

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATIONS- 2026

M.Tech-II Semester (CSE)

COURSE CODE (CREDITS): 22M11CI211 (03)

MAX MARKS: 35

COURSE NAME: Soft Computing

COURSE INSTRUCTOR: ARV

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is not allowed

Q.No	Question	CO	Marks
Q1	a) Explain the architecture and working of Genetic Algorithm in detail. b) Discuss various selection strategies in Genetic Algorithms with examples.	3	6 [3+3]
Q2	a) Perform Position-Based Crossover on the following parents for selected positions 2, 5, 7 P1= A B C D E F G H P2= H G F E D C B A b) Perform Precedence Preservation Crossover on the following parents P1= A B C D E F G H P2= H G F E D C B A Assume Random vector: [1, 2, 1, 2, 1, 2] c) Apply Edge Recombination Crossover (ERX) for the following TSP chromosomes: P1=1 2 4 6 8 7 5 3 P2=4 3 5 7 8 6 2 1 Construct offspring using Edge Recombination method.	4	6 [2+2+2]
Q3	Consider the problem of finding the shortest route through several cities, such that each city is visited only once and in the end return to the starting city (the Travelling Salesman problem). Suppose that in order to solve this problem we use a genetic algorithm, in which genes represent links between pairs of cities. For example, a link between London and Paris is represented by a single gene 'LP'. Let also assume that the direction in which we travel is not important, so that LP = PL.	4	6 [3+3]

	a) How many genes will be used in a chromosome of each individual if the number of cities is 10? b) How many genes will be in the alphabet of the algorithm?		
Q4	Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: $f(x) = (a+b)-(c+d)+(e+f)-(g+h)$, and let the initial population consist of four individuals with the following chromosomes: $x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$ $x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$ $x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5$ $x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$ a) Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last. b) Perform the following crossover operations: i) Cross the fittest two individuals using one-point crossover at the middle point. ii) Cross the first and third fittest individuals using a two-point crossover (positions 2 and 6). iii) Cross the second and third fittest individuals using a uniform crossover (positions 1, 4, and 6). c) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question (part b). Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved?	3	11 [4+3+4]
Q5	a) What is the concept of crossover in Genetic Algorithm? Explain any two methods of crossover that are possible in genetic algorithms. b) Explain mutation operation with example. Apply Linear Fitness Scaling on the following: Given: $f(x) = 2f(x) + 1$ Fitness values: [5, 10, 15]	4	6 [3+3]