Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME – SEMESTER II– EXAMINATION – WINTER - 2016**

**Subject Code: 2722012** **Date: 21/11/ 2016**

**Subject Name: Structural Optimization**

**Time: 2:30 pm to 5:00 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 1.75 m subjected to uniformly distributed load of 25 kN/m. Maximum deflection should not be more than span/250 mm. E = 21000 MPa. Width of beam should not be less than 140 mm. | 14 |
| Q.2 | (a) | Elaborate the application of optimization in the structures. | 07 |
| | (b) | Explain the terms: local, absolute and relative minimum and maximum. | 07 |
| | | **OR** | |
| | (b) | Explain Kuhn Tucker conditions. | 07 |
| Q.3 | (a) | Find out the optimum value of the function $f(x) = (x - 2)^4$. Also state the function maxima or minima. | 07 |
| | (b) | Explain Lagragian Multiplier and explain its application. | 07 |
| | | **OR** | |
| Q.3 | (a) | Find the function is concave, convex or neither. $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$ | 07 |
| | (b) | Explain genetic algorithm. | 07 |
| Q.4 | | Minimize $f(x) = -3x_1^2 - 6x_1x_2 - 5x_1^2 + 7x_1 + 5x_2$ subject to $x_1 + x_2 = 5$ | 14 |
| | | **OR** | |
| Q.4 | | Using simplex method, solve the problem. Maximize $Z = 4x_1 - x_2 + 2x_3$ Subject to $2x_1 + x_2 + 2x_3 = 6$, $x_1 - 4x_2 + 2x_3 = 0$, $5x_1 - 2x_2 - 2x_3 = 4$ | 14 |
| 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 | (a) | Find the optimum value of the function $f(x) = x^2 + 3x - 5$. | 07 |
| | (b) | State the various methods of nonlinear programming problem for optimization. Elaborate any one in detail. | 07 |

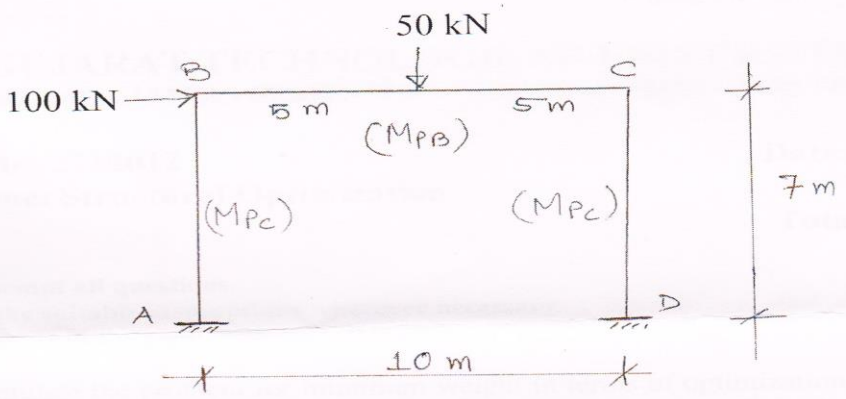


Fig. 1 (Q.5)