Enrolment No.

## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME – SEMESTER IV (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 741501

**Subject Name: Structural Optimization** 

Date:04/05/2016

## **Total Marks: 70**

- Instructions:
  - 1. Attempt all questions.

Time:10:30 am to 01:00 pm

- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 Formulate the simply supported beam of length of 2.8 m for minimum weight subjected to deflection of beam should not exceed span/325. Density of PCC is 24  $kN/m^3$  and E = 17000 MPa. Also obtain the solution graphically for the problem, with the assumption that width of beam should not exceed 180mm.

Q.2	<b>(a)</b>	Explain on "Objective function" and "Design Constraint".	07
	<b>(b</b> )	Explain Kuhn-Tucker conditions and elaborate its use. <b>OR</b>	07
	<b>(b</b> )	-	07
Q.3	<b>(a)</b>	Determine whether function given below is concave or convex or neither. $f(X_1,X_2,X_3) = 2X_1^2 + 2X_2^2 + 4X_3^2 + 2X_1X_2 + 4X_2X_3$	07
	<b>(b)</b>	What is constrained optimization problem? Explain with structural engineering. <b>OR</b>	07
Q.3	(a)	Using Lagrange's multiplier method, Maximize $f(X) = 3X_1^2 + X_2^2 + 2X_1X_2 + 6X_1 + 2X_2$ subjected to $2X_1 - X_2 = 4$	07
	(b)		07
Q.4		Use simplex method to maximize, $P = 3x + 4y$ subject to: $x + y \le 4$ , $2x + y \le 5$ , $x \ge 0$ , $y \ge 0$ <b>OR</b>	14
Q.4		Minimize the function using the simplex method $Z = 3X_1 + 5X_2 + 4X_3 \text{ subjected to}$ $2X_1 + 3X_2 \le 8 \text{ and } 2X_2 + 5X_3 \le 10 \text{ and } 3X_1 + 2X_2 + 4X_3 \le 15, X_1, X_2, X_3 \ge 0$	14
Q.5		Formulate constraint equations & objective function for the figure 1, using plastic method. Obtain solution for minimum weight by graphical method. <b>OR</b>	14
05		Design the following pin jointed statically determinate truss structure for	14

Q.5 Design the following pin jointed statically determinate truss structure for 14 minimum weight (Refer figure 2). The horizontal and vertical deflections at joint D are both limited to 8.2 mm and the numerical value of stress in any member is limited to  $2.1 \times 10^6$  kN/m<sup>2</sup>. Use matrix force or displacement method.

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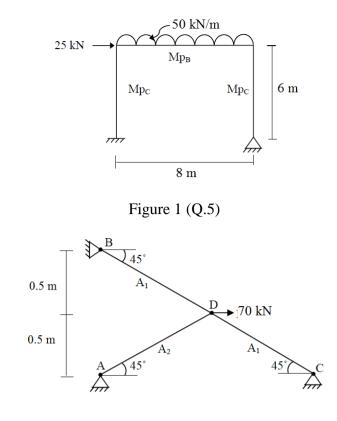


Figure 2 (OR Q. 5)