



RM-7755

**B. E. IV (Sem. VIII) (Electrical) Examination**

May / June – 2010

**Optimisation Methods**

Time : 3 Hours]

[Total Marks : 100

**Instruction :**

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
**B. E. 4 (Sem. 8) (Electrical)**

Name of the Subject :  
**Optimisation Methods**

Subject Code No. : **7 7 5 5** Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

- (2) Please write answers pointwise and try to avoid essay type answers.
- (3) Due weightage will be given to neat and clean answer-sheets.
- (4) Write both sections in **separate** answer sheets.
- (5) Make assumptions wherever you feel required.
- (6) Attempt all questions.

**Section I**

1 Solve any two 18

a 8

A firm manufactures three products A, B, and C.

Time to manufacture product A is twice that for B and thrice that for C and they are to be produced in the ratio of 3 : 4 : 5.

The relevant data is given in the table.

If the whole labour is engaged in manufacturing product A, 1600 units of this product can be produced.

There is a demand for atleast 300, 250 and 200 units of products A, B, and C. Profit earned per unit is Rs 50, Rs 40 and Rs 70 respectively. Formulate the problem as a linear programming problem.

**(Just formulate the problem, solution is not required)**

Raw Material	Requirement per unit of product (kg)			Total availability (kg)
	A	B	C	
P	6	5	9	5000
Q	4	7	8	6000

- b Solve by any simplex method : 10
- Minimize  $z = 4x_1 + x_2$   
 Subject to:  
 $3x_1 + x_2 = 3$   
 $4x_1 + 3x_2 \geq 6$   
 $x_1 + 2x_2 \leq 4$   
 $x_1, x_2 \geq 0$
- 2 **Attempt any two :** 20
- a Use principal of Duality to solve following example : 10
- Minimize  $z = x_1 + x_2$   
 Subject to :  
 $2x_1 + x_2 \geq 4$   
 $x_1 + 7x_2 \geq 7$   
 $x_i \geq 0$
- b Use lagrange Multiplier method to find out maximum value of 10
- $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$ ,  
 subject to :  
 $x_1 + 2x_2 = 2$ , all  $x \geq 0$
- c Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. Apply the sufficiency conditions to prove that the solution found out is indeed maximum. 10
- 3 a **Attempt any one :** 12
- Solve by Revised simplex method:  
 Maximize  $z = 2x_1 + x_2$   
 Subject to :  
 $3x_1 + 4x_2 \leq 6$   
 $6x_1 + x_2 \leq 3$   
 All  $x \geq 0$ .
- b Solve by cutting plane or branch and bound method :  
 Maximize  $z = 7x_1 + 9x_2$   
 Subject to :  
 $-x_1 + 3x_2 \leq 6$   
 $7x_1 + x_2 \leq 35$   
 $x_i \geq 0$  and are integers

## Section - II

**Q-4 Attempt all questions.**

- (a) An automobile dealer wishes to put four repairmen to four different jobs. The repairmen have somewhat different kinds of skills and they exhibit different levels of efficiency from one job to another. The dealer has estimated the number of man hours that would be required for each job-man combination. This is given in following table. Find the optimum assignment that will result in minimum man hours needed. (5)

		Jobs			
		A	B	C	D
<b>Man</b>	<b>1</b>	5	3	2	8
	<b>2</b>	7	9	2	6
	<b>3</b>	6	4	5	7
	<b>4</b>	5	7	7	8

- (b) ABC company is engaged in manufacturing 5 brands of packed snacks. It is having five manufacturing set ups, each capable of manufacturing any of its brands, one at a time. The cost to make a brand on these setups vary according to the following table. Find the optimal assignment of products on these setups resulting in minimum cost. (5)

		Setups				
		S1	S2	S3	S4	S5
<b>Brands</b>	<b>B1</b>	4	6	7	5	11
	<b>B2</b>	7	3	6	9	5
	<b>B3</b>	8	5	4	6	9
	<b>B4</b>	9	12	7	11	10
	<b>B5</b>	7	5	9	8	11

- (c) Solve the transportation problem where all entries are unit costs.

[10]

	<b>D1</b>	<b>D2</b>	<b>D3</b>	<b>D4</b>	<b>D5</b>	<b>ai</b>
<b>O1</b>	73	40	9	79	20	8
<b>O2</b>	62	93	96	8	13	7
<b>O3</b>	96	65	80	50	65	9
<b>O4</b>	57	58	29	12	87	3
<b>O5</b>	56	23	87	18	12	5
<b>bj</b>	6	8	10	4	4	

**Q-5 Attempt any one:**

- (a) Use the Kuhn-Tucker condition to solve the following non-linear programming [15] problem.

$$\text{Maximize } Z = x_1^2 + 5x_2^2 - 10x_1 - 10x_2$$

Subject to the constraints

$$x_1 + x_2 \leq 5$$

$$2x_1 + x_2 \leq 4$$

$$\text{And } x_1, x_2 \geq 0$$

- (b) Use Wolfe's method to solve the quadratic programming problem.

$$\text{Maximize } Z = -x_1^2 + 2x_1 + x_2$$

Subject to the constraints

$$2x_1 + 3x_2 \leq 6$$

$$2x_1 + x_2 \leq 4$$

$$\text{And } x_1, x_2 \geq 0$$

**Q-6 Attempt any one.**

- (a) Using Fibonacci method, find the maximum of the function [15]

$$f(x) = (11/4) + 3x - x^2 \text{ in the interval } [0,4].$$

Assume permissible error in  $x$  to be 0.05.

- (b) Using the Golden section method, maximize the function ,

$$f(x) = (x-3)^2 (7-x) \text{ in the interval } 3 \leq x \leq 7.$$

Assume permissible error in  $x$  to be 0.1 .