, MU LI, AND ALEXANDER J.SMOLA(2024)*Dive into Deep Learning*Paperback. ISBN 1009389432. link- https://d2l.ai/d2l-en.pdf
2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	**W.E.F**	**AY:** 2023 - 2024 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING	**COURSE NAME**	DEEP LEARNING
	COURSE CODE	2304337T
	COURSE CREDITS	3
RELEASE DATE : 01/07/2024	**REVISION NO.**	2.0

TEACHING SCHEME (HOURS/WEEK)		**EXAMINATION SCHEME AND MARKS**					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
3	NIL	30	20	50	NIL	NIL	100

PREREQUISITE KNOWLEDGE: Statistics and Integral Calculus, Artificial Intelligence and Machine learning

COURSE OBJECTIVES:

2304337T.CEO.1: Develop a comprehensive understanding of the mathematical foundation of neural network employed on static and dynamic data set.

2304337T.CEO.2: Apply algorithms to solve real-world problems in computer vision, natural language processing, and other domains.

2304337T.CEO.3: To analyze the performance of various approaches of deep learning algorithms.

2304337T.CEO.4: Handle techniques for evaluating and fine-tuning model performance.

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

2304337T.CO.1: Model the mathematical intuition of underlying neural networks for its application to both static and dynamic datasets[L3].

2304337T.CO.2: Apply relevant deep learning algorithms to develop intelligent systems in various real world domains[L3]

2304337T.CO.3: Evaluates the performance of intelligent models using various evaluation techniques and metrics[L5].

2304337T.CO.4: Fine-tune hyper-parameters to optimize intelligent models[L4].

2304337T.CO.5: Analyse the relative advantages and limitations of various deep learning algorithms[L5].

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This course explores deep learning in artificial intelligence, covering its fundamental principles, methodologies, and practical applications. It covers neural networks, convolutional and recurrent neural networks, and their applications in image classification, object detection, segmentation, natural language processing, and time series analysis. The course also covers reinforcement learning and transfer learning techniques. The course emphasizes both theoretical understanding and practical implementation, combining lectures with hands-on exercises and projects. Students gain a comprehensive understanding of deep learning concepts and skills in applying these techniques to real-world datasets and challenges. This equips students with the knowledge and proficiency to contribute to AI-driven solutions across various industries.

THEORY COURSE CONTENTS

UNIT 1	**Fundamental of Neural network**	**07 HOURS**

Applications/Case Study: Customer Engagement

Contents: Neural Network Contents: Neural Network: Introduction to Neural Networks, Fundamental Concepts: Neuron Models And Basic Learning Rules, Perceptron Training Rule, Gradient Descent And Delta Rule, Back- Propagation Algorithm,Loss Functions, Multi layer Network,Regularization techniques.

Self Study: Activation Function

Further Readings: Optimization Algorithms

UNIT 2	**Deep Convolutional Neural network**	**08 HOURS**

Applications/Case Study: Chest X Ray Image Classification

Contents: Convolutional Neural Network (CNN)Architecture, Activation Functions, Training and Back-propagation Transfer Learning:Approaches,Pre-trained Models,Fine-tuning and Feature Extraction. Object Detection: Faster R-CNNs, YoLO,evaluation metrics.

Self Study: RetinaNet

Further Readings: Graph Convolutional Neural Networks

UNIT 3	**Deep Quantum Computing**	**08 HOURS**

Applications/Case Study: Quantum-enhanced image classification

Contents: Quantum Mechanics Foundations,Quantum Gates and Circuits,Quantum Algorithms,Overview of Quantum CNN,Architecture of Quantum CNN, Quantum CNN Operations simulators -IBM's Qiskit, PennyLane, or Google's Cirq.

Self Study: Quantum Error Correction

Further Readings: Quantum Hardware

UNIT 4	Time Series Analysis	08 HOURS

Applications/Case Study: Marketing and Customer Analytics

Contents: Time Series Data,Time Series Decomposition Statistical Models:Autoregressive Integrated Moving Average (ARIMA), Forecasting Techniques, Sequence Model,Understanding sequential data,Types of sequence models,Hidden Morkow Model,Recurrent Neural Network,Vanishing gradient Problem,Long Short term Memory,Gated Recurrent Unit,mathematical modeling of behind sequence model.

Self Study: Seasonal Decomposition of Time Series (STL)

Further Readings: Stochastic recurrent neural network

UNIT 5	Sequence to Sequence Models	08 HOURS

Applications/Case Study: Text Summarization and Machine Translation

Contents: Overview of Natural language processing, Introduction to Seq2Seq models,Encoder-Decoder Architecture,Attention Mechanism, Transformer-based Seq2Seq Models: Introduction of transformer architecture and self-attention mechanisms for parallelized computation,Handling Variable-Length Sequences,Evaluation Metrics: BLEU for machine translation and ROUGE for summarization.

Self Study: Teacher Forcing,Beam Search

Further Readings: Fine-tuning encoder and decoder

UNIT 6	Explainable AI	06 HOURS

Applications/Case Study: Interpreting Diabetes Risk Predictions.

Contents: Introduction to Explainable AI,Model-Specific, Model-Agnostic:LIME (Local Interpretable Model-agnostic Explanations): Approximating models with simple interpretable ones. SHAP (SHapley Additive exPlanations).

Self Study: Trends in research (causality in XAI, human-centered AI). The role of XAI in AI governance and regulation.

Further Readings: Ethical considerations: Bias, fairness, and regulatory compliance (GDPR, etc.)

TEXT BOOKS

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REFERENCE BOOKS

1. A. B. A. Arriola, J. R. G. de C. Santos, and J. A. de Morais Amado(2021) *Quantum Neural Networks*,Springer Publishing. ISBN: 978-3030641911
2. Seth Weidman(2019)*Deep Reinforcement Learning Hands-Ons*Packt Publishing. ISBN 978-1788834247
3. Parikshit N. Mahalle and Poonam N.(2021) *Explainable AI: Foundations, Applications, and Challenges*, Wiley-Scrivener Publishing. ISBN-13: 978-1119786202

E-BOOKS/E-CONTENTS LINKS

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2. https://developer.nvidia.com/deep-learning
3. https://builtin.com/machine-learning/deep-learning
4. https://www.deeplearningbook.org/
5. https://www.ibm.com/topics/explainable-ai
6. https://research.ibm.com/topics/quantum-machine-learning

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE DESCRIPTION	
Alandi (D), Pune - 412105	ACADEMIC YEAR	2024 - 2025
SCHOOL OF COMPUTER ENGINEERING	SEMESTER	VIII
	CLASS	TY BTech
	UG	COMPUTER ENGINEERING

COURSE NAME (CODE)	Deep Learning	**DATE OF DOCUMENT PREPARATION**	3/1/2025
LECTURE /WEEK	3	**PRACTICAL /WEEK**	3 Hrs/week

TEACHING PHISOPHY

The Deep Learning course is designed to provide students with a solid foundation in current deep learning technologies and their real-world applications through a project-based, practical learning approach. The course emphasizes both theoretical understanding and hands-on experience, ensuring that students not only grasp the core principles but also develop the skills needed to implement deep learning techniques. It covers neural networks, including convolutional and recurrent networks, and explores their use in applications such as image classification, object detection, natural language processing, and time series analysis. Students will also dive into advanced topics like reinforcement learning, transfer learning, and the integration of quantum computing in AI.
A key feature of the course is its focus on project-based learning. Students will work on real-world projects, applying the concepts learned in class to solve industry-relevant problems. These projects will allow students to gain practical experience by building and deploying deep learning models, analyzing real datasets, and exploring the latest technologies. Case studies will further demonstrate the practical application of deep learning in fields such as healthcare, marketing, and customer analytics.
The teaching approach integrates practical exercises, self-study topics, and further readings to ensure students stay up to date with the latest advancements. By combining theoretical lectures with hands-on projects, students will not only learn the concepts but also enhance their problem-solving and technical proficiency, equipping them to contribute to AI-driven solutions in diverse industries.

