Code No: R41028 **R10** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February - 2019
OPTIMIZATION TECHNIQUES
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) A uniform column of rectangular cross section is to be constructed for supporting a water tank of mass M. It is required to minimize the mass of the column for economy and to maximize the natural frequency of transverse vibration of the system for avoiding possible resonance due to wind. Formulate the problem of designing the column to avoid failure due to direct compression and buckling. Assume permissible compressive stress to be σ_{max}. as shown in the figure 1 (a)

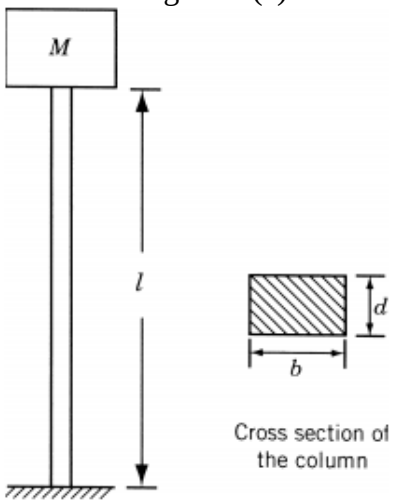

Figure 1 (a) [7]

b) Explain the following (i) Constrain surface and (ii) Objective function. [8]

2 a) Find the maxima and minima, if any, of the function
$f(x) = 4x^3 - 18x^2 + 27x - 7.$ [7]

b) Consider the following optimization problem
Minimize $f(x_1, x_2) = x_1^2 + x_2^2$
Subject to
$x_1 + 2x_2 \leq 15$
$1 \leq x_i \leq 10;\ i = 1,2$
Derive the condition to be satisfied at the point $X1 = \{1, 7\}^T$ by the search direction $S = \{S_1, S_2\}^T$ if it is a (i) usable direction and (ii) a feasible direction. [8]

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3 Find all the basic solutions corresponding to the system of equations:

$2x_1 + 3x_2 - 2x_3 - 7x_4 = 1$

$x_1 + x_2 + x_3 + 3x_4 = 6$

$x_1 - x_2 + x_3 + 5x_4 = 4$

[15]

4 a) When do you say a solution to a transportation problem is Degenerate? [7]

b) Find the optimum solution to the transportation problem given in figure for which the cost, origin-availabilities, and destination-requirements are given.

	D1	**D2**	**D3**	**D4**	**Supply**
O1	5	3	6	2	19
O2	4	7	9	1	37
03	3	4	7	5	34
Demand	16	18	31	25	90

[8]

5 a) Find the minimum of the function $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$using Fibonacci search method in the interval (0,5). [7]

b) Discuss Quadratic interpolation method in detail. [8]

6 Explain briefly about Steepest Descent method, and Minimize the function,

$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$. [15]

7 a) Explain Exterior penalty method in detail. [7]

b) Discuss in detail Convex programming problem. [8]

8 a) Explain the computational procedure in Dynamic programming. [7]

b) Explain the concept of Sub-optimization and principle of optimality with an example. [8]