NDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA
Mid Semester Examination for Academic Session 2024-25

E: **B. TECH** SEMESTER: **4TH**

BRANCH NAME: **CIVIL ENGINEERING**

SUBJECT NAME: **ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

MARKS: **30** TIME: **90 Minutes**

Answer **All** Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. **[2 × 3]**

a) Differentiate between uninformed search and informed search. - CO1

b) Differentiate between knowledge and belief with appropriate example. - CO2

c) Provide a brief explanation and classify the different types of Machine Learning. - CO3

Q2. - CO1

a) The city's road network consists of five intersections: A, B, C, D, and E, connected by roads with specific travel times. The fire truck can travel from A to B in 4 minutes and from A to C in 6 minutes. From intersection B, it can reach D in 5 minutes, while from C, it can reach D in 3 minutes or go directly to E in 7 minutes. Lastly, the shortest connection between D and E takes 2 minutes. The goal is to determine the fastest route from the fire station at A to the fire incident location at E using State Space Representation. **[8]**

OR

b) A civil engineer is designing a road network connecting multiple cities. Each road has a construction cost, and the engineer wants to find the least expensive route by using UCS algorithm to connect the source city (A) to a destination city (E). Also, prepare tree representations of the scenario mentioned below. *[8]*

The city road network consists of multiple routes connecting different locations with associated travel costs. The source location, A, has roads leading to B with a cost of 4 and C with a cost of 2. From B, there are connections to D with a cost of 3 and E with a cost of 6. Location C connects to B with a cost of 1 and D with a cost of 5. From D, there is a direct road to E with a cost of 2. Finally, E is the goal location and has no further outgoing connections.

Q3. - CO2

a) A high-rise building is structurally safe if it meets at least two of these criteria: column strength ≥ 40 MPa, seismic resistance ≥ 1.5, or wind load resistance ≥ 2.0 kN/m². If column strength is below 40 MPa, then seismic resistance must be at least 1.8. Write logic, an algorithm, and a Python program to assess safety. **[8]**

OR

b) Compare propositional logic and predicate logic, highlighting their key differences. Additionally, provide an example of how a general statement can be converted into both propositional and predicate logic representations. **[4]**

c) A cantilever beam is fixed at A and subjected to point loads: 400N at B, 300N at C, 800N at D, and 500N at E, with each section 0.5m long. At A, the reaction force is 2000N, and the moment is 2700Nm. Write a Python program to compute Shear Force and Bending Moment. **[4]**

Q4.

- CO3

a) A highway section is monitored for traffic density (vehicles/km) at six different locations: [10, 12, 20, 22, 100, 105] **[8]**
Apply K-Means clustering (K=2) using 10 and 100 as initial centroids and perform one full iteration.
After updating centroids, check if a third cluster (K=3) would be more suitable.

OR

b) You have measured concrete slump values (mm) from different batches: **[8]**
[15, 18, 20, 25, 70, 75]
Apply one iteration of K-Medoids clustering (K=2) with initial medoids as (15, 70) and check if swapping improves the total cost.