Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: MCA III
Name of the Paper: Machine Learning-II
Paper Code: TMC-311
Time: 3 hours **Maximum Marks: 100**

Note:
(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. Describe the working of Bagging. How does it reduce variance in machine learning models? (CO1)

b. Describe the architecture of a Convolutional Neural Network. Explain the role of convolution and pooling layers. (CO2)

c. A simple Recurrent Neural Network often fails to learn from information that appeared much earlier in a sequence. Explain how a Long Short-Term Memory network overcomes this problem. In your explanation, be sure to mention the key feature that allows it to handle long-range dependencies, the names and simple roles of its three gates, and the name of its central memory pathway. (CO3)

Q2. (2X10=20 Marks)

a. Explain Boosting with an example. How does it improve model accuracy compared to Bagging? (CO1)
b. Explain the primary benefits and key challenges of leveraging cloud computing platforms (such as AWS, Azure, or Google Cloud) for developing, training, and deploying large-scale Machine Learning models. (CO2)
c. Differentiate and compare Gaussian Mixture Models and Spectral Clustering algorithms. (CO3)

Q3. (2X10=20 Marks)

a. Define Random Forest? Explain how multiple decision trees are combined to give a final prediction. (CO1)
b. Discuss the concept of Dimensionality Reduction in Machine Learning, describing two main categories of techniques. Furthermore, detail the steps and primary objective of the Principal Component Analysis algorithm and state two key benefits of applying dimensionality reduction to a dataset (CO2)
c. What is the name of the table that the core Q-Learning algorithm uses to store its learned knowledge? What does each entry in this table represent? (CO4)

Q4. (2X10=20 Marks)

a. Explain the working of Autoencoders for dimensionality reduction. How do the encoder and decoder function? (CO1)
b. Why is continuous Model Performance Tracking crucial post-deployment? Differentiate between Concept Drift and Data Drift. Finally, list the standard metrics used to track and alert on a deployed classification model versus a regression model.? (CO3)
c. Tokenization is often the very first step. What is the goal of the tokenization process? Provide a simple example by tokenizing the sentence: "I'm loving it! (CO4)

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Q5. (2X10=20 Marks)

a. Explain the ARIMA and SARIMA models. How do they differ in terms of handling trend and seasonality in time-series forecasting? (CO1)

b. Explain Spectral Clustering? Explain the role of similarity matrix and eigenvalues in this method. (CO2)

c. In the context of AI, what is the fundamental difference between a black-box model and an interpretable or white-box model? Provide one example of each. What does the acronym LIME stand for? (CO5)