Course Code : CSTM 61 **SUVT/MS – 22 / 2571**

Sixth Semester Bachelor of Engineering Examination

AI AND MACHINE LEARNING

Time : 2 Hours] [Max. Marks : 40

Instructions to Candidates :—

(1) Assume suitable data wherever necessary.
(2) Each Question carries marks as indicated against it.
(3) Draw neat sketches whenever necessary.

1. A milkman has three containers of capacities 8 gallons, 5 gallons and 3 gallons. The 8-gallons container is full of milk. How can he divide the milk into two 4-gallon portions without using anything but the available three containers ?

   (i) Give the state space representation of this problem.

   (ii) What are the intermediate states to get from (8, 0, 0) to (4, 4, 0) ?

   (iii) Write the production rules for the given problem. 7 (CO 1)

2. Give an initial state of a 8-puzzle problem and final state to be reached —

   Initial State :

2	8	3
1	6	4
7		5

   Final State :

1	2	3
8		4
7	6	5

   Find the most cost-effective path to reach the final state from initial state using A* Algorithm.
   Consider g(n) = Depth of node and h(n) = Number of misplaced tiles. 7 (CO 1)

3. Consider the dataset given below for classification of tree as Oak and pine :—

(i) Use ID3 algorithm to construct the decision tree.

(ii) Write decision rules from the decision tree.

Example	**Density**	**Grain**	**Hardness**	**Class**
Example #1	Heavy	Small	Hard	Oak
Example #2	Heavy	Large	Hard	Oak
Example #3	Light	Large	Soft	Oak
Example #4	Light	Large	Hard	Pine
Example #5	Heavy	Small	Soft	Pine
Example #6	Heavy	Large	Soft	Pine

7 (CO 2)

4. (a) Assume $k = 2$, Initial cluster centroids are $A(1, 1)$ and $C(0, 2)$. Apply k-means clustering algorithm. Show the final clusters and plot.

Sample	X1	X2
A	1	1
B	1	0
C	0	2
D	2	6
E	4	5

5 (CO 2)

(b) Apply k-NN algorithm on following dataset and find the value of Target function "C" for new instance when $A = 4$ and $B = 7$.
Use $k = 3$.

A	B	C (Target Function)
1	6	Yes
4	5	No
6	4	No
2	6	Yes
8	4	Yes

2 (CO 3)

5. Design a two input perceptron that implements the Boolean function NAND. Draw neat sketch. Find out the weight vector and its direction. 6 (CO 3)

6. It is estimated that the prior probability of having heart disease (H) is 0·01. Generally, the probability of testing positive when the patient has heart disease is 90% and the probability of testing negative when the patient do not has heart disease is 89·9% :

   (i) Find the prior probability of having a positive test P(POS).

   (ii) If a patient has been tested positive, find the probability that the patient has heart disease ? [Apply Bayes Theorem]. 6 (CO 4, CO 2)