EXAMINATION SCHEME

Type	Examination	Syllabus	Marks	Mode of Assessment	Weightage in Final Score	Total Marks
Assessment Items 1	MSE	Unit 1 and 2	20	Theory Exam	20	100
Assessment Items 2	ESE	Unit 3,2,4,5,6	50	Project Based Assessment	50	
Assessment Items 3	Internal Assessment	Unit 1,2,3,4,5,6	30	Deminstartion and Mathematical Based Assessment	30	

INTERNAL ASSESSMENT DETAILS					
Sr. No.	**Name**	**Course Outcomes**	**RBT Level**	**Tentative Marks**	**Tentative Date of Conduction**
Assessment Items 3.1	**Assignemnt 1:** Mathematical Foundations and Applications of Neural Networks **Aim of Assignemnt:**The aim is to assess neural network principles, mathematical derivations, and practical problem-solving in training.	CO1 ,CO4	L4	10	17/01/2025
Assessment Items 3.2	**Assignment No. 2:** Mathematical Modeling of LSTM and ARIMA for Time Series Forecasting **Aim:**To mathematically model LSTM and ARIMA, explaining their equations and applications for dynamic time series forecasting.	CO1	L3	20	3/3/2025
Assessment Items 3.3	**Activity 1:** Quantum Error Correction in Quantum Systems: Theory and Simulation **Aim:**To explore quantum error correction techniques, analyze their applications, and simulate error correction algorithms using Qiskit or Cirq.	CO3	L4	20	27/3/2025
Assessment Items 3.4	**Activity No. 2:** Exploring Explainable AI in Healthcare: Research Paper Analysis and Presentation **Aim:**To analyze recent research on XAI techniques, focusing on healthcare applications, trends, and implications in governance and regulation.	CO5	L5	20	13/2/2025

GROUND RULES	
1	It is mandatory to maintain minimum 75% of attendance in theory and practical sessions to appear for final theory, practical and project presentation examinations.
2	Student should attend all theory and practical sessions on time.
3	A student coming late within 15 minutes of scheduled time will be marked as '**L**' instead of '**P**'. Two consecutive 'L' shall lead to one absenteeism every time.
4	All Assignments/ Activities and discussions should be submitted on or before deadline.

5	MITAOE has no tolerance policy for plagiarism. Plagiarism means copying the content of others as it is and without acknowledgement. Any student repeatedly involved in plagiarized work will not be graded.
6	**Active Participation: Students are expected to actively engage in all lectures, practical sessions, and discussions to enhance their understanding and collaborative learning.**
7	**Device Usage: Use of electronic devices during sessions is restricted to course-related activities. Non-compliance will result in marks deduction or disciplinary action.**

COURSE TEAM

Name of the Faculty	Designa-tion	Teaching Exp. in Years	Seating Location	Office Hours	Mobile No. & Email-ID
Dr.Diptee Ghusse	Assistant Professor	16	H 204 / 23	Monday (8.30 am -10.20 am)	992360812 diptee.chikmurge@mitaoe.ac.in
Dr.Sunita Barve	Professor	20	H 204 / 23	Monday (8.30 am -10.20 am)	81496 88922 ssbarve@mitaoe.ac.in

Course Teacher Name and Sign **Course Champion** **HOD / Dean**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **23 SEPTEMBER 2022**

FINAL YEAR BTECH SEMESTER-VII 2022-23 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 03 **TOTAL NO OF PRINTED PAGES: 03**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a) You are given a binary classification task that includes classifying images as cat vs. non-cat. Design a CNN with a single output neuron for the above task. Let the output of this neuron be z. The final output of the network, Pred_y is given by: **Pred_y = σ(ReLU(z))** Classify all inputs with a final value Pred_y ≥ 0.5 as cat images. Explain Convolutional neural network(CNN) algorithm for given example with architecture diagram. *(Architecture-4M, Explanation-4M)* **[8] CO2 L3**

1 **b)** Given a CNN classifier (refer the table below), calculate the number of weights, number of biases and the size of the associated feature maps for each layer. **[10] CO1 L3**

The notation follows the convention:

• CONV-K-N denotes a convolutional layer with N filters, each them of size K×K, Padding and stride parameters are always 0 and 1 respectively.

• POOL-K indicates a K × K pooling layer with stride K and padding 0.

• FC-N stands for a fully-connected layer with N neurons *(weights calculation-5M, biases calculation-2.5M and size calculation-2.5M)*

Layer	Activation map dimensions	Number of weights	Number of biases
INPUT	128 × 128 × 3	0	0
CONV-9-32			
POOL-2			
CONV-5-64			
POOL-2			
CONV-5-64			
POOL-2			
FC-3			

[2]

2	**a)**	Consider a Generative Adversarial Network (GAN) which successfully produces images of apples. Determine each of the following propositions as true/false. Justify your answer for each proposition. (i) The generator aims to learn the distribution of apple images. (ii) The discriminator can be used to classify images as apple vs. non-apple. (iii) After training the GAN, the discriminator loss eventually reaches a constant value. (iv) The generator can produce unseen images of apples. *(correct answer -0.5M Justification-1.5M for each proposition)*	**[8]**	**CO4**	**L4**
	b)	What are the essential components of an autoencoder and explain with diagram any one type of autoencoder.*(Essential components 3 marks, explanation for encoder type with diagram - 5 marks)*	**[8]**	**CO1**	**L2**
3	**a)**	Turtle Group is a NGO working towards sea turtle conservation and research. They have collected 20000 images of underwater ocean. Suggest the use of Fast R-CNN algorithm for detection of plastic garbage in the ocean. *(Problem significance - 1M,Algorithm -4M,Diagram -3M)*	**[8]**	**CO3**	**L3**
	b)	Compare the Faster RCNN and RCNN algorithm with respect to identification of region proposal in images. *(each algorithm-4M)*	**[8]**	**CO4**	**L4**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS422T **23 SEPTEMBER 2022**

FINAL YEAR BTECH SEMESTER-VII BACKLOG 2016 PATTERN 2022-23 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 4 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a) The manager of the ibis hotel is keen in knowing how much people spend time at the restaurant. He examines 10 randomly selected receipts for parties and writes down the following data. 44, 50, 38, 96, 42, 47, 40, 39, 46, 50 Calculate Mean, Mode, Median,Standard Deviation and Variance of selected samples. **[05] CO1 L2**

b) You toss a fair coin three times: What is the probability of three heads, HHH?(1.5M) What is the probability that you observe exactly one heads?(1.5M) **[03] CO1 L2**

c) Let X be a continuous random variable with PDF. Find Probability density function P(X<=2/3 | X>1/3) **[02] CO1 L2**

$$f(x)=\begin{cases} 4x^3 & 0 < x \leq 1 \\ 0 & otherwise \end{cases}$$

2 a) Compare the discrete and continuous random variables in population with example(any four comparisons(4M) and one example of each(1M)) **[05] CO1 L2**

b) How bias and variance measured and balanced for analysis of outcomes of linear regression model? **[05] CO2 L2**

3 a) What is data augmentation? and State the significance of data augmentation in real time machine learning applications. Explain with suitable examples **[05] CO2 L3**

b) Consider linear regression algorithm to find the predicted salary of employees based on their experience in company.and calculate Sum of Squared Errors (SSE). (2M)Assume the initial values of Intercept c=10.15 and Slope m=5.80 to reduce SSE.And find updated values of m and c to reduce SSE using gradient descent(4M)and new predicted salary values of every data points(4M)Learning rate: 0.001 **[10] CO2 L3**

Years of Experience	Salary in 1000$
2	15
3	28
5	42
13	64
8	50
16	90
11	58
1	8
9	54

