UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Subject: Operation Research and Optimization **Max. Marks : 100**
Code : CSEG 389 **Duration : 3 Hrs**
No. of page/s:4

Instructions:

SECTION A

Section: A (Answer all questions, each question carries 4 Marks) 5X 4M=20M

S. No.		Marks	CO
Q 1.a	While solving an IPP any non-integer variable in the solution is picked up in order to i. Obtained the cut constraints. ii. Enter the solution iii. Leave the solution iv. None of the above	**2**	**CO1**
Q 1.b	Consider the problem of solving a linear programming problem with simplex method. Find which of the following statements is false with respect to the simplex method. i. The optimality conditions for the maximization and minimization problems are different in the simplex method. ii. The feasibility conditions for the maximization and minimization problems are different in the simplex method iii. In a simplex method, the pivot element cannot be zero or negative iv. In the simplex method, if the leaving variable does not correspond to the minimum ratio, at least one variable will definitely become negative in the next iteration	**2**	**CO1**
Q 2.a	The linear programming model for a transportation problem has constraints for supply at each ______ and _______ at each destination. i. Destination/Source ii. Source / Destination iii. Demand /Source iv. Source/Demand	**2**	**CO2**
Q 2.b	A ___________ is the sequence of cells in the transportation table such that no cell appears more than once in the i. Loop ii. rim iii. degeneracy iv. (a) and (b) but not c	**2**	**CO2**
Q 3.a	Alternative solution exist of an LP model when i. One of the constraints is redundant ii. Objective function equation is parallel to one of the constrains iii. Two constrains are parallel	**2**	**CO3**

	iv. All of the above		
Q 3.b	For a minimization problem, the objective function coefficient for an artificial variable is i. +M ii. –M iii. -1 iv. +1	**2**	**CO3**
Q 4.a	The solution to a transportation problem with m-rows and n-columns is degenerate if number of positive allocations are i. < m+n-1 ii. > m+n-1 iii. = m+n-1 iv. =m*n	**2**	**CO4**
Q 4.b	If there are n workers and n jobs there would be i. n! solutions ii. (n-1)! solutions iii. $(n!)^n$ solutions iv. n solutions	**2**	**CO4**
Q 5.a	Which of the cost can vary with order size i. Unit cost only ii. Reorder cost only iii. Holding cost only iv. All of the above	**2**	**CO5**
Q 5.b	If EOQ is calculated but an order is then placed which is smaller than this , will the variable cost i. Increase ii. Decrease iii. Either increase or decrease iv. No change	**2**	**CO5**
SECTION B **Answer all questions, each question carries 8 Marks) 5X 8M=40M**			
Q 6	A person requires 10, 12 and 12 units of chemicals A, B and C respectively for his garden. A typical liquid product contains 5, 2 and 1 units of A, B and C respectively per jar. On the other hand a typical dry product contains 1,2 and 4 units of A,B and C per unit . If the liquid product sells for ₹ 3 per jar and dry product ₹2 per carton. How many of each should be purchased to minimize the cost and meet the requirement. (Do not use graphical method).	**8**	**CO1**
Q 7	Solve the dual of given primal problem to find the solution of primal. Maximize $Z=5x_1+20x_2$ Subject to $2x_1+4x_2 \leq 25$ $x_1+2x_2 \leq 8$	**8**	**CO2**

$$x_1 + 6x_2 \le 12$$

$$x_1, x_2 \ge 0 \wedge integers$$

Q 8

A steel company has three open-hearth furnaces and five rolling mills. The transportation costs for shipping steel from furnaces to rolling mills are given the following table

	M1	M2	M3	M4	M5	Supply
F1	4	2	3	2	6	8
F2	5	4	5	2	1	12
F3	6	5	4	7	7	14
Demand	4	4	6	8	8	

What is the optimum shipping schedule? (Use VAM to find initial basic feasible solution.

8 **CO3**

Q 9

A department of a computer has five employees with five jobs to be performed. The time in hours that each man takes to perform each job is given in the effectiveness matrix.

		I	II	III	IV	V
	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man hour?

8 **CO3**

Q 10

Suppose that the demand for a product is 30 units per month and the items are withdrawn at a constant rate. The setup cost each time a production run is under taken to replenish inventory is \$15. The production cost is \$1 per item, and the inventory holding cost is \$0.30 per item per month. Assuming shortages are not allowed, determine how often to make a production run and what size it should be.

8 **CO4**

SECTION-C

Answer all questions, each question carries 20 Marks)   2X 20M=40M

Q

Solve following IPP by using Gomory cutting plane algorithm

$$Maximize\ Z = 2x_1 + 3$$

$$Subject¿\ x_1 + 3x_2 \le 9, 3x_1 + x_2 \le 7, x_1 - x_2 \le 1, x_1, x_2 \ge 0 \wedge integer$$

20 **CO2, CO4**

Solve the game graphically whose payoff matrix is

10 **CO5**

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$$\begin{array}{c|c|c|c} & & \multicolumn{2}{c}{B} \\ & & I & II \\ \hline & 1 & -6 & 7 \\ A & 2 & 4 & -5 \\ & 3 & -1 & -2 \\ & 4 & -2 & 5 \\ & 5 & 7 & 6 \end{array}$$

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Solve the following game

$$\begin{array}{c|c|c|c|c|c|c|c} & & \multicolumn{6}{c}{B} \\ & & I & II & III & IV & V & VI \\ \hline & I & 4 & 2 & 0 & 2 & 1 & 1 \\ A & II & 4 & 3 & 1 & 3 & 2 & 2 \\ & III & 4 & 3 & 7 & -5 & 1 & 2 \\ & IV & 4 & 3 & 4 & -1 & 2 & 2 \\ & V & 4 & 3 & 3 & -2 & 2 & 2 \end{array}$$

</td><td>10</td><td>CO5</td></tr>
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At certain petrol pump, customers arrive in a Poisson process with an average time of 5 minutes between arrivals. The time intervals between services at the petrol pump follow exponential distribution and as much the mean time taken to service a unit a 2 minutes. On the basis of this information you are required to answer the following questions:

i. What would be the expected average queue length? (7)
ii. What would be the average number of customers in the queuing system? (7)

</td><td>14</td><td>CO4</td></tr>
<tr><td></td><td>The demand for an item is 8000 units per annum and the unit cost is Re.1/-. Inventory carrying charges of 20% of average inventory cost and ordering cost is Rs. 12.50 per order. Calculate optimal order quantity, optimal order time, optimal inventory cost and number of orders. (6)</td><td>6</td><td>CO4</td></tr>
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