Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY ME - SEMESTER-II EXAMINATION – SUMMER 2015

Subject Code: 2722012 Subject Name: Structural Optimization Time: 02:30 PM to 05:00 PM Instructions:

Total Marks: 70

Date: 01/06/2015

- 1. Attempt all questions.
- 2. Figures to the right indicate full marks.
- 3. Make suitable assumptions wherever necessary
- Q.1 Explain the Langrange Method with its necessary and sufficient conditions. A beam of uniform rectangular cross section is to be cut from a log having a circular cross section of diameter -2aø The beam has to be used as cantilever beam to carry UDL throughout the length of beam. The length is fixed. Find the dimensions of the beam that corresponds to the maximum tensile stress carrying capacity. Use only necessary condition of Langrange multiplier method.
- Q.2 (a) What is genetic algorithm for optimization? Why genetic algorithm is required? 07 (b) Find the extreme points of the function. 07 $f(x) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

OR

- (b) Explain Kuhn-Tucker conditions with its necessary and sufficient conditions. 07 Explain it uses for structural engineering problem.
- Q.3 Formulate the optimization statement of simply supported beam, length of 4.5 14 m with UDL 50 kN/m throughout for the minimum weight. Deflection of beam should not be more than span/300. Assume E = 22000 MPa and Density of PCC = 24 kN/m³. Width and depth of beam should not be less than 230mm and 300 mm. Using the graphical method find its solution.

OR

- Q.3 Formulate the optimization statement of cantilever beam, length of 2.2 m with UDL 20 kN/m throughout and a point load of 10 kN at tip of beam for the minimum weight. Deflection of beam should not be more than span/350. Assume E = 22000 MPa and Density of PCC = 24 kN/m³. Width and depth of beam should not be less than 150mm and 200 mm. Using the graphical method find its solution.
- Q.4Using Simplex method minimize $f = 6 x_1 6 2x_2 6 x_3$ 14Subject to $2x_1 + x_2 6 x_3 \ddot{O}2$ $2x_1 6 x_2 + 5x_3 \ddot{O}6$ $4x_1 + x_2 + x_3 \ddot{O}6$ $x_1, x_2, x_3 \times 0$ ORQ.4Using Simplex method maximize $f = 20 x_1 + 30 x_2$ 14Subject to $x_1 + 2x_2 \ddot{O}10$ OR

 $3x_1 + 2x_2 \ddot{O} 18$ $x_1, x_2, \times 0$ Q.5 Formulate the optimization statement of truss for minimum weight and find its solution for the figure 1. The numerical value of stress is limited to any member is $1.2 \times 10^6 \text{ kN/m}^2$. The horizontal and vertical deflection at joint $\pm A\phi$ is limited to 4 mm and 3 mm respectively.

OR

Q.5 Formulate the optimization statement of portal frame by plastic method and 14 obtain the solution for minimum weight for the figure 2.