4 a) How to reduce the overfitting using K-fold Cross validation explain with suitable example.(Explanation 3M,Example 2M) **[05] CO2 L3**

b) There is huge and high dimensional dataset of cat, dog ,lion images. Mr. Clarry want to classify this dataset into Cat, Dog and Lion classes. How can you help him to classify the selected dataset using convolutional neural network, explain with suitable diagram. (Layers in CNN models 7M, diagram -3M) **[10] CO3 L4**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **23 SEPTEMBER 2022**

FINAL YEAR BTECH SEMESTER-VII 2022-23 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 03 **TOTAL NO OF PRINTED PAGES: 03**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a) You are given a binary classification task that includes classifying images as cat vs. non-cat. Design a CNN with a single output neuron for the above task. Let the output of this neuron be z. The final output of the network, Pred_y is given by: **Pred_y = σ(ReLU(z))** Classify all inputs with a final value Pred_y ≥ 0.5 as cat images. Explain Convolutional neural network(CNN) algorithm for given example with architecture diagram. *(Architecture-4M, Explanation-4M)* **[8] CO2 L3**

1 **b)** Given a CNN classifier (refer the table below), calculate the number of weights, number of biases and the size of the associated feature maps for each layer. **[10] CO1 L3**

The notation follows the convention:

• CONV-K-N denotes a convolutional layer with N filters, each them of size K×K, Padding and stride parameters are always 0 and 1 respectively.

• POOL-K indicates a K × K pooling layer with stride K and padding 0.

• FC-N stands for a fully-connected layer with N neurons *(weights calculation-5M, biases calculation-2.5M and size calculation-2.5M)*

Layer	Activation map dimensions	Number of weights	Number of biases
INPUT	128 × 128 × 3	0	0
CONV-9-32			
POOL-2			
CONV-5-64			
POOL-2			
CONV-5-64			
POOL-2			
FC-3			

[2]

2	**a)**	Consider a Generative Adversarial Network (GAN) which successfully produces images of apples. Determine each of the following propositions as true/false. Justify your answer for each proposition. (i) The generator aims to learn the distribution of apple images. (ii) The discriminator can be used to classify images as apple vs. non-apple. (iii) After training the GAN, the discriminator loss eventually reaches a constant value. (iv) The generator can produce unseen images of apples. *(correct answer -0.5M Justification-1.5M for each proposition)*	**[8]**	**CO4**	**L4**
	b)	What are the essential components of an autoencoder and explain with diagram any one type of autoencoder.*(Essential components 3 marks, explanation for encoder type with diagram - 5 marks)*	**[8]**	**CO1**	**L2**
3	**a)**	Turtle Group is a NGO working towards sea turtle conservation and research. They have collected 20000 images of underwater ocean. Suggest the use of Fast R-CNN algorithm for detection of plastic garbage in the ocean. *(Problem significance - 1M,Algorithm -4M,Diagram -3M)*	**[8]**	**CO3**	**L3**
	b)	Compare the Faster RCNN and RCNN algorithm with respect to identification of region proposal in images. *(each algorithm-4M)*	**[8]**	**CO4**	**L4**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS422T **02 JUNE 2022**

FINAL YEAR BTECH SEMESTER - VII RE-EXAMINATION 2021 - 2022

EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

RE-EXAMINATION

DEEP LEARNING

TIME : 3 HOURS **MAX MARKS : 100**

TOTAL NO OF QUESTIONS: **TOTAL NO OF PRINTED PAGES:2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How to classify the images in to Cat and Dog categories explain with CNN architecture.	**[10]**	**CO1**	**L3**
	b)	Explain signficances of CNN over Artificial Neural network with suitable example	**[8]**	**CO2, CO1**	**L2**
	c)	How to utilize deep learning object recognition algorithm is used to localize,detect and recognize the objects in given image.Explain with suitable example.	**[10]**	**CO3**	**L3**
2	**a)**	Mr.Walter want to count the number of vehicles passing on national highway. He is refrencing the live video of higheway,help him to count the vehicles using YOLO model .(Significance of YOLO model-4M,Stepwise counting of vehicels using YOLO model-6M)	**[10]**	**CO4**	**L3**

	b)	What is the significances of unsupervised deep learning algorithm and explain Autoencoder unsupervised deep learning model used for classification purpose ,explain with suitable example.	**[10]**	**CO3, CO2**	**L3**
	c)	How to increase image dataset using Generative Adversial Network (GAN) model,explain with GAN ardchitecture and suitable example.	**[10]**	**CO3, CO2**	**L3**
3	**a)**	How the deep sequence model handle the time series real time applcation.Enlist the sequence modles in deep learning and explain any sequnec model with stock market prediction example.	**[10]**	**CO3**	**L3**
	b)	Explain the LSTM architecture with neat diagram	**[8]**		**L2**
	c)	Which sequence model is best for sentiment ananlysis? Explain with its architecture.	**[10]**	**CO3, CO2**	**L2**
4	**a)**	Compare LSTM and GRU with suitabl example.	**[4]**	**CO3**	**L2**
	b)	Explain how encoder decoder model is more suitable for sequence to sequence model over LSTM model, explain with Chatbot example.	**[10]**	**CO3**	**L4**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS422T **21 July- 2022**

FINAL YEAR BTECH SEMESTER - VII REMEDIAL TERM 2021 - 2022 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

REMEDIAL EXAMINATION

DEEP LEARNING

TIME : 3 HOURS **MAX MARKS : 100**

TOTAL NO OF QUESTIONS: 4 **TOTAL NO OF PRINTED PAGES: 1**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Explain classification cat and dog images using CNN Architecture	**[10]**	**CO3**	**L3**
	b)	What NLP techniques are used in chatbot?Explain any one technique with suitable diagram.	**[15]**	**CO4**	**L2**
	c)	Consider the image of group of persons crossing road in circle .How to localize and recognize the persons using R-CNN algorithm. Explain with diagram of algorithm architecture.	**[15]**	**CO3**	**L3**
2	**a)**	Explain AlexNet CNN architecture with neat diagram.	**[10]**	**CO2**	**L2**
	b)	How LSTM is used for stock market prediction.	**[10]**	**CO2**	**L2**
3	**a)**	What is significances of encoder -decoder model.	**[05]**	**CO4**	**L2**
	b)	How encoder and decoder used for machine translation task?	**[10]**	**CO3**	**L2**
4	**a)**	Which deep learning algorithm is suitable to image caption.Explain with its significances	**[05]**	**CO3**	**L2**
	b)	How Generative adversial Network GAN algorithm is used to generate cartoon images?	**[10]**	**CO4**	**L3**
	c)	Autoencoder deep learning algorithm is unsupervised algorithm,Explain its significances with its working.	**[10]**	**CO4**	**L3**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **09 DECEMBER 2022**

FINAL YEAR BTECH SEMESTER - VII 2022 - 2023 EXAMINATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 Solve Any Two

a) How is faster R-CNN better than fast R-CNN? [3 Marks]. Explain Faster R-CNN architecture networks: Region Proposal Network (RPN) Object Detection Network. [6 Marks] **[9] CO4 L3**

b) What is the difference between Object Detection Algorithms and Classification Algorithms?[1 Marks] Compare R-CNN vs Fast R-CNN vs Faster R-CNN [8 Marks – 2 Marks each Point] **[9] CO4 L2**

c) Explain the purpose of the following term related to the Object Detection CNN model. [3 Marks each] **[9] CO4 L2**

1. Interaction over union (IoU)
2. Non- maximum suppression
3. Anchor Boxes

2 Solve Any Two

a) Explain sequence modeling RNN with Inputs x(t) outputs y(t) hidden state's(t) the memory of the network with diagram. **[9] CO3 L2**

b) Explain Emotion recognition in Natural Language Processing filed from text using Recurrent Neural Networks by following. **[9] CO3 L3**

i) Design and explain system architecture for Emotion recognition [4 Marks]

ii)Explain Preprocessing steps on text data. [2 Marks]

iii) Develop an experimental set using RNN for emotion recognition. [3 Marks]

c) Explain Long Short-Term Memory networks (LSTMs) advantage over RNN [1 Mark]. **[9] CO3 L3**

Describe the Following term of LSTM with a diagram.

