



M.E / M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

DATA SCIENCE

24DSI504: Artificial Intelligence and Machine Learning

COURSE OUTCOMES

- CO1:** Understand and apply advanced machine learning algorithms and techniques to solve complex problems.
- CO2:** Design, implement, and evaluate AI models using state-of-the-art tools and frameworks.
- CO3:** Develop and deploy AI systems that address real-world challenges in various domains.
- CO4:** Evaluate and optimize AI and ML models for performance, accuracy, and scalability
- CO5:** Apply reinforcement learning algorithms to solve problems using open platforms.

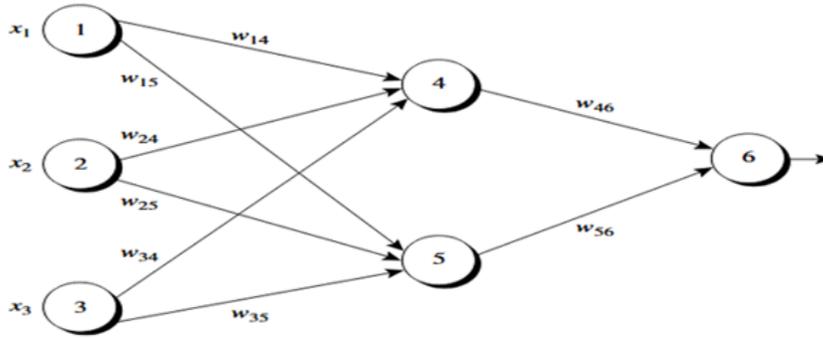
Time: Three Hours

Maximum Marks: 100

PART A (4*20 = 80 Marks)

- | | | | | | |
|----|----|---|----|-----|-------------------|
| 1. | a) | You have a dataset containing 10,000 features, and you believe that many of them might be redundant. Explain how Principal Component Analysis (PCA) can be used to address this issue and outline the process for identifying the optimal number of principal components. | 10 | CO1 | [K ₃] |
| | b) | Suppose you are tasked with generating captions for images. Would you choose a CNN-RNN model or a Transformer-based model? Justify your decision by analyzing the strengths and limitations of both architectures in this context. | 10 | CO4 | [K ₄] |
| 2. | a) | How does a GAN (Generative Adversarial Network) work, and what are the main ways it differs from other machine learning models? | 10 | CO2 | [K ₃] |
| | b) | Explain ADA boosting algorithm with neat sketch | 10 | CO3 | [K ₂] |
| 3. | a) | Explain the back-propagation algorithm.
Consider a multilayer feed-forward neural network given below. Let the learning rate be 0.9. Assume the initial values of weights and biases as given in the table below. Show the weight and bias updates by using back-propagation algorithm. Assume that sigmoid activation function is used in the | 10 | CO5 | [K ₄] |

network.



Initial Input, Weight, and Bias Values

x_1	x_2	x_3	w_{14}	w_{15}	w_{24}	w_{25}	w_{34}	w_{35}	w_{46}	w_{56}	θ_4	θ_5	θ_6
1	0	1	0.2	-0.3	0.4	0.1	-0.5	0.2	-0.3	-0.2	-0.4	0.2	0.1

- b) Explain Q Learning Algorithm with suitable illustration 10 CO5 [K₂]
- 4. a) Discuss how hyper parameter optimization impacts the performance of machine learning models. 10 CO4 [K₃]
- b) Elaborate the concept of multimodal learning, highlighting its mechanisms and providing relevant examples. 10 CO4 [K₂]

**Answer any ONE Question
PART B (1*20 = 20 Marks)**

- 5. a) Describe the working mechanism of Random Forests and discuss its advantages over individual decision trees. 10 CO2 [K₂]
- b) Compare t-SNE and UMAP, focusing on their use cases and differences. 5 CO1 [K₂]
- c) Describe the architecture and working of Auto encoders. How are they used for representation learning? 5 CO3 [K₂]

OR

- 6. a) Describe the concept of adversarial attacks and explain how they pose threats to AI models. 10 CO3 [K₂]
- b) Describe the challenges of making deep learning models explainable. Provide examples. 5 CO4 [K₂]
- c) Outline the key components of an AI governance framework. 5 CO5 [K₂]
