College of Engineering, Pune

(Class)- [T.Y.B.Tech., B.Tech. (Branch) - Electrical] and M.Tech[ILOE]

(EE-5112)- (Engineering Optimization)

End –Semester Examination

Date- 11/11/2013 **Timing**: 3 hrs
Academic Year: 2013-2014 **Max. Marks**: 60

Instructions:
1. All Questions compulsory.
2. Q.1 is T_2 (10 Marks)
3. Q.2 to Q.7 ESE questions
4. Figures to the right indicate full mark.
5. Assume suitable data wherever necessary.

[T_2]

Q.1 Fill in the blanks (0.25 negative marks for each wrong answer) **----- (10)**

1. In an optimization problem X is the ------------ and f(X) is the ---------------
2. In Kuhn-Tucker theory L(X, S, λ) = -----------------------
3. Graphical method, Simplex method and Transportation are concerned with ---------------
4. A feasible solution which optimizes the objective function is called ---------------
5. If a Transportation problem has m factories and n retail shops the number variables is -------- and number of constraints is -------------
6. In NWC rule, if the demand in the column is satisfied, one must move to the ---------- cell in the next -------------
7. The sub problem of a main problem in a dynamic programming is known as -----------
8. The algebraic equation that represents the benefits of a decision in dynamic programming is ---------
9. The basic approach of the numerical methods , in general, is to produce a sequence of improved ------------------
10. A unimodal function is a function having only ----------------- in the given range or interval.

[ESE]

Q.2 A] Give the statement of a general optimization problem and explain it. **----- (3)**

Q.2 B] Define the terms:

1. Design vector, 2. Objective function, 3. Design constraints **----- (3)**

Q.2 C] Find the maxima and minima if any of the function

$f(x) = 10x^6 - 48x^5 + 15x^4 + 200x^3 - 120x^2 - 480x + 100$ **----- (4)**

Q.3 A]

Optimize $f(x_1, x_2, x_3) = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

subject to

$x_1 + x_2 + x_3 = 15$ ----- **(6)**

$2x_1 - x_2 + 2x_3 = 20$

Use Lagrange Multiplier Method

(OR)

Q.3 A]

Maximize $f(x_1, x_2) = 3.6x_1 - 0.4x_1^2 + 1.6x_2 - 0.2x_2^2$

subject to $2x_1 + x_2 \le 10$

$x_1, x_2 \ge 0$ ----- **(6)**

Use Kuhn-Tucker conditions

Q.3 B] State and explain the necessary and sufficient condition for multivariable optimization problem without constraints. ----- **(4)**

Q.4 A] A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suitings, shirtings and woolens yielding a profit of Rs.2, Rs.4 and Rs. 3 per meter respectively. Minutes required for weaving, processing and packing for clothes suitings, shirtings and woolens are as in table. In a week total run time of each department is 60, 40 and 80 hours for weaving, processing and packing department respectively. Formulate the L.P. Problem to find the product mix to minimize the profit.(write steps carried out)

	Departments		
	Weaving (in Min.)	Processing (In min.)	Packing (In Min.)
Suitings	3	2	1
Shirtings	4	1	3
Wollens	3	3	3

----- **(6)**

Q.4 B] Draw neat flow chart and describe computational procedure of the Simplex method for the solution of L.P. problem. ----- **(4)**

Q.5 A] Solve the following L.P.P. by simplex method.

$$\begin{aligned} \textit{Maximize } f &= 15x_1 + 6x_2 + 9x_3 + 2x_4 \\ \textit{subject to } \quad & 2x_1 + x_2 + 5x_3 + 6x_4 \le 20 \\ & 3x_1 + x_2 + 3x_3 + 25x_4 \le 24 \\ & 7x_1 + x_2 \le 70 \\ & x_1, x_2, x_3, x_4 \ge 0 \end{aligned}$$

----- **(5)**

Q.5 B] Obtain IBFS for the following TP by Least Cost method.

	D1	**D2**	**D3**	**D4**	**supply**
O1	**3**	**1**	7	**4**	**300**
O2	2	6	5	9	**400**
O3	**8**	**3**	**3**	**2**	**500**
Demand	**250**	**350**	**400**	**200**	

(OR)

Q.5 B] Obtain IBFS for the following TP by VAM method. ----- **(5)**

	D1	**D2**	**D3**	**D4**	**supply**
O1	**19**	**30**	**50**	**10**	7
O2	**70**	**30**	**40**	**60**	9
O3	**40**	8	**70**	**20**	**18**
Demand	5	8	7	**14**	

Q.6 A] Write the computational procedure in steps for unconstrained minimization using univariate method. ----- **(4)**

Q.6 B] *Minimize* $f = 2x_1^2 + x_2^2$

From starting point (1, 2) using Steepest-Descent method (two iterations only) ----- **(6)**

Q.7 A] Write the computational procedure in steps for one dimensional minimization using Fibonacci method. ----- **(4)**

Q.7 B] *Minimize* $f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$

with starting point $X_1(-1, 1)$. Find minimum of f(x) along direction $S_1 = (4, 0)$ using Quadratic interpolation method. (Two refits only) ----- **(6)**

Best of Luck