Seat No.: ________ Enrolment No.________

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 741501 **Date: 26-11-2014**

Subject Name: Structural Optimization

Time: 02:30 pm - 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 simply supported beam of length of 2.8 m for minimum weight subjected to deflection of beam should not exceed span/300. Density of PCC is 24 kN/m^3 and E = 22000 MPa. Also obtain the solution for the problem, with the assumption that width of beam should not exceed 200mm **14**

Q.2 (a) Elaborate the terms on ñObjective functionò and ñDesign Constraintò **07**

(b) Explain with example about unconstrained optimization. **07**

OR

(b) Elaborate the terms with sketch: Bound Acceptable Point, unacceptable point and Feasible Region. **07**

Q.3 (a) Using the Langrange Multiplier Method, **07**

Maximize $f(x) = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$, subjected to $2x_1 - x_2 = 4$

(b) Find whether the given function is convex, concave or neighter, **07**

$f(x_1, x_2, x_3) = 12x_1^2 + 5x_2^2 + 9x_3^2 + 7x_1x_2 + 9x_1x_3$

OR

Q.3 (a) Define óSaddle pointô. Explain the characteristic with respect to one or two variables. **07**

(b) Classify the stationary points as minima, maxima and points of inflection for the function : $f(x) = 18x^2 - 45x^3 + 40x^4 + 5x + 9$ **07**

Q.4 Using plastic method, formulate the objective function and constraint equations for the Figure 1. Also obtain the solution for minimum weight graphically. **14**

OR

Q.4 Using displacement method, design statically determinate pin jointed truss shown in Figure 2. Adopt E = 2 x 10^5 MPa, ů(comp.) = 0.12 kN/mm^2, ů(ten.) = 0.18 kN/mm^2, δ at 1 = 5 mm **14**

Q.5 (a) Using Simplex method maximize : **07**

$A = 5x + 7y$ subject to : $x + y \le 4$, $2x + y \le 5$, $x \ge 0$, $y \ge 0$

(b) Elaborate and explain the ñKuhn Tuckerôs conditionò. **07**

OR

Q.5 Using plastic method, formulate the objective function and constraint equations for the Figure 3. Also obtain the solution for minimum weight. **14**

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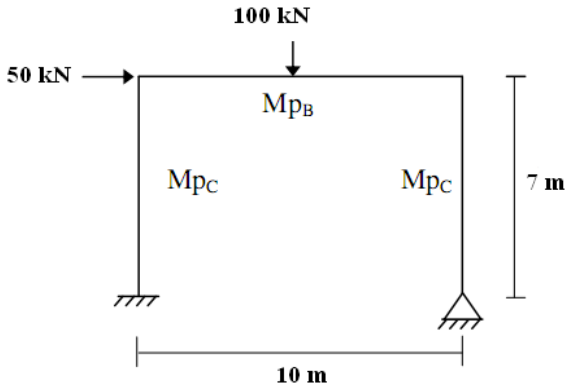

Figure 1

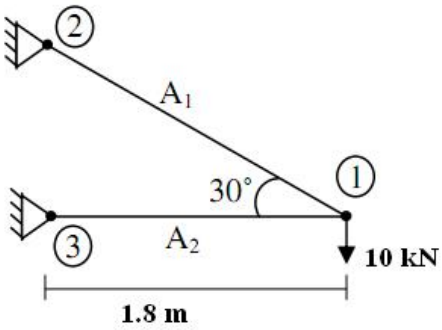

Figure 2

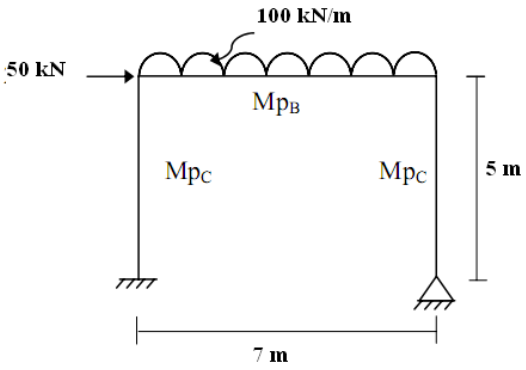

Figure 3