R22 Regulation *Subject code: 4E6EC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VI Semester Supplementary Examinations, November 2025

MACHINE LEARNING

(CSE)

Maximum Marks: 60 Date:11.11.2025 Duration: 3 hours

Note:
1. **This question paper contains two parts A and B.**
2. **Part A is compulsory which carries 10 marks. Answer all questions in Part A.**
3. **Part B consists of 5 Units. Answer any one full question from each unit.**
4. **Each question carries 10 marks and may have a, b, c, d as sub questions.**

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	List the stages of the machine learning process.	1M	CO1	1
b)	In machine learning, what does the term "linear separability" refer to?	1M	CO1	1
c)	What is the main purpose of interpolation in machine learning?	1M	CO2	1
d)	Define the term "basis functions" in the context of Radial Basis Function Networks	1M	CO2	1
e)	In decision trees, what is the criterion used to split nodes?	1M	CO3	2
f)	How do ensemble methods combine multiple classifiers?	1M	CO3	1
g)	How does Isomap differ from traditional PCA?	1M	CO4	2
h)	What is the key idea behind Least Squares Optimization?	1M	CO4	1
i)	What is the primary assumption in a Hidden Markov Model (HMM)?	1M	CO5	1
j)	How is the Kalman filter used in tracking problems?	1M	CO5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	Explain the structure and functioning of a biological neuron. How artificial neurons are in a neural network modeled after biological neurons, and what are the key components of an artificial neuron?	10M	CO1	3
	OR			
3	Explain the concept of version spaces and the Candidate Elimination algorithm. How does the Candidate Elimination algorithm help in narrowing down the hypotheses space in the process of learning a concept?	10M	CO1	2
4	What is back propagation in the context of neural networks? Derive the back propagation algorithm for a simple 2-layer network and explain how it minimizes the error during training using example.	10M	CO2	3
	OR			
5	Discuss the role of Support Vector Machines (SVM) in classification tasks. How do SVMs work to find the optimal hyperplane and what is the role of support vectors? Explain how SVMs can be extended to non-linear classification using the kernel trick.	10M	CO2	3

<table>
<tr><td>6</td><td>Demonstrate the KNN algorithm. Predict the shirt size for a customer with measurement {161cms, 61Kgs} by finding the nearest three neighbors for the below given dataset.
<table>
<tr><th>Height in Cms</th><th>Weight in Kgs</th><th>T-shirt Size</th></tr>
<tr><td>158</td><td>58</td><td>M</td></tr>
<tr><td>158</td><td>59</td><td>M</td></tr>
<tr><td>160</td><td>59</td><td>M</td></tr>
<tr><td>160</td><td>60</td><td>M</td></tr>
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<tr><td>168</td><td>66</td><td>L</td></tr>
<tr><td>170</td><td>64</td><td>L</td></tr>
<tr><td>170</td><td>68</td><td>L</td></tr>
</table></td><td>10M</td><td>CO3</td><td>4</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Explain the concept of Ensemble Learning in machine learning with example. How do ensemble methods combine the predictions of multiple models and what are the advantages of using ensemble learning over a single model.</td><td>10M</td><td>CO3</td><td>3</td></tr>
<tr><td>8</td><td>Describe the process of Principal Component Analysis (PCA). How does PCA reduce dimensionality while retaining as much information as possible? What are the limitations of PCA?</td><td>10M</td><td>CO4</td><td>2</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>9</td><td>Explain is the role of Least Squares Optimization in machine learning models? Discuss how it is used in linear regression and discuss its limitations when dealing with large datasets or multicollinearity.</td><td>10M</td><td>CO4</td><td>3</td></tr>
<tr><td>10</td><td>Explain the concept of Reinforcement Learning. How does an agent learn a policy by interacting with the environment? Provide an example to illustrate how RL works.</td><td>10M</td><td>CO5</td><td>3</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>11</td><td>Discuss the process of Markov Chain Monte Carlo (MCMC) sampling. Explain the role of the proposal distribution and the acceptance-rejection rule in generating samples from the target distribution.</td><td>10M</td><td>CO5</td><td>2</td></tr>
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