

Sub Code: R2331035B

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM

III B. Tech I Semester Regular Examinations November -2025

APPLIED OPERATION RESEARCH

(ME)

Time: 3 hours

Max. Marks: 70

The Question paper consists of Part A & Part B.

Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.

1		PART-A	(20Marks)
	a)	State five engineering applications of optimization.	[2]
	b)	Determine concavity of the function $3x^5 - 5x^3$	[2]
	c)	Under what conditions are the processes of reflection, expansion, and contraction used in the simplex method?	[2]
	d)	Why is Powell's method called a pattern search method?	[2]
	e)	What is the difference between the interior and extended interior penalty function methods?	[2]
	f)	What is the limitation of the linear extended penalty function?	[2]
	g)	Define Degree of difficulty for an unconstrained optimization problem.	[2]
	h)	What is the degree of difficulty for the following Geometric Programming? $\text{Minimize } f(X) = \frac{1}{2}x^{-3} + x^2 + 2x$	[2]
	i)	Mention the methods to solve Non-linear integer programming problems.	[2]
	j)	Name any two engineering systems for which zero-one programming is applicable.	[2]
		PART-B	(50Marks)
		Question from Unit - I	
2	a)	Solve the function $f(X) = 2x^2 - 24x + 2y^2 - 8y + 2z^2 - 12z + 200$ Subjected to $x + y + z = 1$, $x, y, z \geq 0$ using Lagrangian method	[5]
	b)	Determine the minimum value of $2e^x + e^{-x}$.	[5]
		(OR)	
3	a)	Find the maximum and minimum value of the function $X^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.	[5]
	b)	A beam of uniform rectangular cross section is to be cut from a log having a circular cross section of diameter 2a. The beam has to be used as a cantilever beam (the length is fixed) to carry a concentrated load at the free end. Find the dimensions of the beam that correspond to the maximum tensile (bending) stress carrying capacity.	[5]
		Question from Unit - II	
4	a)	Write brief notes on the following method. (a) Pattern Search method.	[10]

		(b) Conjugate gradient method	
		(OR)	
5	a)	Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $x_1 = (0, 0)$ by steepest decent method.	[10]
		Question from Unit - III	
6	a)	Minimize $f(x) = x_1^2 + x_2^2 + 6x_1 - 8x_2 + 10$ subject to, $4x_1 + x_2^2 \leq 16$ $3x_1 + 5x_2 \leq 15$ $x_i > 0, i = 1, 2$ by using the interior penalty function method with the starting point $x_1 = \begin{Bmatrix} 1 \\ 1 \end{Bmatrix}$.	[10]
		(OR)	
7	a)	It has been decided to shift grain from a warehouse to a factory in an open rectangular box of length x_1 meters, width x_2 meters, and height x_3 meters. The bottom, sides, and the ends of the box cost, respectively, Rs.80, Rs.10, and Rs.20/m ² . It costs Rs.1 for each round trip of the box. Assuming that the box will have no salvage value, find the minimum cost of transporting 80m ³ of grain.	[10]
		Question from Unit - IV	
8	a)	Solve the following Geometric Programming Problem Minimize the following function. $f(X) = x_1x_2x_3^{-2} + 2x_1^{-1}x_2^{-1}x_3 + 5x_2 + 3x_1x_2^{-2}$	[10]
		(OR)	
9	a)	Compute one iteration of Complementary Geometric Programming for the following. Minimize x_1 Subjected to $-4x_1^2 + 4x_2 \leq 1$ $x_1 + x_2 \geq 1$ $x_1 > 0, x_2 > 0$	[10]
		Question from Unit - V	
10	a)	Use Gomory's Cutting plane method to solve the following. Maximize $Z = 2x_1 + 3x_2$ Subject to $6x_1 + 5x_2 \leq 25$ $x_1 + 3x_2 \leq 10$ $x_1, x_2 \text{ are integer}$	[10]
		(OR)	
11	a)	Use Bala's algorithm to solve the following BIPP. Minimize $f(X) = -x - 2y + 3z$	[10]

		subject to $-20x - 15y + z \geq -10$ $-12x + 3y + 4z \geq -20$ $-3x - 5y - z \geq -6$ $x, y, z = (0,1)$ *****	
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