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 SHARDA UNIVERSITY <i>Beyond Boundaries</i>		School of Computing Science and Engineering Department of: Computer Science and Engineering				
Assignment-2, Session: 2026-2027 [Programme: B.Tech. CSE] [Semester: V]						
Course Title: Soft Computing Course Code: CSA301				Max Marks: 20		
Instructions:		1. All questions are compulsory 2. Assume missing data suitably, if any 3. All questions should be of higher learning.		BTL Level (K)		
Unit 3 Unit 4 Unit 5	CO3: Explain applications & operations of Fuzzy Logic in real life problems.					
	CO4: Apply different FIS models to solve optimization problems.					
	CO5: Analyze and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems					
	CO6: Choose of different optimization algorithms to solve real-life multi objective problems.					
Q.No.	Section A (3×4=12 Marks)			Unit	COs	K
1	A first-order Sugeno system has two rules: R1: IF x is A ₁ THEN z ₁ = 2x + 3; R2: IF x is A ₂ THEN z ₂ = x + 1. At x = 5 the firing strengths are w ₁ = 0.4 and w ₂ = 0.6. Compute the normalized weights and the crisp output, showing every step. Repeat for a three-rule system with w = (0.2, 0.5, 0.3) and f = (10, 20, 30).			Unit 3	CO1	K1
2	Map any six terms of natural genetics (individual, chromosome, gene, allele, fitness, generation) to their counterparts in a Genetic Algorithm.			Unit 4	CO1	K2
3	Give the formal mathematical statement of a multi-objective optimization problem, defining the objective vector, the constraints and the feasible region.			Unit 5	CO2	K1
Section B (1×8=8 Marks)						
5	Consider maximizing $f(x) = x^2$ for $x \in [0, 31]$ using 5-bit encoding, with the initial population 01101, 11000, 01000, 10011. (a) Decode each string and compute its fitness and selection probability. (b) Perform single-point crossover on the two fittest strings at k = 4 and compute the fitness of the offspring. (c) Apply a bit-flip mutation to one offspring and comment on whether the population has improved after one generation.			Unit 4	CO1	K2