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

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Operations Research **Semester: III**
Program: BBA (EPRCC) **Time: 03 Hours**
Course code: DSQT 2006 **Max. Marks: 100**

SECTION A **(20 Marks)**

1.	**Each question in section A is a multiple-choice question with four answer choices. Read each question and choose the one best answer.**	**Marks**	**CO**
i)	If two constraints do not intersect in the positive quadrant of the graph, then **i)** the problem is infeasible **ii)** the solution is unbounded **iii)** one of the constraints is redundant **iv)** none of the above	**2**	**CO1**
ii)	A variable which does not appear in the basic variable column of simplex table is **i)** never equal to zero **ii)** always equal to zero **iii)** called a basic variable **iv)** none of the above	**2**	**CO1**
iii)	As simulation is not an analytical model, therefore, the result of simulation must be viewed as i) Unrealistic ii) Exact iii) Approximation iv) simplified	**2**	**CO1**
iv)	In pure strategy game i) Any strategy may be selected arbitrarily ii) A particular strategy is selected by each player iii) Both players selected their optimal strategy iv) None of the above	**2**	**CO1**
v)	A saddle point exists when **i)** maximin value = maximax value **ii)** minimax value = minimum value **iii)** minimax value = maximin value **iv)** none of the above	**2**	**CO1**

vi)	Graphical Method can be applied to solve a LPP when there are only variable(s) i) One ii) Two iii) Three **iv)** More than three	**2**	**CO1**
vii)	Non-negativity condition is an important component of LP model because i) Variables value should remain under the control of the decision maker ii) Value of the variables make sense and corresponds to real world problems iii) Variables are interrelated in terms of limited resources iv) None of the above	**2**	**CO1**
viii)	While solving a LP model graphically, the area bounded by the constraints is called i) Feasible region ii) Infeasible region iii) Unbounded solution iv) None of the above	**2**	**CO1**
ix)	If for a given solution a slack variable is equal to zero then i) The solution is optimal ii) The solution is infeasible iii) The entire amount of resource with the constraints in which the slack variable appears has been consumed iv) All of the above	**2**	**CO1**
x)	The assignment problem i) Requires that only one activity be assigned to each resource ii) Is a special case of transportation problem iii) Can be used to maximize resources iv) All of the above	**2**	**CO1**
SECTION B		**(20 Marks)**	
This section has 4 Questions of 5 marks each. **These questions are short answer type.** **All the questions are compulsory.**			
2.	What is meant by a feasible solution of an LP problem?	**5**	**CO2**
3.	What is an unbounded solution, and how is this condition recognized in the graphical method?	**5**	**CO2**
4.	Describe the Monte Carlo Simulation technique..	**5**	**CO2**
5.	What is meant by unbalanced transportation problem. What is degeneracy in transportation problem?	**5**	**CO2**

SECTION-C **(30 Marks)**

This section has 3 Questions of 10 marks each, out of which first 2 Questions are compulsory. Questions 8 has internal choice to attempt any one.

6. Solve the following LP problems using the simplex method.

$$\boldsymbol{Maz\ Z = x_1 + x_2 + x_3}$$

Subject to

$$\boldsymbol{3x_1 + 2x_2 + x_3 \leq 3}$$
$$\boldsymbol{2x_1 + x_2 + 2x_3 \leq 2}$$
$$\boldsymbol{x_1, x_2, x_3 \geq 0}$$

10 **CO3**

7. The following table provides all the necessary information on the availability of supply to each warehouse, the requirement of each market, and the unit transportation cost (in ₹) from each warehouse to each market

Market

		P	Q	R	S	Supply
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
	Demand	7	12	17	9	

The shipping clerk of the shipping agency has worked out the following schedule, based on his own experience: 12 units from A to Q, 1 unit from A to R, 9 units from A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R. Check and see if the clerk has the optimal schedule.

10 **CO3**

8. An airline company has drawn up a new flight schedule that involves five flights. To assist in allocating five pilots to the flights, it has asked them to state their preference scores by giving each flight a number out of 10. The higher the number, the greater is the preference. A few of these flights are unsuitable to some pilots, owing to domestic reasons. These have been marked with '×'

Flight Number

		1	2	3	4	5
Pilot	A	8	2	x	5	4
	B	10	9	2	8	4
	C	5	4	9	6	x
	D	3	6	2	8	7
	E	5	6	10	4	3

What should be the allocation of the pilots to flights in order to meet as many preferences as possible?

OR

10 **CO3**

A glass factory that specializes in crystal is developing a substantial backlog and for this the firm's management is considering three courses of action: To arrange for subcontracting (S1), to begin overtime production (S2), and to construct new facilities (S3). The correct choice depends largely upon the future demand, which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon the profits. This is shown in the table below:

Demand	Probability	Course of Action		
		S1 (Subcontracting)	S2 (Begin Overtime)	S3 (Construct Facilities)
Low (L)	0.1	10	-20	-150
Medium (M)	0.5	50	60	20
High (H)	0.4	50	100	200

Determine the expected opportunity losses, given no other information than that stated above, and state which strategy is preferable.

SECTION-D (30 Marks)

This section has 2 Questions of 15 marks each, out of which Question 9 is compulsory and Question 10 has internal choice to attempt any one.

9. The following table provides all the necessary information on the availability of supply to each warehouse, the requirement of each market, and the unit transportation cost (in ₹) from each warehouse to each market.

15 **CO4**

		Market				
		P	Q	R	S	Supply
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
	Demand	7	12	17	9	

Find out optimal cost and route of transportation.

10. The maintenance cost and resale value per year of a machine whose purchase price is Rs. 7000/ - is given below:

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Maintenance Cost in ₹	**900**	**1200**	**1600**	**2100**	**2800**	**3700**	**4700**	**5900**
Resale value in ₹	**4000**	**2000**	**1200**	**600**	**500**	**400**	**400**	**400**

Determine the optimum period of replacement of the machine.

OR

Solve the game whose payoff matrix as following and find out the value of the game.

		B's strategy		
		I	**II**	**III**
A's strategy	**I**	1	7	2
	II	6	2	7
	III	5	1	6

15 **CO4**