

# INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date: 20/10/2011 FN / AN Time: 2/3 Hrs. Full Marks: 30 No. of Students: 46  
 Autumn / ~~Spring~~ Semester: 2010-2011 Deptt: Mechanical Engineering Sub. No: MF41601  
4-th Yr. B.Tech. (H) / B.Arch. (H) / M.Sc. Sub. Name: Soft Computing  
 Instruction: Answer all questions. Assume suitable data, if necessary

Marks:  $= 17(3+14) + 7(2+2+2+1) + 6(3+3) = 30$

Q. 1

Let us consider the following optimization problem:

$$\begin{aligned} \text{Minimize } f(x_1, x_2) &= x_1 - x_2 - 2x_1^2 + 2x_2^2 + x_1x_2 \\ \text{subject to } &-5.0 \leq x_1, x_2 \leq 5.0 \\ &\text{to solve it.} \end{aligned}$$

(i) Use Steepest Descent Method. Start with a random initial solution:  $X_1 = \{0.0, 0.0\}^T$ . Show one iteration only. ^

(ii) Solve the above optimization problem using a binary-coded GA. Use a random population of size  $N = 8$ , a single-point crossover with probability  $p_c = 1.0$  and bit-wise mutation with probability  $p_m = 0.03$ . Use 4 bits to represent each variable. Use a suitable reproduction scheme. Show one generation only by hand calculations.

Q. 2

- (i) Explain the concept of Pareto-optimal solutions in multi-objective optimization
- (ii) Can you declare GA a global optimizer? Explain.
- (iii) Why do we use a high value of crossover probability and a low value of mutation probability in GA search?
- (iv) Explain the concept of cycle crossover used in Scheduling GA.

Q. 3

Write short notes on

- (i) Real-Coded GA
- (ii) Micro-GA