[2 Marks each]

i) memory cell input

ii) forget the gate

ii) input gate

iii) output gate

3 Solve any Two

a) Describe Autoencoder. Explain Autoencoder as Dimensionality reduction for an image. [4 Marks] **8 CO3 L2**

Explain the importance of Autoencoder in computer vision as compared to the PCA algorithm. [4 Marks].

b) Explain the Architecture of Autoencoders in detail as Encoder, Coder, and Decoder with a block diagram. **8 CO3 L2**

[Encoder-2 Marks, Coder- 2 Marks, 2 - Decoder, 2 Marks block diagram]

c) Demonstrate Word Level English to Marathi Neural Machine Translation for **8 CO3 L2**

•Input sentence (English)=> "Rahul is a good boy"

•Output sentence (Marathi) => "राहुल चांगला मुलगा आहे"

Using Encoder-Decoder Model. [4 Marks for Expatiation, 4 Marks for Block diagram]

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **09 DECEMBER 2022**

FINAL YEAR BTECH SEMESTER - VII 2022 - 2023 EXAMINATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 Solve Any Two

a) How is faster R-CNN better than fast R-CNN? [3 Marks]. Explain Faster R-CNN architecture networks: Region Proposal Network (RPN) Object Detection Network. [6 Marks] **[9] CO4 L3**

b) What is the difference between Object Detection Algorithms and Classification Algorithms?[1 Marks] Compare R-CNN vs Fast R-CNN vs Faster R-CNN [8 Marks – 2 Marks each Point] **[9] CO4 L2**

c) Explain the purpose of the following term related to the Object Detection CNN model. [3 Marks each] **[9] CO4 L2**

1. Interaction over union (IoU)
2. Non- maximum suppression
3. Anchor Boxes

2 Solve Any Two

a) Explain sequence modeling RNN with Inputs x(t) outputs y(t) hidden state's(t) the memory of the network with diagram. **[9] CO3 L2**

b) Explain Emotion recognition in Natural Language Processing filed from text using Recurrent Neural Networks by following. **[9] CO3 L3**

i) Design and explain system architecture for Emotion recognition [4 Marks]

ii)Explain Preprocessing steps on text data. [2 Marks]

iii) Develop an experimental set using RNN for emotion recognition. [3 Marks]

c) Explain Long Short-Term Memory networks (LSTMs) advantage over RNN [1 Mark]. **[9] CO3 L3**

Describe the Following term of LSTM with a diagram.

[2 Marks each]

i) memory cell input

ii) forget the gate

ii) input gate

iii) output gate

3 Solve any Two

a) Describe Autoencoder. Explain Autoencoder as Dimensionality reduction for an image. [4 Marks] **8 CO3 L2**

Explain the importance of Autoencoder in computer vision as compared to the PCA algorithm. [4 Marks].

b) Explain the Architecture of Autoencoders in detail as Encoder, Coder, and Decoder with a block diagram. **8 CO3 L2**

[Encoder-2 Marks, Coder- 2 Marks, 2 - Decoder, 2 Marks block diagram]

c) Demonstrate Word Level English to Marathi Neural Machine Translation for **8 CO3 L2**

•Input sentence (English)=> "Rahul is a good boy"

•Output sentence (Marathi) => "राहुल चांगला मुलगा आहे"

Using Encoder-Decoder Model. [4 Marks for Expatiation, 4 Marks for Block diagram]

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **12 DECEMBER-2022**

FINAL YEAR BTECH SEMESTER - VII 2022 - 2023 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a)	How is the Long Short Term Memory (LSTM)model better than the Recurrent Neural Network (RNN)model to preserve long-term dependency, explain the architecture of LSTM. Comparison of LSTM and RNN-2M, LSTM architecture diagram-2M, Explanation of LSTM architecture-4M)	**[8]**	**CO3**	**L3**
1 b)	Which sequential model of deep learning is suitable for weather forecast prediction ,explain with suitable system architecture diagram for following dataset (Identification of algorithm-2M with reason, System architecture /algorithm-1M,Explanation-4M)	**[7]**	**CO3 CO4**	**L3**

Time	Temperature
5:00 am	59 °F
6:00 am	59 °F
7:00 am	58 °F
8:00 am	58 °F
9:00 am	60 °F
10:00 am	62 °F
11:00 am	64 °F

2 a)	How is the sequence-to-sequence model employed for machine translation using encoder-decoder model?(Model architecture-3M,Explanation with example-7M)	**[10]**	**CO3**	**L3**
2 b)	Write short notes on 5M each 1)Bidirectional Encoder Representations from Transformers. (BERT) 2)Q -Reinforcement learning 3)Gated Recurrent Unit(GRU) (Architecture diagram-1M,Explanation -3M, Example-1M)	**[15]**	**CO6**	**L2**
3 a)	How is reinforcement learning different from supervised learning algorithm, explain with a suitable example	**[5]**	**CO4, CO5**	**L2**
3 b)	The policy, value, and action-based approaches to reinforcement learning utilized for reward maximization, justify with suitable examples.	**[5]**	**CO6**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **12 DECEMBER-2022**

FINAL YEAR BTECH SEMESTER - VII 2022 - 2023 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

END SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a)	How is the Long Short Term Memory (LSTM)model better than the Recurrent Neural Network (RNN)model to preserve long-term dependency, explain the architecture of LSTM. Comparison of LSTM and RNN-2M, LSTM architecture diagram-2M, Explanation of LSTM architecture-4M)	**[8]**	**CO3**	**L3**
1 b)	Which sequential model of deep learning is suitable for weather forecast prediction ,explain with suitable system architecture diagram for following dataset (Identification of algorithm-2M with reason, System architecture /algorithm-1M,Explanation-4M)	**[7]**	**CO3 CO4**	**L3**

Time	Temperature
5:00 am	59 °F
6:00 am	59 °F
7:00 am	58 °F
8:00 am	58 °F
9:00 am	60 °F
10:00 am	62 °F
11:00 am	64 °F

2 a)	How is the sequence-to-sequence model employed for machine translation using encoder-decoder model?(Model architecture-3M,Explanation with example-7M)	**[10]**	**CO3**	**L3**
2 b)	Write short notes on 5M each 1)Bidirectional Encoder Representations from Transformers. (BERT) 2)Q -Reinforcement learning 3)Gated Recurrent Unit(GRU) (Architecture diagram-1M,Explanation -3M, Example-1M)	**[15]**	**CO6**	**L2**
3 a)	How is reinforcement learning different from supervised learning algorithm, explain with a suitable example	**[5]**	**CO4, CO5**	**L2**
3 b)	The policy, value, and action-based approaches to reinforcement learning utilized for reward maximization, justify with suitable examples.	**[5]**	**CO6**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **7 OCTOBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

MID SEMESTER EXAMINATION(YLIP)

