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**END-TERM EXAMINATION, ODD SEMESTER DECEMBER 2024**

**COURSE CODE: CSET 326**  
**COURSE NAME: Soft Computing**  
**PROGRAM: B.Tech**

**MAX. DURATION: 2 HRS**

**TOTAL MARKS: 40**

Mapping of Questions to Course and Program Outcomes								
Q.No.	A1	A2	A3	B1	B2	B3	C1	C2
CO	3	3	2	3	3	2	3	1
PO	1-5,12	1-5,12	3,4,12	1-5,12	1-5,12	3,4,12	1-5,12	1,2
BTL	2	2	4	2	3	3	2	3

**GENERAL INSTRUCTIONS: -**

1. Do not write anything on the question paper except **name, enrolment number and department/school**.
2. Carrying mobile phones, smartwatches and any other non-permissible materials in the examination hall is an act of UFM.

**COURSE INSTRUCTIONS:**

- a) If any question has the missing value, make your own assumptions and solve the problem by including your assumptions.

**SECTION A**

[3Q × 4 Marks = 12 Marks]

- A1) Define Multi-Objective Optimization and explain the challenges associated with solving multi-objective problems with the help of suitable examples. [2+2=4 Marks]
- A2) How do Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) differ in their search mechanisms? [4 Marks]
- A3) Using the McCulloch-Pitts neuron model, design a neural network to implement the OR logic gate. Explain all technical details with the help of suitable examples. [3+1=4 Marks]

**SECTION B**

[3Q × 6 Marks = 18 Marks]

- B1)
  - a. Discuss the practical applications, strengths, and weaknesses of Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) in solving optimization problems.
  - b. Explain the working principles and architecture of Artificial Bee Colony Optimization.

[3+3=6 Marks]

- B2)** Ramesh is travelling to ten cities with the help of the Traveling Salesman Problem (TSP). He used a Genetic algorithm to optimize his travelling route. After selection, he has the two best chromosomes named Parent 1 and Parent 2, given below:

Parent 1: [3, 7, 2, 9, 4, 6, 5, 8, 1, 10]

Parent 2: [5, 8, 1, 10, 7, 4, 3, 9, 2, 6]

Generate two offspring by applying Order Crossover (OX) to each of the following points:

- Index 2 as crossover point.
- Index 4 as crossover point.
- Index 7 as crossover point

[2+2+2=6 Marks]

- B3)** Given a population of individuals with fitness values:  $\{F1=12, F2=25, F3=30, F4=40\}$ . Calculate the probabilities of each individual using Roulette Wheel Selection. Then, explain how Rank Selection would affect these probabilities.

[6 Marks]

### SECTION C

[2Q × 5 Marks = 10 Marks]

- C1)** Compare the Pareto-based approach with the non-Pareto-based approach regarding their methodologies, advantages, and limitations. Discuss situations where one approach may be preferred over the other.
- [5 Marks]
- C2)** Nicolas has two fuzzy sets  $A = \{(x1, 0.4), (x2, 0.8), (x3, 0.6)\}$  and  $B = \{(y1, 0.7), (y2, 0.5)\}$  and he wants to calculate:
- Cartesian Product of set A and B
  - Height of both fuzzy set
  - Find alpha cut at  $\alpha=0.4, \alpha=0.5, \alpha=0.7, \alpha=0.8$ .

[ 2+1+2=5 Marks]