POORNIMA UNIVERSITY, JAIPUR
END SEMESTER EXAMINATION, 2023-2024 EVEN SEMESTER

Write Roll No Below: _____

MCA (General) - II Sem (Main/Back) End Semester Examination

MCAECA2112: Soft Computing

Time: 3 Hours **Total Marks:** 60 **Min. Passing Marks:** 21/24/27 **Question Paper ID:** 001283

Instructions: Attempt all five questions. There is an internal choice either (a or b) in Q1 to Q5. Marks of each question or its parts are indicated against each question/part. Draw neat sketches wherever necessary to illustrate the answer. Assume missing data suitably (if any) and clearly indicate the same in the answer.

Bloom Level(BL): 1-Remembering, 2-Understanding, 3-Applying, 4-Analysing, 5-Evaluating, 6-Creating

Use of following supporting material is permitted during examination for this subject:

			Marks	BL	CO
Q1.	**(a)**	(i) Explain the concept of soft computing and its significance in contemporary computing paradigms. How does it differ from traditional computing approaches, and what are its key components? **(6 Marks)** (ii) Define a computing system and elaborate on its fundamental elements. How does soft computing fit into the landscape of computing systems, and what advantages does it offer over conventional computing systems? **(6 Marks)**	**12**	**1**	**1**
		(OR)			
	(b)	(i) Analyze the practical applications of soft computing techniques across various domains, such as engineering, healthcare, finance, and pattern recognition. Provide specific examples illustrating how soft computing methods have been deployed to solve challenging problems effectively. **(6 Marks)** (ii) Evaluate the future prospects and emerging trends in the field of soft computing. How are advancements in machine learning, artificial intelligence, and computational intelligence shaping the evolution of soft computing techniques, and what implications do they hold for future research and applications? **(6 Marks)**			
Q2.	**(a)**	(i) Define fuzzy logic and elucidate its fundamental principles in handling uncertainty and imprecision in decision-making. How does fuzzy logic extend traditional binary logic, and what are its key advantages in representing and processing vague information? **(6 Marks)** (ii) Explore the operations on fuzzy sets, including union, intersection, and complementation. How do these operations differ from their counterparts in classical set theory, and how are they applied in fuzzy logic to manipulate fuzzy sets? **(6 Marks)**	**12**	**1**	**2**
		(OR)			
	(b)	(i) Explain the concept of fuzzy sets and membership functions in fuzzy logic. Discuss how membership functions quantify the degree of membership of elements in a fuzzy set, and provide examples illustrating the application of different types of membership functions. **(6 Marks)** (ii) Examine defuzzification techniques used to convert fuzzy output into crisp values for decision-making. Compare and contrast popular defuzzification methods such as centroid, mean of maximum (MOM), and weighted average techniques, highlighting their respective advantages and limitations. **(6 Marks)**			
Q3.	**(a)**	(i) Explain the basic structure and functioning of artificial neural networks (ANNs). Discuss the role of neurons, weights, biases, and activation functions in modelling complex relationships between input and output data. **(6 Marks)** (ii) Describe the process of training artificial neural networks through back propagation. Discuss how back propagation adjusts the network's weights to minimize prediction errors, and highlight the significance of gradient descent optimization algorithms in this process. **(6 Marks)**	**12**	**1**	**3**
		(OR)			
	(b)	(i) Explore different types of artificial neural network architectures, including feed forward, recurrent, convolutional, and self-organizing networks. Compare and contrast their characteristics, applications, and suitability for various types of data processing tasks. **(6 Marks)** (ii) Discuss the challenges associated with training artificial neural networks, such as over fitting, vanishing gradients, and computational complexity. Describe techniques such as regularization, dropout, and batch normalization used to mitigate these challenges and improve network performance. **(6 Marks)**			

			Marks	BL	CO
Q4.	**(a)**	(i) Explain the fundamental principles of genetic algorithms (GAs) and their inspiration from the process of natural selection and evolution. Discuss how GAs utilize selection, crossover, and mutation operators to iteratively evolve a population of candidate solutions toward optimal or near-optimal solutions. **(6 Marks)** (ii) Describe the key components of a genetic algorithm, including the representation of individuals, the fitness function, and the genetic operators. How do these components work together to drive the evolutionary search process and find solutions to optimization problems? **(6 Marks)**	**12**	**1**	**4**
		(OR)			
	(b)	(i) Explore the concept of ant colony optimization (ACO) and its inspiration from the foraging behavior of ants. Explain how ACO algorithms use pheromone trails and heuristic information to guide a population of artificial ants in finding optimal paths or solutions in complex problem spaces. **(6 Marks)** (ii) Compare and contrast genetic algorithms and ant colony optimization in terms of their problem-solving approaches, scalability, convergence properties, and applicability to different types of optimization problems. Provide examples illustrating the strengths and weaknesses of each approach. **(6 Marks)**			
Q5.	**(a)**	(i) Define multi-objective optimization (MOO) and discuss its significance in decision-making processes where multiple conflicting objectives need to be considered simultaneously. Explain how MOO differs from single-objective optimization and its relevance in real-world problem-solving contexts. **(6 Marks)** (ii) Explore the concept of a Pareto-based approach in multi-objective optimization. Describe the Pareto dominance relation and the notion of Pareto optimality, highlighting its importance in identifying trade-off solutions that cannot be improved in one objective without sacrificing performance in another. **(6 Marks)**	**12**	**1**	**5**
		(OR)			
	(b)	(i) Explain the concept of Multi-Objective Evolutionary Algorithms (MOEAs) and their role in solving multi-objective optimization problems. Describe popular MOEAs, such as NSGA-II (Non-dominated Sorting Genetic Algorithm II) and SPEA2 (Strength Pareto Evolutionary Algorithm 2), highlighting their key features and advantages. **(6 Marks)** (ii) Compare and contrast Pareto-based and non-Pareto approaches in terms of their ability to handle various types of optimization problems, computational complexity, convergence behavior, and scalability. Discuss scenarios where one approach may be more suitable than the other. **(6 Marks)**			

*****End of Question Paper*****