DEEP LEARNING

TIME : 2 HOUR **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 2 **TOTAL NO OF PRINTED PAGES:02**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Why we require advanced optimizer in Deep Learning. [3 Marks] Explain any three advanced optimizers in detail. [6 Marks]	**[9]**	**CO1**	**L2**
	b)	What is the purpose of the pooling layer, mention and explain the types of pooling in CNN. [4 Marks]. Explain Relu and Softmax activation function [4 Marks]	**[8]**	**CO1**	**L2**
	c)	Explain the concept of overfitting in Deep Learning. [2 Marks]. Explain the following two methods to avoid overfitting i) Data Augmentation ii) Dropout . [6Marks]	**[8]**	**CO1**	**L2**
2	**a)**	Explain transfer learning in the context of deep learning.[3 Marks]. Draw and explain the block diagram of the Inception V3 Deep Learning Modle.[6 Marks]	**[9]**	**CO2**	**L2**

b)	Explain Identity and Convolution Block in ResNet Deep Learning Model with block diagram.	**[8]**	**CO2**	**L2**
c)	Compare AlexNet and VGG Deep Learning Model with architecture diagram.	**[8]**	**CO2**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **8 OCTOBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOUR **MAX MARKS : 02**

TOTAL NO OF QUESTIONS: 2 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How does the choice of pooling operation (e.g., max-pooling, average-pooling) affect the down-sampling of feature maps?Explain with suitable example.[6M] Can you explain how the pooling layer reduces spatial dimensions and helps control overfitting in a CNN?[4M]	**[10]**	**CO2**	**L4**
	b)	What is fine-tuning in the context of transfer learning, and why is it important?and How does fine-tuning adapt a pre-trained model to a specific task or dataset?(Fine tuning in context 4M,Imporatnce - 2M,Example 3M,Fine tuning adaption-3M)	**[12]**	**CO4**	**L4**
2	**a)**	"What are the key differences between GRU (Gated Recurrent Unit) and LSTM (Long Short-Term Memory) architectures in recurrent neural networks, and how do these differences impact their performance?(any five difference along with architure -5M;and impact of their performamnce -3M)	**[8]**	**CO3**	**L2**

	b)	What is reinforcement learning, and how does it work in the context of training intelligent agents to make decisions in uncertain environments? Explain the key components of reinforcement learning, including agents, environments, rewards, and policies?	**[10]**	**CO3**	**L2**
3	**a)**	Discuss the role of exploration and exploitation in reinforcement learning algorithms.	**[5]**	**CO1**	**L2**
	b)	What is the discount factor and how it will impact on deep Q learning model,Explain with example.	**[5]**	**CO3**	**L3**

MIT ACADEMY OF ENGINEERING

COURSE CODE: ET481T **20 SEPTEMBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 2 **TOTAL NO OF PRINTED PAGES:2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	Is it possible to train a neural network model by setting all of the weights to zero? Justify your answer ***[2Marks]*** Why the weight initialization technique is important in the Deep learning model ***[2Mark]***. Explain any one weight initialization technique with a mathematical equation ***[4 Mark]***.	**[8]**	**CO1**	**L2**
	b)	What are the different layers used in CNN explain the purpose of each layer? ***[6 Marks].*** What is the need for including the padding? List down the type of padding. ***[3 Mark]***	**[9]**	**CO1**	**L2**
	c)	Why is a convolutional neural network preferred over a dense neural network for an image classification task ***[2 Marks]***? What is the purpose of activation function ***[2 Marks].*** Explain activation function used in AlexNet CNN ***[4 Marks].***	**[8]**	**CO1**	**L2**

2	**a)**	Explain the architecture of the VGG Model to classify objects in photographs. ***[6 Marks]*** What are the advantages of VGG16 over AlexNet? ***[2Marks]***	**[8]**	**CO2**	**L2**
	b)	Draw and Explain the Inception of Block A, Block B, and Block C **[*3 Marks Each]***	**[9]**	**CO2**	**L2**
	c)	What is ResNet, and Why was it Proposed? ***[4 Marks]*** What is the dropout layer in deep learning and purpose? ***[4 Mark]***	**[8]**	**CO2**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS422T **22 SEPTEMBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2016 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOUR **MAX MARKS :50**

TOTAL NO OF QUESTIONS: 2 **TOTAL NO OF PRINTED PAGES:2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How do kernel size,padding and stride hyperparameters impact the output of convolutional layer and pooling layer and feature extraction in CNNs? Explain the importance of the number of convolutional layers (depth) as a hyperparameter in CNN architecture with suitable example ***(Impact of Hyperparametrs -5M calculation of dimension of outout of Covolutional layer and Pooling layers-3M,Importance of Convolutional depth-2M)***	**[10]**	**CO2**	**L1**
	b)	"How do various optimization algorithms like Stochastic Gradient Descent (SGD), SGD with momentum, Adagrad, RMSProp (Adadelta), and Adam impact the training efficiency and final performance of Convolutional Neural Networks (CNNs)? Explain the underlying mathematical intuitions behind their behaviors." ***(2M per Optimizer and Mathematical intution 2M)***	**[12]**	**CO4**	**L4**

2	**a)**	What is a Sequential model in deep learning, and how does it differ from other neural network architectures?Explain with suitable example ***(Sequential model description and significances over Neural network 5M,Example 3M)***	**[8]**	**CO3**	**L2**
	b)	"How do Long Short-Term Memory (LSTM) networks outperform traditional recurrent neural networks (RNNs) in addressing the challenge of vanishing gradients? Explain the architectural components and mechanisms that make LSTMs more effective in handling long-range dependencies." ***(LSTM significance over RNN to solve vanishing gradient problem-5M, LSTM architectural components and mechanism-5M)***	**[10]**	**CO3**	**L4**
3	**a)**	Provide real-world examples of applications where reinforcement learning has been successfully applied. What made RL suitable for these tasks?	**[5]**	**CO1**	**L2**
	b)	"How does Deep Q-Learning (DQL) address the challenges in reinforcement learning, and what are the key components and techniques that make it effective? Explain the step-by-step process of how DQL learns to make optimal decisions in a given environment."	**[5]**	**CO1**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS462T **22 SEPTEMBER 2023**

FINAL YEAR BTECH SEMESTER - VII 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DEEP LEARNING

TIME : 2 HOURS **MAX MARKS : 50**

TOTAL NO OF QUESTIONS: 2 **TOTAL NO OF PRINTED PAGES:2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How do kernel size,padding and stride hyperparameters impact the output of convolutional layer and pooling layer and feature extraction in CNNs? Explain the importance of the number of convolutional layers (depth) as a hyperparameter in CNN architecture with suitable example. ***(Impact of Hyperparametrs -5M calculation of dimension of outout of Covolutional layer and Pooling layers-3M,Importance of Convolutional depth-2M)***	**[10]**	**CO2**	**L1**
	b)	"How do various optimization algorithms like Stochastic Gradient Descent (SGD), SGD with momentum, Adagrad, RMSProp (Adadelta), and Adam impact the training efficiency and final performance of Convolutional Neural Networks (CNNs)? Explain the underlying mathematical intuitions behind their behaviors." **(*2M per Optimizer and Mathematical intution 2M)***	**[12]**	**CO4**	**L4**

2	**a)**	What is a Sequential model in deep learning, and how does it differ from other neural network architectures?Explain with suitable example ***(Sequential model description and significances over Neural network 5M,Example 3M)***	**[8]**	**CO3**	**L2**
	b)	"How do Long Short-Term Memory (LSTM) networks outperform traditional recurrent neural networks (RNNs) in addressing the challenge of vanishing gradients? Explain the architectural components and mechanisms that make LSTMs more effective in handling long-range dependencies." ***(LSTM significance over RNN to solve vanishing gradient problem-5M, LSTM architectural components and mechanism-5M)***	**[10]**	**CO3**	**L4**
3	**a)**	Provide real-world examples of applications where reinforcement learning has been successfully applied. What made RL suitable for these tasks?	**[5]**	**CO1**	**L2**
	b)	"How does Deep Q-Learning (DQL) address the challenges in reinforcement learning, and what are the key components and techniques that make it effective? Explain the step-by-step process of how DQL learns to make optimal decisions in a given environment."	**[5]**	**CO1**	**L2**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS422T **16 JUNE 2023**

FINAL YEAR BTECH SEMESTER - VII RE-EXAMINATION BACKLOG
2016 PATTERN 2022-2023 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

