विश्वजीवनामृतं ज्ञानम्

Atal Bihari Vajpayee Indian Institute of Information Technology & Management, Gwalior

IT306: Machine Learning

Major Examination (Session 2023–24)

Maximum Time: 3 Hours **Max Marks: 60**

Note: Answer all questions. Clearly mention assumptions and steps in derivations.

1. (a) Explain the perceptron learning algorithm with a flowchart. (b) Train a perceptron to classify the AND function with suitable initialization. (10 Marks)

2. (a) Derive the gradient descent algorithm for minimizing mean squared error. (b) Apply one step of gradient descent to a dataset of your choice with learning rate $\alpha = 0.1$. (10 Marks)

3. (a) Discuss Naïve Bayes classification. (b) Classify whether a student passes or fails based on the following dataset using Naïve Bayes:

Hours	*Attendance*	*Result*
High	*High*	*Pass*
Low	*High*	*Pass*
Low	*Low*	*Fail*
High	*Low*	*Pass*

(10 Marks)

4. What are support vector machines (SVM)? Derive the optimization problem for a linear SVM and explain the role of kernel trick. (10 Marks)

5. (a) Explain PCA for dimensionality reduction. (b) Compute the principal components for covariance matrix $\Sigma = 21$
12. (10 Marks)

6. Write short notes on any two: (i) Ensemble methods (Bagging and Boosting) (ii) Cross-validation techniques (iii) Applications of reinforcement learning (10 Marks)