Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec-2023

EC3ET06 Metaheuristic Techniques

Programme: B.Tech. Branch/Specialisation: EC

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. The optimization problem involves: **1**

(a) Short computations (b) Zero computations

(c) Long computations (d) Span computations

ii. Optimization can be defined as- **1**

(a) Finding the conditions that give the maximum or minimum value of a function

(b) Finding the conditions that give the only maximum value of a function

(c) Finding the conditions that give the only minimum value of a function

(d) None of these

iii. Genetic Algorithm are a part of- **1**

(a) Evolutionary Computing

(b) Inspired by Darwin's theory about evolution - "survival of the fittest"

(c) Are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics

(d) All of these

iv. Concept of Elitism is- **1**

(a) The children replace two randomly chosen individuals in the population

(b) A weaker parent is replaced by a strong child

(c) The current fittest member of the population is always propagated to the next generation

(d) The new population of children completely replaces the parent selection

P.T.O.

v. Biologically inspired computation is not appropriate for- **1**
(a) Optimization (b) Modelling
(c) Safety critical systems (d) Simulation

vi. Ant Colony Algorithms is- **1**
(a) Based on the behaviour of ants seeking a path between their colonies.
(b) Initially proposed by Marco Dorigo in 1992.
(c) Constitutes some metaheuristic optimizations.
(d) All of these

vii. Particle Swarm Optimization (PSO) is- **1**
(a) The PSO algorithm maintains multiple potential solutions at one time
(b) During each iteration of algorithm, each solution is evaluated by an objective function to determine its fitness.
(c) Each solution is represented by a particle in the fitness ape (search space).
(d) All of these

viii. Particle Swarm Optimization (PSO)- **1**
(a) Does not use the gradient of the problem being optimized.
(b) Do not guarantee an optimal solution is ever found.
(c) Does not require that the optimization problem be differentiable as is required by classic optimization methods.
(d) All of these

ix. Bacterial Foraging Optimization Algorithm- **1**
(a) Is not a multi-optimal function optimization.
(b) Is to allow cells to stochastically and collectively swarm toward optima.
(c) Individual bacterium can't communicate with others by sending signals.
(d) All of these

x. Bacterial Foraging optimization theory is explained by following steps: **1**
(a) Chemotaxis-Swarming–Reproduction-Dispersal-Eliminational
(b) Swarming–Chemotaxis-Reproduction-Elimination-Dispersal
(c) Chemotaxis-Swarming–Reproduction-Elimination-Dispersal
(d) Chemotaxis–Reproduction-Swarming -Dispersal-Elimination

Q.2 i. What is no free lunch theorem? **3**
ii. Explain Multi-objective and Multi-model optimization. **7**

OR iii. What do you mean by optimization? Classify optimization algorithms in detail. **7**

Q.3 i. Explain the working principle of Genetic Algorithm. **3**
ii. What is fitness function? Explain the process of parent selection. **7**
OR iii. What is mutation? Explain the process of survivor selection. **7**

Q.4 i. What is double bridge problem? **3**
ii. Explain Ant Colony Optimization in detail. **7**
OR iii. Differentiate Honey Bee Algorithm and Virtual Bee Algorithm. **7**

Q.5 i. Explain the basic principle of Particle Swarm Optimization (PSO). **4**
ii. Explain various variations of PSO in detail. **6**
OR iii. Discriminate accelerated PSO and multimodal PSO. **6**

Q.6 Attempt any two:
i. Explain the concept of Chemotaxis and Swarming. **5**
ii. Differentiate fuzzy BFO and Adaptive BFO. **5**
iii. Explain BFOA with suitable example /application in detailed. **5**

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Marking Scheme

EC3ET06 / EI3ET06 Metaheuristic Techniques

Q.1	i.	c) Long computations	**1**
	ii.	a) finding the conditions that give the maximum or minimum value of a function	**1**
	iii.	d) All of the above	**1**
	iv.	c) The current fittest member of the population is always propagated to the next generation	**1**
	v.	c) Safety critical systems	**1**
	vi.	d) all of the above.	**1**
	vii.	d) all of the above.	**1**
	viii.	d) all of the above.	**1**
	ix.	b) Is to allow cells to stochastically and collectively swarm toward optima.	**1**
	x.	c) Chemotaxis-Swarming–Reproduction-Eliminational-Dispersal	**1**

Q.2	i.	No free lunch theorem	(As per explanation)
OR	ii.	Multi-objective	3.5 Marks
		Multi-model optimization	3.5 Marks
	iii.	Optimization	3.5 Marks
		Optimization algorithms in detailed.	3.5 Marks
Q.3	i.	Working principle of genetic algorithm	(As per explanation)
	ii.	Fitness function	3.5 Marks
		Process of parent selection.	3.5 Marks
OR	iii.	Mutation	2 Marks
		Process of survivor selection.	5 Marks
Q.4	i.	Double bridge problem	(As per explanation)
	ii.	Ant colony optimization in detailed	(As per explanation)
OR	iii.	Honey bee algorithm	3.5 Marks
		virtual bee algorithm.	3.5 Marks
Q.5	i.	Principle of Particle Swarm Optimization (PSO)	(1 Mark*4)
	ii.	Various variation of PSO in detailed.	(As per explanation)
OR	iii.	Accelerated PSO	3 Marks
		Multimodal PSO.	3 Marks
Q.6		Attempt any two:	
	i.	Concept of Chemotaxis	2.5 Marks
		Concept of Swarming.	2.5 Marks
	ii.	Differentiate fuzzy BFO	2.5 Marks
		Adaptive BFO.	2.5 Marks
	iii.	BFOA with suitable example	2.5 Marks
		Application in detailed.	2.5 Marks

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