Code No: K0224 **R07** **Set No. 1**

IV B.Tech. II Semester Regular/Supplementary Examinations, April, 2012

OPTIMIZATION TECHNIQUES

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) Give the classification of optimization problems with examples. [8]
   b) Define design vector, design constraints and constraint surface and objective function. [8]

2. *Optimize* $Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$
   Subject to $x_1 + x_2 + x_3 = 15; 2x_1 - x_2 + 2x_3 = 20;$ *and* $x_1, x_2, x_3 \geq 0$
   Solve by Langrangian function. [16]

3. Give the theorems along with proof of Kuhn-Tucker necessary conditions. [16]

4. Solve the LPP Maximize, $Z = 3x_1 + 5x_2 + 4x_3$
   Subject to $2x_1 + 3x_2 \leq 8; 2x_2 + 5x_3 \leq 10; 3x_1 + 2x_2 + 4x_3 \leq 15$ *and* $x_1, x_2, x_3 \geq 0$ [16]

5. a) What are the areas, where the time minimization transportation problems are applied? [4]
   b) If the matrix elements represent the time, solve the following transportation problem: [12]

		To				
		D1	D2	D3	D4	Available
From	O1	10	0	20	11	15
	O2	1	7	9	20	25
	O3	12	14	16	18	5
	Required	12	8	15	10	45

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6. Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ using quadratic interpolation method. [16]

7. Minimize $f = (x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ [16]

8. Four types of machine tools are to be installed (purchased) in production shop. The costs of the various machine tools and the number of jobs that can be performed on each are given below:

Machine tool type	Cost of machine tool (Rs.)	Number of jobs that can be performed
1	3500	9
2	2500	4
3	2000	3
4	1000	2

If the total amount available is Rs. 10000, determine the number of machine tools of various types to be purchased to maximize the number of jobs performed. (Note: the number of machine tools purchased must be integers). [16]

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1. A manufacturer of a particular product produces x_1 units in the first week and x_2 units in the second week. The number of units produced in the first and second weeks must be at least 200 and 400 respectively, to be able to supply the regular customers. The initial inventory is zero and the manufacturer ceases to produce the product at the end of the second week. The production cost of a unit, in rupees, is given by $4x_i^2$, where x_i is the number of units produced in week i (i= 1,2). In addition to the production cost, there is an inventory cost of Rs. 10 per unit for each unit produced in the first week that is not sold by the end of the first week. Formulate the problem of minimizing the total cost and find its solution using a graphical optimization method. [16]

2. Find the extreme points of the function: $f = (x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$ [16]

3. Find all the basic solutions corresponding to the system of equations: [16]

$$2x_1 + 3x_2 - 2x_3 - 7x_4 = 1$$
$$x_1 + x_2 + x_3 + 3x_4 = 6$$
$$x_1 - x_2 + x_3 + 5x_4 = 4$$

4. The cost-requirement table for the transportation problem is given below:

	W1	W2	W3	W4	W5	Available
F1	4	3	1	2	6	40
F2	5	2	3	4	5	30
F3	3	5	6	3	2	20
F4	2	4	4	5	3	10
Required	30	30	15	20	5	

Obtain feasible solution by north-west corner rule and then obtain the optimum solution . [16]

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5. Minimize $f(x) = 0.65 - [0.75/(1+x^2)] - 0.65x\tan^{-1}(1/x)$ in the interval [0, 3] by Fibonacci method using $n = 6$. [16]

6. Minimize $f = (x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ from the starting point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Powell's method. [16]

7. Construct the φ_k function, according to the interior penalty function method and plot its contours for the following problem: $Maximize \quad f = 2x \quad subject \quad to \; 2 \le x \le 10$ [16]

8. Solve the following LPP using dynamic programming technique.

   Maximize $Z = 10x_1 + 30x_2$

   Subjected to $3x_1 + 6x_2 \le 168$

   $12x_2 \le 240$

   x_1 and $x_2 \ge 0$. [16]

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OPTIMIZATION TECHNIQUES

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
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1. A manufacturing firm producing small refrigerators has entered into a contract to supply 50 refrigerators at the end of the first month, 50 at the end of the second month, and 50 at the end of the third. The cost of producing x refrigerators in any month is given by Rs. (x^2+1000). The firm can produce more refrigerators in any month and carry them to a subsequent month. However, it costs Rs. 20 per unit for any refrigerator carried over from one month to the next. Assuming that there is no initial inventory, determine the number of refrigerators to be produced in each month to minimize the total cost. [16]

2. a) Discuss convex programming problem with its formulation. [8]
   b) Explain constraint surface and objective function surfaces with examples. [8]

3. A progressive university has decided to keep its library open round the clock and gathered that the following number of attendants are required to reshelve the books:

Time of day (Hours)	Minimum number of attendants required
0-4	4
4-8	7
8-12	8
12-16	9
16-20	14
20-24	3

If each attendant works eight consecutive hours per day, formulate the problem of finding the minimum number of attendants necessary to satisfy the requirements above as a LPP. [16]

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4. How do you optimize the transportation problem using least cost entry method and then find the optimal method? Explain the step-by-step procedure with an example. [16]

5. Give the classification of one-dimensional minimization methods and explain Fibonacci method and quadratic programming methods with an example. [16]

6. Minimize $f = (x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ from the starting point (0, 0) using univariate method. [16]

7. Construct the φ_k function, according to the exterior penalty function method and plot its contours for the following problem: $Maximize \quad f = 2x \quad subject \quad to\ 2 \le x \le 10$ [16]

8. Use DPP method to
   Minimize Z = $x_1+3x_2+4x_3$
   Subject to
   $2x_1+4x_2+3x_3 \geq 60$,
   $3x_1+2x_2+x_3 \geq 60$
   $2x_1+x_2+3x_3 \geq 90$
   $x_1, x_2, x_3 \geq 0$. [16]

Code No: K0224 **R07** **Set No. 4**

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OPTIMIZATION TECHNIQUES

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1. a) Explain the statement of optimization problem along with its objective function, design vector and design constraints by taking an example. [8]
   b) Give a classification of optimization techniques. [8]

2. Use the Kuhn-Tucker conditions to solve the following non-linear programming problem.
   $Max.Z = 7x_1^2 - 6x_1 + 5x_2^2$
   Subjected to constraints :
   $x_1+2x_2\leq10$, $x_1-3x_2\leq9$, $x_1, x_2\geq0$. [16]

3. Max. $Z=30x_1+23x_2+29x_3$
   Subjected to constraints
   $6x_1+5x_2+3x_3 \leq 26$
   $4x_1+2x_2+5x_3 \leq 7$
   and $X_1, X_2, X_3 \geq 0$

4. A company has three plants at locations A, B, and C which supply to warehouses located at D, E, F, G and H. monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouses requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (in Rs.) are given below:

From \ To	D	E	F	G	H
A	5	8	6	6	3
B	4	7	7	6	5
C	8	4	6	6	4

   Determine an optimum distribution for the company in order to minimize the total transportation cost. [16]

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5. Find the minimum of the function $f = \lambda / \log \lambda$ using quadratic interpolation method. [16]

6. a) How do you convert a constrained optimization problem into a unconstrained problem? [8]
   b) Discuss the principle of steepest descent method. [8]

7. a) Explain the characteristics of a constrained non-linear programming problem. [8]
   b) Give the classification of a constrained non-linear programming and give the basic approach of penalty function method. [8]

8. a) What is meant by curse of dimensionality? Explain it with reference to Dynamic Programming. [8]
   b) Discuss Bellman's Principle of Optimality with an example. [8]