	COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY **DEPARTMENT OF COMPUTER SCIENCE**

Programme: Seventh Semester MSc (Five-Year Integrated) in Computer Science, Artificial Intelligence & Data Science
Course Code & Title: 21-805-0703 Deep Learning

Name of Examination: Series I		Max. Marks: 20	Semester: VII
Batch: 2022-27	Duration: 2 Hours	Date: 17.09.2025	Time: 9:00 AM – 11:00 AM

Answer all questions

1. (i) Describe the Multi-Layer Perceptron Learning algorithm.
(3 marks) [CO1, DL-1, BTL-2]

   (ii) Derive the equation for updating weights in the Back Propagation algorithm
(3.5 marks) [CO1, DL-2, BTL-3]

2. What is the main limitation of using plain Stochastic Gradient Descent (SGD)? Explain SGD, Ada-Grad, RMS-Prop, and Adam optimizers' update rules.
(3.5marks) [CO2, DL-3, BTL-3]

3. How to Reduce Overfitting in Neural Networks? Briefly explain each method.
(3 marks) [CO2, DL-2, BTL-2]

4. How Does a GAN Work? Briefly explain different types of GAN Models.
(3 marks) [CO2, DL-2, BTL-2]

5. (i) Explain the structure of the CNN architecture. What is the purpose of pooling in a CNN?
(2 marks) [CO3, DL-1, BTL-2]

   (ii) Mention why Alex-Net performed significantly better than earlier CNNs. Also, draw the Alex-Net architecture.
(2 marks) [CO3, DL-2, BTL-3]

Cochin University of Science and Technology
Department of Computer Science

23-813-0706 Reinforcement Learning

I Term, Date: Sept 19, 2025

Timing: 09:00 AM to 11:00 AM | VII Semester | Max Marks: 20

Attempt ALL Questions

1. (a) How Reinforcement Learning (RL) is different from other forms of AI. Highlight how RL agents learn from direct interaction and feedback rather than from labeled datasets. Contrast this with a supervised learning model that explicitly tells the correct output for a given input. **(Marks 3, CO2, DL 2, BLT 1,2)**

   (b) What are the main components of a reinforcement learning problem and what role does each component play in the agent-environment interaction cycle? **(Marks 2, CO2, DL 2, BLT 1,2)**

2. (a) Describe the exploration-exploitation trade-off and explain why it is a fundamental challenge unique to Reinforcement Learning. Provide an example to illustrate this dilemma, distinguishing between an agent that solely exploits its current knowledge to maximize immediate reward and one that explores to potentially discover better long-term strategies. **(Marks 2, CO1, DL 1, BLT 1,2)**

   (b) How do the concepts of the State-Value Function $V_\pi(s)$ and the Action-Value Function $Q_\pi(s, a)$ differ? and how are they related mathematically? **(Marks 3, CO2, DL 2, BLT 1,2)**

3. (a) Consider a simple logistics problem where a delivery robot needs to learn the optimal path to deliver a package from a warehouse to a customer's house in a new, unknown neighborhood. Formulate this problem as a Reinforcement Learning problem by identifying and describing the key components of RL. **(Marks 2, CO1, DL 1, BLT 1,2)**

   (b) Derive the state-value function from the action-value function. **(Marks 3, CO1, CO2 DL 2, BLT 1,2)**

4. (a) Clearly define the Binary Bandit Problem. Write the ϵ-Greedy Algorithm. What problem does it solve? **(Marks 2, CO2, DL 1, BLT 1,2)**

   (b) Explain the core idea behind Value Iteration and Policy Iteration. How each algorithm approaches the process of finding an optimal policy? **(Marks 3, CO1, DL 1, BLT 1,2)**

Cochin University of Science and Technology

Department of Computer Science

Seventh Semester M.Sc. (Five Year Integrated) in Computer Science (Artificial Intelligence & Data Science)

First Series Examination - September 2025

21-805-0702: Digital Image and Video Processing

Duration : 2 Hrs

Maximum Marks : 20

Answer all questions.

1. Define histogram of an image. Illustrate the concept of histogram matching in detail. [4 marks][CO2, DL-2, BTL-2]

2. Compute the 2D linear convolution between the following two signals:

$$x(m,n) = \begin{bmatrix} 4 & 5 & 8 & 9 \\ 6 & 7 & 9 & 8 \\ 4 & 5 & 4 & 5 \end{bmatrix} \text{ and } h(m,n) = \begin{bmatrix} -2 & 0 & 2 \\ -2 & 0 & 2 \\ -2 & 0 & 2 \end{bmatrix}$$

[4 marks][CO1, DL-2, BTL-3]

3. With the help of neat sketches explain any two intensity transformation functions in detail. [4 marks][CO2, DL-2, BTL-2]

4. Compute the 2D DFT of the following 2D signal:

$$\begin{bmatrix} 2 & 3 & 1 & 2 \\ 2 & 3 & 3 & 2 \\ 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 4 \end{bmatrix}$$

[4 marks][CO3, DL-2, BTL-3]

5. Illustrate the working principle of homomorphic filtering in detail. [4 marks][CO3, DL-2, BTL-2]

Cochin University of Science And Technology

Department of Computer Science

Seventh Semester M.Sc. (Five-Year Integrated) in Computer Science (Artificial Intelligence & Data Science)

First Series Examination – September 2025

21-805-0701: Computational Linguistics

Duration: 2 Hours

Maximum Marks: 20

Answer all questions.

1. a. Define Computational Linguistics. Differentiate between theoretical and applied linguistics.

   [CO1, DL-1, BTL-1] 2 marks

   b. How lexical ambiguity is different from syntactic ambiguity? Explain with examples.

   [CO1, DL-2, BTL-2] 3 marks

2. a. Differentiate between derivational and inflectional morphology with a suitable example for each.

   [CO1, DL-2, BTL-3] 3 marks

   b. What are Regular Expressions? What is their role for more complex natural language processing tasks?

   [CO2, DL-2, BTL-2] 2 marks

3. Briefly describe the concept of a 'Noisy Channel Model'. How it applies to spelling correction?

   [CO3, DL-2, BTL-3] 5 marks

4. a. What are N-grams? What is the purpose of N-grams in Computational Linguistics?

   [CO1, DL-1, BTL-1] 2 marks

   b. Explain the Minimum Edit Distance algorithm. How it is calculated and what are its primary applications in NLP?

   [CO2, DL-2, BTL-2] 3 marks