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Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VII - THEORY EXAMINATION (2024 - 2025)

Subject: Application of Machine learning in Biotechnology

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. Which of the following is NOT a common application of ML in drug discovery? (CO1, K3) 1

(a) Predicting drug-target interactions

(b) Identifying potential drug candidates

(c) Assessing the taste of drugs

(d) Analyzing chemical compound structures

1-b. Which ML technique is suitable for predicting the toxicity of chemical compounds? (CO1, K2) 1

(a) Logistic Regression

(b) Recurrent Neural Networks (RNN)

(c) Decision Trees

(d) K-Means clustering

1-c. What is the primary goal of predicting RNA secondary structure using ML? (CO2, K2) 1

(a) Identifying sequence motifs

(b) Predicting protein function

(c) Predicting the three-dimensional structure

(d) Predicting RNA base pairings

1-d. In metabolomics research, ML is used to predict metabolic pathways and 1

metabolic flux analysis based on: (CO2, K3)

(a) RNA-Seq data
(b) Protein structures
(c) Metabolomics data
(d) Gene expression data

1-e. Anomaly detection in healthcare using ML is primarily used for: (CO3, K3) 1

(a) Detecting unusual patient behavior
(b) Identifying rare diseases
(c) Finding errors in medical billing
(d) Predicting the weather

1-f. ML can assist in optimizing resource allocation during health crises like pandemics by: (CO3, K2) 1

(a) Ignoring data
(b) Predicting demand and allocating resources accordingly
(c) Distributing resources randomly
(d) Closing healthcare facilities

1-g. What is the main advantage of using ML models for water quality prediction in rivers and lakes? (CO4, K2) 1

(a) They rely on manual data collection.
(b) They can provide real-time monitoring.
(c) They require no data input.
(d) They are immune to environmental changes.

1-h. Which ML technique is often used for species identification in environmental bioengineering through image analysis? (CO4, K2) 1

(a) Principal Component Analysis (PCA)
(b) k-Nearest Neighbors (k-NN)
(c) Linear Regression
(d) Naive Bayes Classifier

1-i. Which of the following is a common challenge in unsupervised machine learning? (CO5, K2) 1

(a) Feature selection
(b) Data preprocessing
(c) Clustering
(d) Classification

1-j. What is the main goal of transfer learning in machine learning? (CO5, K2) 1

(a) Sharing trained models among researchers
(b) Applying knowledge from one task to improve performance on another task
(c) Transferring data between different domains

(d) Reducing the dimensionality of data

2. Attempt all parts:-

2.a.	What is ADME, and why is it important in drug discovery? (CO1, K2)	2
2.b.	What is the role of ML in predicting protein secondary structure? (CO2, K2)	2
2.c.	What is the role of ML in personalized medicine? (CO3, K2)	2
2.d.	How can ML assist in urban green space design for environmental sustainability? (CO4, K2)	2
2.e.	What is the "curse of dimensionality," and how does it pose a challenge in machine learning? (CO5, K2)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Describe the role of Machine Learning in predicting drug-target interactions. Provide examples of ML algorithms used for this purpose. (CO1, K2)	6
3-b.	Describe how Machine Learning models predict drug-drug interactions (DDIs). Discuss the significance of DDI prediction in drug safety. (CO1, K2)	6
3-c.	How can machine learning techniques assist in predicting protein secondary structure from amino acid sequences? (CO2, K2)	6
3-d.	Discuss the application of convolutional neural networks (CNNs) in gene expression data analysis. (CO2, K3)	6
3.e.	Describe the role of natural language processing (NLP) in healthcare ML applications. (CO3, K2)	6
3.f.	Describe the role of ML techniques used in predicting and managing air quality in urban environments with examples. (CO4, K2)	6
3.g.	Discuss the challenges and opportunities presented by the integration of machine learning and the Internet of Things (IoT) in various industries. Provide examples of how IoT data can be leveraged for predictive analytics. (CO5, K3)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Explain the concept of telemedicine and how Machine Learning is applied to enhance telemedicine services in Precision Medicine.(CO1, K2)	10
4-b.	Explain the concept of disease diagnosis and prognosis using ML. Provide a detailed overview of the steps involved in developing and deploying ML models. (CO1, K2)	10

5. Answer any one of the following:-

5-a.	Describe the importance of feature selection in gene expression analysis with ML. (CO2, K2)	10
5-b.	How can ML be applied to identify key regulators in biological pathways? (CO2, K2)	10

6. Answer any one of the following:-

6-a.	Discuss the use of ML in pharmaceutical research and clinical trials. (CO3, K2)	10
6-b.	What are the challenges of using ML for predicting patient outcomes? (CO3, K2)	10
7. Answer any <u>one</u> of the following:-		
7-a.	Discuss the application of predictive models of machine learning in sustainable wastewater and sewage system management with examples of improving wastewater treatment and management. (CO4, K3)	10
7-b.	Explain how feature selection methods in machine Learning contributes to the prediction and management of invasive species in natural ecosystems. (CO4, K3)	10
8. Answer any <u>one</u> of the following:-		
8-a.	What are the ethical challenges associated with using machine learning in decision-making systems, and how can we ensure fairness and accountability in ML algorithms? (CO5, K3)	10
8-b.	What are the challenges and opportunities in the integration of quantum computing and machine learning? How might quantum machine learning revolutionize the field? (CO5, K3)	10