RE-EXAMINATION

DEEP LEARNING

TIME : **MAX MARKS : 100**

TOTAL NO OF QUESTIONS: 4 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1	**a)**	How to classify the images in to Cat and Dog categories explain with CNN architecture.	**[10]**	**CO1**	**L3**
	b)	Explain signficances of CNN over Artificial Neural network with suitable example	**[8]**	**CO2 CO1**	**L2**
	c)	How to utilize deep learning object recognition algorithm is used to localize,detect and recognize the objects in given image.Explain with suitable example.	**[10]**	**CO3**	**L3**
2	**a)**	Mr.Walter want to count the number of vehicles passing on national highway. He is refrencing the live video of higheway,help him to count the vehicles using YOLO model .(Significance of YOLO model-4M,Stepwise counting of vehicels using YOLO model-6M)	**[10]**	**CO4**	**L3**

	b)	What is the significances of unsupervised deep learning algorithm and explain Autoencoder unsupervised deep learning model used for classification purpose ,explain with suitable example.	**[10]**	**CO3 CO2**	**L3**
	c)	How to increase image dataset using Generative Adversial Network (GAN) model,explain with GAN ardchitecture and suitable example.	**[10]**	**CO3 CO2**	**L3**
3	**a)**	How the deep sequence model handle the time series real time applcation.Enlist the sequence modles in deep learning and explain any sequnec model with stock market prediction example.	**[10]**	**CO3**	**L3**
	b)	Explain the LSTM architecture with neat diagram	**[8]**		**L2**
	c)	Which sequence model is best for sentiment ananlysis? Explain with its architecture.	**[10]**	**CO3 CO2**	**L2**
4	**a)**	Compare LSTM and GRU with suitable example.	**[4]**	**CO3**	**L2**
	b)	Explain how encoder decoder model is more suitable for sequence to sequence model over LSTM model, explain with Chatbot example.	**[10]**	**CO3**	**L4**

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	W.E.F	AY: 2024 - 2025 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING	COURSE NAME	DESIGN AND ANALYSIS OF ALGORITHMS
	COURSE CODE	2304314T
	COURSE CREDITS	3
RELEASE DATE : 01/07/2024	REVISION NO.	2.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
3	NIL	30	20	50	NIL	NIL	100

PREREQUISITE:

Calculus and differential equation

Foundation of Computing

COURSE OBJECTIVES:

2304314T.CEO.1: To develop problem solving abilities using mathematical theories.
2304314T.CEO.2: To apply algorithmic strategies while solving problems.
2304314T.CEO.3: To analyze performance of different algorithmic strategies in terms of time.
2304314T.CEO.4: To distinguish between P and NP class of problems.

COURSE OUTCOMES:

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

2304314T.CO.1: Analyze the given algorithm in terms of its computational complexity. [L4].
2304314T.CO.2: Apply algorithmic strategies to solve given problems. [L3].
2304314T.CO.3: Find optimal solution by applying various methods. [L3].
2304314T.CO.4: Solve intractable problem by using approximation algorithm. [L3].
2304314T.CO.5: Make use of string matching algorithm to find matches between specified pattern. [L3].

COURSE ABSTRACT:

This course introduces the mathematical notion of algorithms and teaches how to develop, validate, and optimize them for performance and memory. The course includes a significant mathematics component, as well as the design of various algorithms.

THEORY COURSE CONTENTS

UNIT 1	**INTRODUCTION OF ALGORITHMIC STRATEGY**	**08 HOURS**

Applications/Case Study: Packet switched network, Binary Search.
Contents: Algorithm, performance analysis, Need of Algorithm,Asymptotic Notation, Problem solving strategies Divide and Conquer: Basic method, Example: Quick Sort, Max-Min Problem, Large integer multiplication algorithm, Recurrence: Substitution method, Master Theorem.
Self Study: Median of Two sorted arrays of same size.
Further Readings: Strassen's Matrix Multiplication.

UNIT 2	**GREEDY METHOD**	**06 HOURS**

Applications/Case Study: CPU Scheduling Algorithms, Network Routing
Contents: Greedy Algorithm: Basic Method and Algorithms, Example: Fractional Knapsack Problem, Job Sequencing with Deadline, Huffman Algorithm, Activity Selection Problem.
Self Study: Coin Changing Problem
Further Readings: Task scheduling problem as a matroid.

UNIT 3	**DYNAMIC PROGRAMMING**	**08 HOURS**

Applications/Case Study: Google Map, Google search engine
Contents: Dynamic Programming: Basic Method, Example: 0/1 Knapsack, Chain Matrix Multiplication OBST, All pairs shortest path, Floyd-Warshall's Algorithm, Travelling Salesman Problem.
Self Study: Coin changing problem.
Further Readings: Longest common Subsequence Problem.Single source shortest path: Bellman Ford algorithm.

UNIT 4	**BACKTRACKING AND BRANCH AND BOUND**	**08 HOURS**

Applications/Case Study: Parser, Crossword puzzle, Sudoku.
Contents: Backtracking: Basic Method, Examples: Eight Queen Problem, Sum of Subset problem,Branch and Bound: Basic Method, FIFO and LC approach, 0/1 knapsack problem using FIFO LC Approach, Traveling Salesperson problem FIFO LC Approach
Self Study: Backtracking Algorithms for Enumerating Independent Sets of a Graph.
Further Readings:15 Puzzle problem.

UNIT 5	COMPUTATIONAL COMPLEXITY THEORY	07 HOURS

Applications/Case Study: Airline crew scheduling, TSP and Graph coloring problem.
Contents: Classifying Problems, Nondeterministic Deterministic problems, Tractable Non Tractable problems, Reductions, Cook's Theorem, NP-Complete problem, NP-Hard problem,3SAT Problem Approximation algorithm: vertex cover problem.
Self Study: Approximation algorithm for TSP.
Further Readings: Clique Decision problem.

UNIT 6	ADVANCED ALGORITHMS AND APPLICATIONS	08 HOURS

Applications/Case Study: plagiarism detector, spell checker, web search engines
Contents: Randomized algorithms : Monte Carlo and Las Vegas algorithm, String matching algorithm: KMP, Boyer Moore Algorithm, Robin Karp Algorithm, Number theoretic algorithm: : the GCD – Modular Arithmetic – The Chinese Remainder Theorem.
Self Study: Naïve string matching algorithm.
Further Readings: The general string problem as a finite automata.

TEXT BOOKS

1. E.Horowitz , S. Sahni, S. Rajasekaran (2008) *Fundamentals of Computer Algorithms.* 2^{nd} Edition, Universities Press pvt Ltd ,ISBN 9788173716126.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein (2022) *Introduction to Algorithm.* 4^{th} edition, Cambridge, Massachusetts : The MIT Press, ISBN 9780262367509.
3. Anany Levitin *Introduction to the Design and Analysis of Algorithms.* 3^{rd} edition,ISBN: 9780132316811.

REFERENCE BOOKS

1. V. Aho , J.D. Ullman,(2002)*Design and Analysis of Computer Algorithms.* 1^{st} Edition , Pearson Education , ISBN 8131702057 PHI Learning Pvt Ltd, 2011, ISBN 978-81-203-40007-7.
2. Brassard G. and Bratley P.*Algorithms, Theory and Practices.* 1^{st} Edition , PHI. ISBN 0-13-023243-2.

