Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–II • EXAMINATION – SUMMER - 2017

Subject Code: 2722012 **Date: 30/05/2017**

Subject Name: Structural Optimization

Time: 02:30 PM To 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Formulate the problem for minimum weight in terms of optimization statement and solve it graphically. A simply supported PCC beam of length of 4.5 m subjected to point load of 25 kN/m at the center of beam. Maximum deflection should not be more than span/350 mm. E = 22500 MPa. Width of beam should not be less than 200 mm. **14**

Q.2 **(a)** Write in short on "Design Constrains". **07**

(b) The ultimate strength attained by the concrete is found to be based on a certain empirical relationship between the ratios of cement and concrete used. The basic objective is to maximize the strength attained by the hardened concrete given by the function f(x). Here x_1 and x_2 are two variables based on the cement and concrete used. **07**

$$f(x) = 20 + 2x_1 - x_1^2 + 6x_2 + \frac{3x_2^2}{2}$$

OR

(b) Find the optimum value of the function f(x) and states if the function attains maximum or minimum. **07**

$$f(x) = x^2 + 3x - 5$$

Q.3 **(a)** Find the dimensions of cylindrical tin with top and bottom made up of sheet metal to maximize its volume such that the total surface are equals to 24π, using Lagrange Multiplier Method **10**

(b) Explain the term: canonical form with taking simple example. **04**

OR

Q.3 **(a)** Maximize the function f (x, y) = 2x + 3y subject to g(x, y) = $x^2 + y^2 \leq 2$, using any method of optimization. **10**

(b) Write the basic equation of Lagrange Multiplier method. **04**

Q.4 Using Kuhn Tucker conditions, solve the problem. **14**

f(x, y, z) = x.y.z subject to $g_1 = x^2 + y^2 \leq 1$ and $g_2 = x + z \geq 1$.

OR

Q.4 Using simplex method, solve the problem. **14**

Maximize the $Z = 2x_1 - x_2 + 2x_3$ subject to

$2x_1 + x_2 \leq 10$, $x_1 + 2x_2 - 2x_3 \leq 20$ *and* $x_2 + 2x_3 \leq 5$

Q.5 Formulate the objective function and constraints for the portal frame shown in figure (1) by using plastic method and obtain its solution. **14**

OR

Q.5 Formulate the objective function and constraints for the truss shown in figure (2) by using any method and obtain its solution. The horizontal and vertical displacement at joint D is restricted to 4 mm. Stress in members are limited to 1 x 10^6 kN/mm^2. Length of each member is same 'L'. **14**

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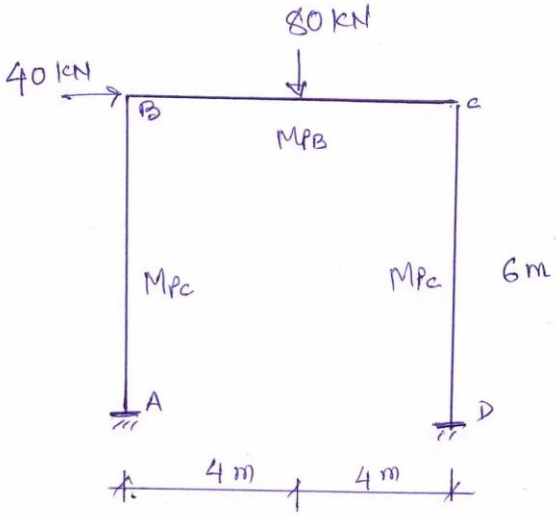

Fig. 1 (Q.5)

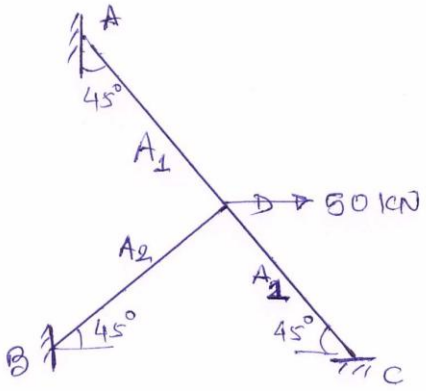

Fig. 2 (OR Q.5)