17431

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – B.Tech.(CSE)-2023
Course Name – Optimization Techniques
Course Code - PCC-CSG503
(Semester V)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the correct one: Optimization techniques were first widely applied

a) Physics
b) Manufacturing
c) Military operations
d) Biology

(ii) Select the following that is not a valid optimization objective

a) Minimize cost
b) Maximize profit
c) Minimize constraints
d) Maximize efficiency

(iii) An optimization problem with discrete variables is defined as

a) Continuous optimization
b) Integer optimization
c) Nonlinear optimization
d) Unconstrained optimization

(iv) Identify the primary goal of formulating an optimization problem

a) To define the objective function and constraints
b) To identify infeasible solutions
c) To eliminate redundant variables
d) To increase complexity

(v) The constraint surface represents

a) The feasible region boundary
b) The set of design variables
c) The maximum value of the objective function
d) An unbounded solution space

(vi) A function $f(x) = 3x^3 - 2x^2 + 4$ is classified as

a) Linear function
b) Quadratic function
c) Cubic function
d) Exponential function

(vii) Write the correct option: The Hessian matrix is positive definite then

a) The function has a local minimum
b) The function has a local maximum
c) The function is linear
d) The function has no critical points

(viii) Choose the correct one from below: The gradient of a function at an optimal point is

a) Negative
b) Zero
c) Undefined
d) Always positive

(ix) Write the appropriate: A linear programming problem is infeasible if

a) The feasible region is empty
b) The objective function is non-linear
c) The constraints are equalities
d) None of these

(x) Choose the correct:

To convert an inequality constraint to an equation in the standard form, you need to add

a) A slack variable
b) A surplus variable
c) Both slack and surplus variables
d) None of these

(xi) Consider the LP problem:

Minimize $2X_1 + 6X_2$

subject to

$X_1 + X_2 \geq 4$

$2X_1 - 3X_2 \leq 6$

$X_1, X_2 \geq 0$

Write the canonical form

a) Maximize $-2X_1 - 6X_2$

subject to

$-(X_1 + X_2) \leq -4$

$2X_1 - 3X_2 \leq 6$

$X_1, X_2 \geq 0$

b) Minimize $2X_1 - 6X_2$

subject to

$-(X_1 - X_2) \leq -4$

$2X_1 + 3X_2 \leq 6$

$X_1, X_2 \geq 0$

c) Maximize $-2X_1 - 6X_2$

subject to

$X_1 + X_2 \geq 4$

$2X_1 - 3X_2 \leq 6$

d)

None of these

(xii) Identify the correct option from below: The capital budgeting problem maximizes

a) Total return on investment
b) Number of projects
c) Time taken to allocate capital
d) Probability of success

(xiii) Select the correct option from below: The general problem in dynamic programming is characterized by

a) Independent decision variables
b) Unimodal functions
c) Single-stage optimization
d) Sequential decision-making

(xiv) Identify the correct option from below: The calculus method in dynamic programming involves

a) Matrix inversion
b) Random sampling
c) Graph algorithms
d) Differentiation and optimization

(xv) Identify the correct option from below: A dynamic programming approach for cargo-loading involves

a) Maximizing cargo value while respecting constraints
b) Distributing cargo equally
c) Allocating space randomly
d) Finding the shortest delivery route

Group-B

(Short Answer Type Questions) 3 x 5=15

2. List three engineering fields where optimization is widely applied. (3)

3. Determine the initial B.F.S of the transportation problem by VAM. also find the cost. (3)

	D1	D2	D3	D4	Availability
O1	10	30	50	10	7
O2	70	30	40	60	9
O3	40	8	70	20	18
Demand	5	8	7	14	

4. Differentiate between nonlinear programming and linear programming. (3)

5. Examine the following linear programming problem by graphical method. (3)

Max $Z = 10x_1 + 15x_2$

subject to

$$10x_1 + 5x_2 \leq 10$$

$$6x_1 + 3x_2 \leq 12$$

and $x_1, x_2 \geq 0$

6. Write the minimum of the function $f(x) = x^3 - 6x^2 + 9x + 15$ using the first and second derivative tests. (3)

OR

Write the necessity of Lagrange multiplier method. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. A system has two subsystems: (5)
   - Subsystem 1: Components with reliabilities 0.9 and 0.85 in series
   - Subsystem 2: Components with reliabilities 0.88 and 0.9 in parallel

   Both subsystems are connected in series.
   Find the overall system reliability.

8. Explain the general structure of an optimization problem, including the formulation of objective functions and constraints, with an example. (5)

9. Write the necessary and sufficient conditions for optimality. (5)

10. Evaluate the extrema of the function: $x^2 + y^2 - 4x - 6y + 13$. (5)

11. A small project consists of eleven activities. The details of which along with duration of days are given below: (5)

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M
Predecessor	-	A	B	A	D	E	-	G	J,H	-	A	C,K	I,L
Duration(day)	6	4	7	2	4	10	2	10	6	13	9	3	5

(i) Illustrate the network diagram.

(ii) Construct the critical path and critical activities and project duration.

12. Solve the following linear programming problem by Graphical method (5)

Maximize $z = 2x + 3y$

subject to: $x + y \leq 5$

$x + 2y \leq 8$

$2x + y \leq 10$

$x, y \geq 0.$

OR

Write the definition of reliability problem in dynamic programming with examples. (5)

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