Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2020

Course: Operation Research and Optimizations **Semester: VII**
Program: B. Tech. BAO **Time 03 hrs.**
Course Code: CSBA 3004 **Max. Marks: 100**

SECTION A

1. **Each Question will carry 5 Marks**
2. **Instruction: Complete the statement / Select the correct answer(s)**

S. No.	**Question**	**CO**
Q 1	One can use Linear programming problem (LPP) for optimization purpose if following statement are satisfied: a. There must be a well defined objective function: b. There must be alternative course of action. c. Decision variable must be inter-related. d. All of them	**CO1**
Q2	A paper mill produces paper for books as well as for magazine. Each kg of paper for books requires 2 kg of material A and 3kg of material B. For magazine the proportion is 2kg of A and 2kg of B for each kg of paper. The mill needs 15,000 kg paper for books and 6,000 kg for magazines. Materials A and B are availables as 3 and 5 lakhs kg respectively. Requirement for magzines. Material A and B are availables as 3 and 5 lakhs kg respectively. Requirement for books is twice than that of magazines. Selling price per book is Rs 14/kg and for magazine it is Rs 10/kg. Cost of material A is 2/kg and that for material B is 2.50/kg. It is required to find the product manufacturing plan and the optimum total profit. Predict the required objective function for the given LP problem model. a. Max Z = Rs (2.50 x1 + x2) b. Max Z = Rs (3 x1 + 2 x2) c. Max Z = Rs (2 x1 + 2 x2) d. Min Z = Rs (14 x1 + 10 x2)	**CO2**

Q3	Solve the following problem and predict the solution:
	Max Z = -x1 + 2x2;
	Subject to
	x1-x2<=-1;
	-0.5x1+x2<=2;
	x1,x2>=0;
	a. Unbounded solution
	b. No feasible solution
	c. Unique optimal solution
	d. Multiple optimal solution
		CO2

Q4	While iterating towards the optimal solution, the simplex method tries to move the current basic _____ to an improved basic feasible solution. a. Feasible solution b. Infeasible solution c. Multiple solution d. Unbounded solution	**CO2**
Q5	Analysis of a queuing system involves a study of its different operating characteristics which includes: a. Queue length b. System length c. Waiting Time d. All of them	**CO4**
Q6	Solve the following game: Player A1 has value corresponding to Players B1 and B2 is 30, 2. Player A2 has value corresponding to Players B1 and B2 is 4, 14. Player A3 has value corresponding to Players B1 and B2 is 6, 9. Predict whether this game has saddle point or not. a. No saddle point exist b. Saddle point exist c. Saddle point exist with 10 value. d. Saddle point exist with 4 value.	**CO4**

SECTION B

1. **Each question will carry 10 marks**
2. **Instruction: Write short / brief notes**

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Q 7</td><td>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:
What would be the expected average queue length?
What would be the average number of customers in the queuing system?</td><td>CO3</td></tr>
<tr><td>Q 8</td><td>Consider a modified form of matching coins game problem. The matching player is paid Rs 8 if two coins turn both heads and Rs 1 if the coins turn both tails. The non-matching player is paid Rs 3 when the two coins do not match. Given a choice of matching and non-matching player, which one would you choose and what would be your strategy .</td><td>CO4</td></tr>
<tr><td>Q 9</td><td>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 undertaken 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</td><td>CO3</td></tr>
<tr><td>Q 10</td><td>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
<table>
<tr><td></td><td>M1</td><td>M2</td><td>M3</td><td>M4</td><td>M5</td><td>Supply</td></tr>
<tr><td>F1</td><td>4</td><td>2</td><td>3</td><td>2</td><td>6</td><td>8</td></tr>
<tr><td>F2</td><td>5</td><td>4</td><td>5</td><td>2</td><td>1</td><td>12</td></tr>
<tr><td>F3</td><td>6</td><td>5</td><td>4</td><td>7</td><td>7</td><td>14</td></tr>
<tr><td>Demand</td><td>4</td><td>4</td><td>6</td><td>8</td><td>8</td><td></td></tr>
</table>
What is the optimum shipping schedule? (Use VAM to find initial basic feasible solution.</td><td>CO3</td></tr>
<tr><td>Q 11</td><td>Solve the following game
<table>
<tr><td></td><td></td><td>B</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>VI</td></tr>
<tr><td>A</td><td>I</td><td>4</td><td>2</td><td>0</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td></td><td>II</td><td>4</td><td>3</td><td>1</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td></td><td>III</td><td>4</td><td>3</td><td>7</td><td>-5</td><td>1</td><td>2</td></tr>
</table></td><td>CO4</td></tr>
</table>

	IV	4	3	4	-1	2	2
	V	4	3	3	-2	2	2

Section C

1. **Each Question carries 20 Marks.**
2. **Instruction: Write long answer.**

Q12

Solve following IPP by using Gomory cutting plane algorithm

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

$$Subject\ to\ x_1 + 3x_2 \leq 9$$

$$3x_1 + x_2 \leq 7,$$

$$x_1 - x_2 \leq 1,$$

$$x_1, x_2 \geq 0\ and\ integer$$

OR

Apply Big M to solve the following IPP

$$\text{Maximize } Z = 2x_1 + 20x_3 - 10x_3$$

$$\text{Subject to } 2x_1 + 20x_2 + 4x_3 \leq 15$$

$$6x_1 + 20x_2 + 4x_3 = 20$$

$$x_1, x_2, x_3 \geq 0\ .$$

CO1