B. Mechanical Engineering (Part Time) Examination, 2018

(Third Year Second Semester)

SuB: Optimization Techniques for Engineering Design

Time: Three Hours Full Marks =100

(Answer Any Five)

1. i) A steel bar is subjected to 11 kN axial force. The allowable strength of the material is 180 N/mm^2. If the cost of the material is Rs. 20/kg and the cost of machining per surface is Rs. 10, determine the section size for minimum cost of production. Consider the length of the bar as 750 mm and density as 7800 kg/m^3. ii) Define global optimum point and inflection point. (15+5)

2. i) Describe the rules to create the next generation of G A, ii) What are the Fitness Functions? iii) Elaborate the stopping Condition for Algorithm, iv) Describe the difference between Classical Algorithm and Genetic Algorithm? (5x4)

3. Write short notes on: a) Local optimum point, b) Different maintenance approach, c) Point optimization method, d) Graphical method. (5x4)

4. Find the maximum of the function f(x) = 2 x_1 + x_2 + 10 subject to g(x) = x_1 + 2x_2^2 = 3 using the Lagrange Multiplier method. (25)

5. Answer any two: (10+10)
   i) Define concave and convex functions. b) What is unimodal function?
   ii) Write down the fundamental rules of region elimination methods.
   iii) Write down the steps for solving a LP problem by Simplex method.

6. Design a uniform column of tubular section to carry a compressive load P = 2500 kgf for minimum cost. Material of the column has a yield stress (σ_y) of 500 kgf/cm^2, modulus of elasticity (E) of 0.85 x 10^6 kgf/cm^2, and density (ρ) of 0.0025 kgf/cm^2. The length of the column is 250 cm. The stress induced in the column should be less than the buckling stress as well as yield stress. Mean diameter of the column is restricted to lie between 2.0 and 14.0 cm and columns with thickness outside the range 0.2 to 0.8 cm are not available in the market. The cost of the column includes material and construction cost and can be taken as (5 x W + 2 x d), where (W) is the weight and (d) is the mean diameter of the column in cm. (20)