Q. P. Code: 25263

Time: 3 hours Marks: 80

1) Attempt any **Four** Question
2) Make suitable assumptions if required

Q.No.1 **a)** The goal of this project is to choose insulation thick-ness t to minimize the life-cycle cooling cost for a spherical tank. The cooling costs include the cost of installing and running the refrigeration equipment, and the cost of installing the insulation. Assume a 10-year life, 10 percent annual interest rate, and no salvage value. The tank has already been designed having r(m) as its radius. **(10)**

b) Find local minima, local maxima, global minima, global maxima and plot for the function $f(x) = x^3 - x^2 - 4x + 4$. **(10)**

Q.No.2 **a)** Using the Simplex method, find the optimum (if one exists) for the LP problem of **(10)**

Maximize $f = 2X_1 + X_2$

Subjected to, $4X_1 + 3X_2 \leq 12$,

$2X_1 + X_2 \leq 4$

$X_1 + 2X_2 \leq 4$

$X_i \geq 0$, $i = 1$ to 2

b) Minimize f(x)=0.65-[0.75/(1+x2)]-0.65 x tan-1(1/x) in the interval [0,3] by the Fibonacci method using n=6. **(10)**

Q.No.3 Find the value of x where the function f(X) = (X-1)(X-2)(X-3) attains its minimum in the interval [1,3] by **(20)**

i) Newton's Method
ii) Golden Section Method

Q.No.4 **a)** A beam of rectangular cross section is subjected to a bending moment of M (N·m) and a maximum shear force of V (N). The bending stress in the beam is calculated as $\sigma = 6M/bd^2$ (Pa) and average shear stress is calculated as $\tau = 3V/2bd$ (Pa), where b is the width and d is the depth of the beam. The allowable stresses in bending and shear are 10 MPa and 2 MPa, respectively. It is also desirable that the depth of the beam not exceeds twice its width and that the cross-sectional area of the beam is minimized. Formulate and solve the problem using the graphical method. **(10)**

b) Find the minimum of function by the quadratic interpolation method. **(10)**

$$f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$$

Q.No.5 **a)** Solve the following linear programming problem using dual simplex method. **(10)**

Maximize; $Z = 2x_1 + 4x_2$

Subject to; $2x_1 + x_2 \geq 4$

$x_1 + 2x_2 \geq 3$

$2x_1 + 2x_2 \leq 12$

x_1 and $x_2 \geq 0$

b) Minimize $f = X_1^2 + 2X_2^2 + 3X_3^2$ **(10)**

Subjected to,

$g_1 = x_1 - x_2 - 2x_3 \leq 12$

$g_2 = x_1 + 2x_2 - 3x_3 \leq 8$

by writing the KT conditions.

Q.No.6 Solve the following problem by Gomory Cutting Plane method and Branch and Bound method. **(20)**

Maximise $Z = 3x_1 + x_2$

$2x_1 - x_2 \leq 6$

$3x_1 + 9x_2 \leq 45$

$x_1, x_2 \geq 0$

x_1, x_2 *are integers*

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