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MIT ACADEMY OF ENGINEERING

COURSE CODE: CS321T **20 FEBRUARY 2024**

TY BTECH SEMESTER - VI BACKLOG 2016 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

MID SEMESTER EXAMINATION

DESIGN AND ANALYSIS OF ALGORITHMS

TIME : 2 Hrs **MAX MARKS :50**

TOTAL NO OF QUESTIONS: 3 **TOTAL NO OF PRINTED PAGES: 2**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

1 a)	Explain Merge sort algorithm with example. Also analyze performance of the algorithm in terms of its time complexity. *Algorithm 5 marks, Example 2 marks, Time complexity calculation 3 marks.*	**[10]**	**CO1**	**L1**
b)	Apply Masters Theorem to analyze the given performance equations: i) T(n)= 3T(n/2)+n ii) T (n) = 4T (n/2) + n^2 *3 marks each correct solution.*	**[6]**	**CO1**	**L3**
2 a)	Explain 0/1 Knapsack algorithm. Apply this algorithm to solve problem where n = 4, M = 8, P = {15,9,5,10} W = {1,3,4,5}. Show maximum profit earned in knapsack. *Correct Algorithm : 5 marks, Solution of Prob: 5*	**[10]**	**CO3**	**L3**

	b)	Constuct an optimal Huffman code for the following set of frequencies :- a:42, b:20, c:5, d:10, e:11, f:12. Decode the word "11101101" at the receiver side. *4 Marks for costruction of tree with correct encoding bits, 3 Marks for decoding the word.*	**[7]**	**CO2**	**L4**
3	**a)**	Let the keys {end,goto,print,read} with the successful probablities (1,4,2,1) and unsuccessfull probablities are (4,2,4,1,1) Construct a Binary Search Tree with optimum searching time. *4 marks for Solution with equation , 4 marks for table and 2 marks for tree .*	**[10]**	**CO1**	**L3**
	b)	Find the optimal solution for 0/1 problem, where no of objects are n=4, capacity of sack M=5, profits are (3,4,5,6) and weights are (2,3,4,5). *5 marks for Solution with equation , 2 marks for table.*	**[7]**	**CO2**	**L4**

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS347T/ 321T **14 JUNE 2024**

TY BTECH SEMESTER - VI RE-EXAMINATION BACKLOG 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

RE-EXAMINATION

DESIGN AND ANALYSIS OF ALGORITHMS

TIME : 2.5 hr. **MAX MARKS :70**

TOTAL NO OF QUESTIONS: 6 **TOTAL NO OF PRINTED PAGES: 3**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

a)	Prove that the Worst case time complexity of quick sort is $O(n^2)$ and Average case Time complexity is O(nlogn). **2 marks for proving n^2 and 2 marks for nlogn**	**[04]**	**CO1**	**L1**
b)	Explain the Asymptotic notations with example. **2 marks for each notation**	**[06]**	**CO1**	**L1**
2 a)	Find out the character encoding for the following message using Huffman coding and its transmission cost. Message: yoyoyoutube **4 marks for encoading and 4 marks for tree creation**	**[08]**	**CO2**	**L3**
b)	Why Greedy strategy does not always give you a optimum Solution. Justify your answer with Suitable Example. **Justification with example 4 marks. Justification without example 2 marks.**	**[04]**	**CO2**	**L1**

3 a) Let n=4, (a1, a2, a3, a4) = (do, if return, while). **[08] CO3 L3**
Let (p1, p2, p3, p4)=(3,3,1,1)
and (q0, q1, q2, q3, q4)=(2,3,1,1,1)
Construct OBST for this problem.
Full marks for complete solution and 4 marks for 50% correct solution.

b) Consider the Chain Matrices A1,A2,A3,A4 with dimension given below.Give the optimal parthenzation to get product A1,A2…A4 **[08] CO3 L3**
Matrix Dimension
A1 3*2
A2 2*4
A3 4*2
A4 2x5
Full marks for complete solution and 4 marks for 50% correct solution.

4 a) A School bus must pick up the students at four different locations (1,2,3,4, and 5) as shown in the table, starting and ending at 1. The bus driver wants to minimize the total length of the trip. Find the best path using B&B. **[08] CO4 L3**
Full marks for complete solution and 4 marks for 50% correct solution.

	1	2	3	4	5
1	∞	20	30	10	11
2	15	∞	16	4	2
3	3	5	∞	2	4
4	19	6	18	∞	3
5	16	4	7	16	∞

b) Differentiate between Branch and bound and dynamic programming. **[04] CO4 L2**
One mark for each difference

5 a) Prove that TSP is NP-Complete. **[05] CO5 L3**
Complete marks for valid claim with solution.

b) How NP Complete and NP Hard Problems are related with each other and
How NP Hard problems can be converted to NP Complete problems. **[05] CO L2**

2.5 marks for showing NP Complete and NP Hard relationship.
2.5 marks for conversion pf NP Hard into NP.

6 a) Describe in pseudo-code of the KMP algorithm. **[10] L3**
Find the prefix function for pattern ababaca.
Apply the KMP algorithm to check pattern ababaca is present in given string
bacbababababacaab

4 Marks for algorithm . 2 marks for prefix table. 4 marks for mathing pattern.

MIT ACADEMY OF ENGINEERING

COURSE CODE: CS347T **10 MAY 2024**

TY BTECH SEMESTER - VI 2019 PATTERN 2023 - 2024 EXAMINATION

DEPARTMENT OF COMPUTER ENGINEERING

END SEMESTER EXAMINATION

DESIGN AND ANALYSIS OF ALGORITHMS

TIME : 2 HOURS **MAX MARKS :50**

TOTAL NO OF QUESTIONS: 03 **TOTAL NO OF PRINTED PAGES:02**

INSTRUCTIONS TO CANDIDATES:

1. Assume suitable data wherever necessary
2. Non programmable scientific calculators are allowed
3. Black figures to the right indicate full marks

01 a)	Find an optimal solution for the following 0/1 knapsack instance using least cost branch and bound method. Number of objects n=5,capacity of knapsack m=12,Profits=(10,15,6,8,4),weights=(4,6,3,4,2). *Rubrics:2 Marks for each correct value of cost and uppear value of state space tree.*	**[10]**	**CO3**	**L3**
01 b)	Write an algorithm to solve n queens problem using backtracking method. *Rubrics:5 marks for correct algorithm.*	**[5]**	**CO3**	**L2**
01 c)	Draw the tree organization of the 4-queen's solution space.Number the nodes using depth first search. *Rubrics:3 marks for the correct tree.*	**[3]**	**CO3**	**L1**
02 a)	Write non-deterministic algorithm for knapsack problem? *Rubrics:7 marks for correct algorithm.*	**[6]**	**CO4**	**L2**
02 b)	State and explain Cook's theorem. *Rubrics: 3 marks for correct theorem, 5 marks for the explaination*	**[8]**	**CO4**	**L2**

03 a) Explain randomized algorithm.Differentiate between Monte Carlo and Las Vegas algorithm with examples. **[8] CO5 L2**

Rubrics: 2 marks for explaination. 6 marks for the correct difference and example.

03 b) Apply Boyer Moore algorithm to search the pattern **dridi** in the text **[10] CO5 L3**

gadji_beri_bimba_glandridi.

Rubrics: 2 marks for correct bad table. 2 marks for correct good suffix table.6 Marks for each step for search the pattern in the text.

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	W.E.F	AY: 2024 - 2025 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING	COURSE NAME	CYBER SECURITY AND FORENSICS
	COURSE CODE	2304329T
	COURSE CREDITS	3
RELEASE DATE : 01/07/2024	REVISION NO.	2.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
3	NIL	30	20	50	NIL	NIL	100

PREREQUISITE KNOWLEDGE: Computer Networks, Operating Systems

COURSE OBJECTIVES:

2304329T.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329T.CEO.2: To understand the security concerns in IoT devices.
2304329T.CEO.3: To implement a secure application and maintain integrity with the help of network security appliances.
2304329T.CEO.4: To ascertain the usefulness of Information and Enterprise security.
2304329T.CEO.5: To know about the forensic analysis and the investigation process.
2304329T.CEO.6: To use the forensics tools in an investigation process.

