

Duration: 3 Hours

[Max Marks: 80]

- N.B. : (1) Question No. 1 is compulsory.  
(2) Attempt any three questions out of the remaining five.  
(3) All questions carry equal marks.  
(4) Assume suitable data, if required and state it clearly.

1. Attempt any **FOUR** [20]
  - a) Distinguish between constrained and unconstrained optimization.
  - b) With the help of a suitable example, explain cross-entropy method under stochastic methods.
  - c) Compare first-order and second-order optimization.
  - d) What is convex optimization? Explain the approaches for performing convex optimization.
  - e) What is a fitness function in genetic algorithm?
  
2.
  - a) Explain gradient descent algorithm under first-order methods. [10]
  - b) Explain vector optimization with a suitable example. [10]
  
3.
  - a) Minimize  $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$  starting from the point  $X_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$  using Newton's method. [10]
  - b) Explain mesh adaptive direct search and its algorithm under stochastic methods. [10]
  
4.
  - a) How is tournament selection different from proportional selection? [10]
  - b) What are the effects of population size, mutation rate, and crossover rate on the performance of genetic algorithm? [10]
  
5.
  - a) Explain how Nesterov momentum is an improvement over momentum under evolutionary methods? [10]
  - b) What are the potential drawbacks of using a stopping condition based on the lack of significant change in average population fitness over several consecutive generations in evolutionary algorithms? [10]
  
6. Write short notes on (**any TWO**): [20]
  - a) Ant colony optimization
  - b) RMS Prop
  - c) Particle swarm optimization
  - d) Optima types

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