Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II(New course) • EXAMINATION (Remedial) – WINTER- 2015

Subject Code: 2722012 **Date: 11/12/2015**

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 simply supported beam of length of 2.0 m for minimum weight subjected to deflection of beam should not exceed span/350. Density of PCC is 24 kN/m^3 and E = 20000 MPa. Also obtain the solution graphically for the problem, with the assumption that width of beam should not exceed 150mm.	**14**
Q.2	**(a)**	What is constrained optimization problem? Explain with structural engineering.	**07**
	(b)	Explain Langrange Multiplier Technique with its use in structural engineering.	**07**
		OR	
	(b)	What is genetic algorithm for optimization? Why genetic algorithm is required?	**07**
Q.3	**(a)**	Using Kuhn Tucker condition, maximize the function $f(x) = 4X_1 + 3X_2$ subject to $g(X_1, X_2) = 2X_1 + X_2$ Ò10 and X_1, X_2 Ó0	**07**
	(b)	A beam of uniform rectangular cross section is to be cut from a log having a circular c/s of diameter 2a. The beam has to be used as a cantilever beam to carry a concentrated load at free end. Find the dimensions of the beam that corresponds to the maximum bending stress carrying capacity using any method of optimization.	**07**
		OR	
Q.3	**(a)**	Find out whether the function is convex, concave or neither at the points of optima. $f(x) = 12X^2$ ï $45X^4 + 40X^3 + 5$.	**07**
	(b)	Use the method of Lagrange multipliers to maximize the function $f = X^3Y^5$ subjected to the constraint X + Y = 8.	**07**
Q.4		Using simplex method, minimize the function $f = 4X_1 + 2X_2 + X_3$ subject to $2X_1 + X_2 + X_3$ Ò4 $-X_1 + 2X_3$ Ò3 X_1, X_2, X_3 Ó0	**14**
		OR	
Q.4		Use simplex method to minimize, $f(x, y) = 3X + 2Y$ Subject to: 2X + Y Ò18, 2X + 3Y Ò42, 3X + Y Ò24, x Ó0, y Ó0	**14**
Q.5		Design a pin jointed steel frame shown in figure 1, for minimum weight. The horizontal deflection is limited to 2.2 mm and vertical deflection is limited to 3.1 mm. The allowable stress in each member is limited to 150MPa.	**14**
		OR	
Q.5		Design the fixed based portal frame shown in figure 2, for minimum volume. The permissible sway is 3.2 mm and permissible bending stress is 0.12 kN/mm^2. Use matrix force or displacement method. Axial deformation may be neglected	**14**

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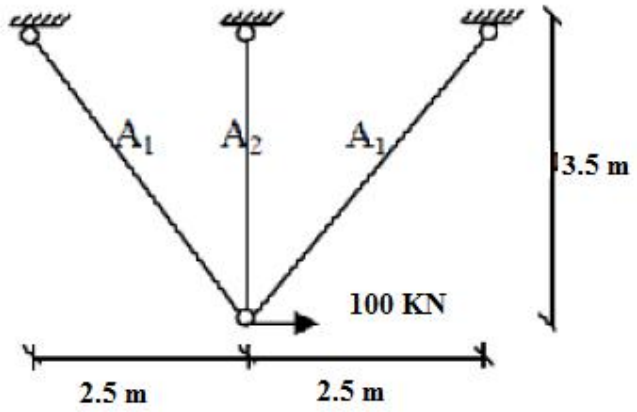

Figure 1

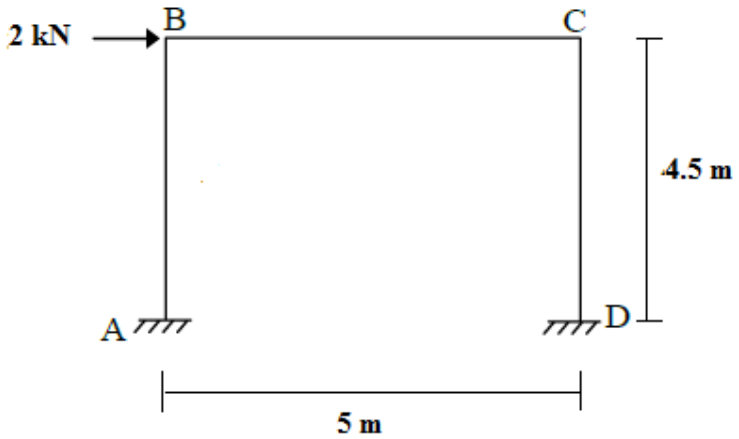

Figure 2