

Roll Number: \_\_\_\_\_

**Thapar University, Patiala**

School of Mathematics

**MID SEMESTER EXAMINATION**

B. E. (Second Year): Semester-II (2016/17)  
 (COE/CML/CAG/SEM/ECE/ENC)

Course Code: UMA031

Course Name: Optimization  
Techniques

March 27, 2017

Time: 2 Hours, M. Marks: 30

Name Of Faculty: MKS, AK, MKR, SJK,  
VKS, NK, RN, ID**Note: Attempt all questions.**

- Q.1 A plant manufactures washing machines and dryers. The major manufacturing departments are the stamping deptt., motor and transmission deptt. and assembly deptt.. The first two departments produce parts for both the products while the assembly lines are different for the two products. The monthly deptt. capacities are (5)

Stamping deptt.	:	1000 washers or 1000 dryers
Motor and transmission deptt.	:	1600 washers or 7000 dryers
Washer assembly line	:	9000 washers only
Dryer assembly line	:	5000 dryers only

Profits per piece of washers and dryers are Rs 270 and Rs. 300 respectively. Formulate the linear programming model.

- Q.2 Consider the following linear programming problem (LPP): (4)

$$\text{Max } z = 2x_1 + 3x_2 + 5x_3 \text{ s.t. } -6x_1 + 7x_2 - 9x_3 \geq 4, x_1 + x_2 + 4x_3 = 10, x_1, x_3 \geq 0, x_2 \text{ unrestricted.}$$

How many basic solutions exists for above LPP after converting  $x_2 = x_2^+ - x_2^-$ ,  $x_2^+ \geq 0, x_2^- \geq 0$ .

Find all basic solutions and also find the optimal value.

- Q.3 Using two phase method , solve the following LPP (5)

$$\text{Min } z = x_1 + x_2 \text{ s.t. } 2x_1 + x_2 \geq 4, x_1 + 7x_2 \geq 7, x_1 \geq 0, x_2 \geq 0.$$

- Q.4 Consider the following linear programming problem with its optimal table. (6)

$$\text{Min } z = x_1 - 2x_2 + x_3 \text{ s.t. } x_1 + 2x_2 - 2x_3 \leq 4, x_1 - x_3 \leq 3, 2x_1 - x_2 + 2x_3 \leq 2, x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, s_1 \geq 0, s_2 \geq 0, s_3 \geq 0 \text{ are slack variables.}$$

Basic Variables	$x_1$	$x_2$	$x_3$	$s_1$	$s_2$	$s_3$	Solution
$z - c_j$	$-\frac{9}{2}$	0	0	$-\frac{3}{2}$	0	-1	8
$x_2$	3	1	0	1	0	1	6
$s_2$	$\frac{7}{2}$	0	0	$\frac{1}{2}$	1	1	7
$x_1$	$\frac{5}{2}$	0	1	$\frac{1}{2}$	0	1	4

Use sensitivity analysis to answer the following

P.T.O

- (i) Find an optimal solution of the variables  $x_1, x_2, x_3$  in the objective function i.e., (4.3.1) is changed to (4.3.1').
- (ii) Find an optimal solution (if exists) if the right hand side of constraints (4.3.2)' is changed to (4.3.2).
- (iii) Using graphical method, find an optimal solution of the following LPP, if exists. Also, write the dual of this LPP and solve it graphically.
- $$\text{Max } z = x_1 + \frac{1}{2}x_2, \quad \begin{aligned} & x_1 + x_2 - x_3 \leq 1, \\ & -0.5x_1 + x_2 + 2x_3 \leq 0, \\ & x_i \geq 0, \quad i=1, 2, 3. \end{aligned}$$
- (4.4) Examine graphically, whether the following set is convex or not.  $\{(x_1, x_2) : 0 \leq x_1 \leq 4, 0 \leq x_2 \leq 4\}$