BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: IMSc **SEMESTER : VI**
BRANCH: QEDS **SESSION : SP/2025**

SUBJECT: ED317 STATISTICAL MACHINE LEARNING

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

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Q.1 Consider a hypothesis space where each hypothesis is represented as a tuple of four attributes: (Weather, Temperature, Humidity, Wind). Given the following training examples: [5]

Weather	Temperature	Humidity	Wind	PlayTennis	Weather
Sunny	Hot	High	Weak	No	Sunny
Sunny	Warm	High	Strong	Yes	Sunny
Rainy	Cold	Low	Strong	No	Rainy

a) Apply the Candidate Elimination Algorithm, starting with the most specific hypothesis (∅, ∅, ∅, ∅), and the most general hypothesis (?,?,?,?,?).
b) Determine the final General and Specific hypotheses after processing the training examples.

Q.2(a) How do bias, variance, and accuracy relate to overfitted, underfitted, and optimally fitted models? Illustrate the relationship using a comparison curve. [3]

Q.2(b) How is semi supervised learning different from supervised and unsupervised learning? Explain briefly. [2]

Q.3(a) Describe the Find-S algorithm in the context of concept learning. Explain its working and key steps. [3]

Q.3(b) Illustrate the concept of an inductive system and its corresponding deductive system with a pictorial representation. [2]

Q.4 Explain the significance of regularization parameters in controlling model complexity during weight updates. Derive the gradient descent-based weight update rule for Ridge Regression, highlighting the impact of L2 regularization on the learning process. [5]

Q.5 Imagine you are working with a dataset of loan approvals. You are using a classifier with the regression equation Y= (−1) + 0.2x , where 'Y' represents regression outcome, and 'x' represents the applicant's credit score. No preprocessing is applied to the data. [5]

Applicant Id	Credit Score	Loan Approval (1=Yes, 0=No)
1	630	0
2	680	1
3	720	1
4	610	0
5	690	1
6	650	0
7	700	1
8	660	1
9	680	1
10	640	0

a) Calculate the probability of a loan being approved for an applicant with a credit score of 650.
b) Determine the minimum credit score required for an applicant to have a loan approval probability of 80% or higher.

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