COURSE OUTCOMES :

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

2304329T.CO.1: Outline different software bugs that pose security threats, and it can attack a network. [L2].

2304329T.CO.2: Identify the issues in implementing secure environment while using IoT devices in the organization. [L3].

2304329T.CO.3: Develop a wide network by selecting right systems and ensuring supportive applications that can speed up all the processes. [L3].

2304329T.CO.4: Analyze the fundamental risk management principles and controlling IT operations to implement security guidelines for various types of Industries [L4].

2304329T.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

2304329T.CO.6: Evaluate with the help of Digital Forensic tools the security vulnerabilities in the systems [L5].

COURSE ABSTRACT:

Cyber Security is an integral part of the network environment. Cyber security is the practice of protecting systems, networks, and programs from digital attacks. These cyber attacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users via ransomware; or interrupting normal business processes. Implementing effective cyber security measures is particularly challenging today because there are more devices than people, and attackers are becoming more innovative.

THEORY COURSE CONTENTS		
UNIT 1	**Emerging Cyber Threats and Vulnerabilities**	**08 HOURS**

Applications/Case Study: Network Security

Contents: Definition of Cybercrime, Classification of Cybercrimes, Cyber Attacks and Their Countermeasures, Behavioral Aspects of Cyber Security, Role of Cyber Security on Intelligent Transportation Systems, Necessity of Cryptography for Cybersecurity Applications, Application of Cyber Security for Cloud-based Applications.

UNIT 2	**IoT Security and Privacy**	**08 HOURS**

Applications/Case Study: Display devices- OLEDs, Micro LEDs, Radar displays

Contents: Trends in Mobility, Security challenges posed by mobile devices, Service Orchestration and Routing for IoT, Privacy, Security, Trust, Identity, and Anonymity in IoT, Threats to mobile applications, analyzers for Mobile Applications to discover Security vulnerabilities, Security architecture in IoT, Android Security Architecture.

Self Study: Wireless system Design, System architecture,

UNIT 3	**Infrastructure and Application Security**	**06 HOURS**

Applications/Case Study: Design of different Applications

Contents: Device Security, Topologies and IDS, Authentication and Authorization, Session Management, Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Privilege, access control and Operating System Security, Case Study: Security of E-mail System, Database Security basics.

Self Study: Firewall Implementation

UNIT 4	**Information and Enterprise Security**	**06 HOURS**

Applications/Case Study: Enterprise Network

Contents: Definition, Terminologies, Goals of Information Security and Implementation issues, Access control- password, MFA, -, Security issues in Cloud Computing, Introduction to Enterprise Security, Planning and designing the Security Architecture, Security Architecture: Operations, Security Governance and Risk Management.

Self Study: E-mail System

UNIT 5	**Digital Forensics**	**06 HOURS**

Applications/Case Study: Forensics Analysis

Contents: Overview of Digital Forensics, the sub disciplines, Digital Evidence, Forensics analysis of email, Digital Forensics Life Cycle, Chain of Custody concept, Network Forensics, Relevance of OSI Layers, Data Recovery and OS Forensics, Email Crimes and Violations, Case Study: The Investigation process, Setting up a laboratory.

Self Study: The methods of data acquisition.

UNIT 6	Digital Forensics Tools	06 HOURS

Applications/Case Study: How can a tool be used for forensic analysis

Contents: Best Practices, what makes a tool forensically sound, performing tool testing, Classes of Forensics tools.

Self Study: Implementation of any tool using kali Linux.

TEXT BOOKS

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber SECURITY Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel

REFERENCE BOOKS

1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition

E-RESOURCES

1. https://nptel.ac.in/courses/106106248

MIT | Academy of Engineering (An Autonomous Institute Affiliated to Savitribai Phule Pune University)	COURSE SYLLABUS	
SCHOOL OF COMPUTER ENGINEERING	W.E.F	AY: 2024 - 2025 (Rev. 2022)
THIRD YEAR BACHELOR OF TECHNOLOGY COMPUTER ENGINEERING	COURSE NAME	CYBER SECURITY AND FORENSICS LAB
	COURSE CODE	2304329L
	COURSE CREDITS	3
RELEASE DATE : 01/07/2024	REVISION NO.	2.0

TEACHING SCHEME (HOURS/WEEK)		EXAMINATION SCHEME AND MARKS					
		THEORY			LABORATORY		TOTAL
LECTURE	PRACTICAL	IA	MSE	ESE	CA	PRACT/DEMO/PRES.	
NIL	2	NIL	NIL	NIL	20	30	50

PREREQUISITE KNOWLEDGE: NIL

COURSE OBJECTIVES:

2304329L.CEO.1: To gain a fundamental knowledge of Cyber threats and Cyber vulnerabilities.
2304329L.CEO.2: To understand the security concerns in web based applications.
2304329L.CEO.3: To implement a secure framework to automate web application security assessment.
2304329L.CEO.4: To ascertain the usefulness of Open Source Intelligence tools.
2304329L.CEO.5: To know about the forensic analysis and the investigation process.

COURSE OUTCOMES:

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

2304329L.CO.1: Outline various security threats that can attack the network and the necessary preventive measures implemented using the security policies [L2].
2304329L.CO.2: Identify the injection flaws and ensure website security [L3].
2304329L.CO.3: Develop a framework that can identify the bugs and ensure that the web applications security assessment is done automatically [L3].
2304329L.CO.4: Analyze the bruteforcing Web Applications to discover common vulnerabilities [L4].
2304329L.CO.5: Examine Forensics systems with respect to maintaining operations in the presence of risks and threats. [L4].

PRACTICALS		
PRACTICAL NO.01	**A. Study of the features of NSA in providing network security and to set Firewall with proper configuration. B. Configure Security parameters in any one web browser C. Study of different types of vulnerabilities for hacking a websites / Web Applications.**	**4 HOURS**
PRACTICAL NO.02	**Implement a penetration testing tool that automates the process of detecting and exploiting SQL injection flaws and taking over of database servers.**	**4 HOURS**
PRACTICAL NO.03	**Install Kali Linux and utilize various security tools for defense of the system.**	**4 HOURS**
PRACTICAL NO.04	**Implement a framework to automate web applications security assessments and could help you to secure your web applications by finding and exploiting web application vulnerabilities.**	**4 HOURS**
PRACTICAL NO.05	**Implement wfuzz to discover common vulnerabilities in web applications through the method of fuzzing.**	**2 HOURS**
PRACTICAL NO.06	**Using an OSINT Tool like Shodan or Censys, find out the details about the servers, networks; and internet connected devices.**	**4 HOURS**
PRACTICAL NO.07	**PWN till Dawn lab offensive security**	**2 HOURS**
PRACTICAL NO.08	**Configure Wireless Access Point and provide MAC based security. A. Analyze wifi traffic. B. Cracking into WEP, WPA2 C. Evil twin attack with fake access point**	**4 HOURS**
PRACTICAL NO.09	**Download and install sleuth kit to identify and recover evidence from available data sets**	**2 HOURS**

TEXT BOOKS

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belpure, Wiley India Edition.
2. Information Systems Security: Security Management, Metrics, Frameworks and best Practices by Nina Godbole Wiley India Edition
3. Cyber Security Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, Thomas Johnson, CRC Press, taylor Franscis Group
4. Digital Forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom, Larry Daniel, Lars Daniel

REFERENCE BOOKS

1. Security Architecture: Design, Deployment and Operations by Christopher King, Curtis Dalton, T.Ertem Osmanoglu
2. Information Security: Principles and Practices by Mark Merkow, Jim Breithaupt
3. Internet Security: A Jumpstart for Systems Administrators and IT managers by Tim Speed and Juanita Ellis
4. Web Hacking-Attacks and Defence by Stuart McClure, Saumil Shah, Shreeraj Shah
5. Computer Security Principles and Practices: William Stallings and Larry Brown Pearson edition