

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: ME372**  
**Course Name: OPERATIONS RESEARCH**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any three full questions, each carries 10 marks.*

Marks

- 1 a) Write down the applications of OR with examples. (4)
  - b) Write down the basic structure of a linear programming problem in the mathematical form. (3)
  - c) What is the physical interpretation of dual variables? (3)
  - 2 Solve the following problem by Simplex method and comment on the result. (10)
- Maximize:  $5x_1 + 3x_2$   
 Subject to:

$$4x_1 - x_2 \leq 10;$$

$$2x_1 + 2x_2 \leq 50;$$

$$x_1, x_2 \geq 0$$

- 3 a) Discuss how an unbalanced assignment problem can be solved. (4)
- b) Explain with a proper example, how a maximization assignment problem can be solved by the Hungarian method? (6)
- 4 A manufacturing company has three factories, F1, F2 and F3, and two retail outlets, R1 and R2. It wishes to transport its products from its factories to its outlets at minimum total cost. The table below gives details of demand and supply, and also the unit costs of transportation.

		Retail outlet		
		R1	R2	Supply
Factories	F1	2	6	30
	F2	2	4	60
	F3	6	9	20
	Demand	60	20	

- i) Prepare the North-West corner rule solution for the balanced form of this problem. (6)
- ii) Check the optimality of the solution and comment on it. (4)

**PART B***Answer any three full questions, each carries 10 marks.*

- 5 There are five jobs, each of which has to go through two machines A and B in the order A-B. The processing times of each job in the machines are as follows. (10)

Job	J1	J2	J3	J4	J5
Machine 1	5	1	9	3	10
Machine 2	2	6	7	8	4

Determine the sequence which minimizes the total elapsed time. What is the idle time each machine

- 6 a) Explain the terminology used in network analysis. Differentiate between the methods of activity on arc and activity on node networks. (3)
- b) What is the use of crashing of networks? Why it is done? (3)
- c) Define CPM and PERT. Discuss the differences between them. What are their uses? (4)
- 7 a) Discuss the notation: M/M/3:20/∞/FCFS (3)
- b) The time to repair electronic equipment is distributed exponentially with mean 30 minutes. The equipment arrives for repair at an average rate of ten per eight hour day. Determine the average time the repairman is idle in each day? What is the average number of items in the repair shop? (7)
- 8 a) Write down any three assumptions of the basic inventory model. (3)
- b) An aircraft company uses rivets at an average customer rate of 2500 kg per year. Each unit costs Rs. 30/- per kg and the company personnel estimate that it costs Rs. 130/- to place an order. The carrying cost of the item is 10% per year. How frequently the orders for the rivets be made? What is the optimum order quantity and time between orders? (7)

### PART C

*Answer any four full questions, each carries 10 marks.*

- 9 a) Discuss any four advantages and disadvantages of using decision trees in decision making situations. (4)
- b) The pay-offs under different combinations of different actions and states of nature are as follows. Determine optimum action under Hurwicz criterion taking  $\alpha=0.75$  (6)

		States of nature			
		1	2	3	4
Alternatives	A1	5	10	18	25
	A2	8	7	8	23
	A3	21	18	12	21
	A4	30	22	19	15

- 10 a) Discuss different types of games. What are the properties of a two-person zero-sum game? (4)
- b) Determine for what value of  $\lambda$  the following game is strictly determinable? (6)

	$B_1$	$B_2$	$B_3$
$A_1$	$\lambda$	6	2
$A_2$	-1	$\lambda$	-7
$A_3$	-2	4	$\lambda$

- 11 Solve the following game completely. (10)

	Player B		
Player A	3	-2	4
	-1	4	2
	2	2	6

- 12 a) Define simulation. Classify simulation models under different criteria. (5)  
 b) Discuss the phases of simulation study by a neat flow chart. Select a bank as an example system with an objective to study and propose alternate queuing system. (5)
- 13 A game is played using two regular numbered six faced dice. In every trial the player rolls the dice together. If the sum of the faces turned up is a multiple of three, the player wins and becomes eligible for a sum of Rs. 5/-. In each trial the player has to pay Rs. 2/-. Using the following random streams simulate the faces turned up in each die for ten trials each. Count the net gain of the player at the end of the game. (10)  
 Die 1: 0.577, 0.206, 0.969, 0.525, 0.509, 0.037, 0.454, 0.708, 0.930, 0.506  
 Die 2: 0.997, 0.005, 0.563, 0.303, 0.888, 0.668, 0.089, 0.211, 0.959, 0.435
- 14 An inventory system faces demand for items in every week, the quantity of demand being distributed uniformly between 12 and 20 units. The items are supplied against the demand by the rule: minimum of demand or stock, if stock is positive. Whenever the stock comes below 30, a replenishment order is placed with the supplier for a fixed quantity of 50 units. The replenishments are realised on the immediate next week end. Orders are placed at the end of a week, if needed. Starting with a stock of 40 units, simulate the system for the next ten weeks. Use the following random numbers for generating demand for these weeks. Note down the number of weeks with the situations of no stock in the system. (10)

\*\*\*\*