15. (a) A manufacturer is offered two machines A and B. A has cost price of Rs. 2500. Its running cost is Rs. 400 for each of the first 5 years and increases by Rs. 100 every subsequent year. Machine 'B' having the same capacity as 'A' costs Rs. 1,250 and has a running cost of Rs. 600 for 6 years, increasing by Rs. 100 per year thereafter If money is worth 10% per year, which machine should be purchased? Scrap value of both the machines are assumed to be negligible. (13)

Or

(b) Solve the game given in table 15(b) by graphical method.

Table 15 (b)

	Y_1	Y_2	Y_3	Y_4
X_1	19	6	7	5
X_2	7	3	14	6
X_3	12	8	18	4
X_4	8	7	13	–1

PART C — (1 × 15 = 15 marks)

16. Alfa associates produce mini computers. The company maintains a constant workforce of 40 employees and there are no Subcontractors available. The company can however go on overtime if necessary and encourage customers to back-order computers. The demand pattern, available production capacities during regular time and overtime, as well as other data are as follows: Formulate this production Planning problem as a transportation model and determine the initial solution using any method. Number of quarter = 4; 60 days/quarter and 8 hours/day. Demand for quarters 1-4 (units) = 2000, 1500, 1700, 2000; Beginning inventory = 400; Desired final inventory = 150 units; The overtime for each employee is limited to 4 hours a day. Standard labor hours per unit = 15 hours; Inventory carrying cost = 10/period/unit; Backorder cost = Rs. 5/unit/period; Regular Time cost = Rs. 10 / hour; Over Time cost = Rs. 15/ hour; Material and overhead (Regular time) = Rs. 100 / unit; Material and overhead (Over time) = Rs. 60 / unit; Cost of unused capacity during regular time = Rs. 60 / unit. (15)

23/11/18 FN

Reg. No. :

Question Paper Code : 20795

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth/Fifth/Sixth/Seventh Semester

Mechanical Engineering

ME 6015 — OPERATIONS RESEARCH

(Common to Mechanical Engineering (Sandwich), Aeronautical Engineering, Manufacturing Engineering, Mechanical and Automation Engineering)

(Regulations 2013)

(Also Common to PTME 6015 – Operations Research for B.E. Part Time – Seventh Semester – Mechanical Engineering – Regulations 2014)

Time : Three hours Maximum : 100 marks

(Use of statistical table is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the mathematical formulation of a generalized LP model.
2. What is a redundant constraint in LPP?
3. Differentiate transportation and transshipment problem.
4. Define the following terms associated with network models.
   (a) Critical path
   (b) Spanning tree
5. Differentiate all unit and marginal unit quantity discounts in inventory.
6. Write the cost components involved in an inventory problem.
7. What are the elements of a queuing system?
8. What are the applications of simulation?
9. Write the applications of game theory.
10. What are the characteristics of dynamic programming?

PART B — (5 × 13 = 65 marks)

11. (a) Solve the following Linear Programming problem (13)

Maximize $Z = 4x_1 + 3x_2 + 6x_3$

Subject to $2x_1 + 3x_2 + 2x_3 \leq 440$

$4x_1 + 3x_3 \leq 470$

$2x_1 + 5x_2 \leq 430$

$x_1, x_2, x_3 \geq 0$

Or

(b) Write the dual of the following Linear Programming problem and solve by simplex method. (13)

Maximize $Z = 5x_1 + 12x_2 + 4x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 10$

$2x_1 - x_2 + x_3 = 8$

$x_1, x_2, x_3 \geq 0$

12. (a) A stell company is distributing imported ore from three ports to four steel mills. The supplies of ore arriving at ports, demand at the steel mills and distance between ports and steel mills are given in Table 12 (a). Transportation cost is Rs.05/ton/km. Solve the given transportation problem to minimize the total cost. (13)

Table 12 (a)

Ports	Steel mills				
	1	2	3	4	Supply
A	50	60	100	50	20000
B	80	40	70	50	38000
C	90	70	30	50	16000
Demand	10000	18000	22000	24000	

Or

(b) The routes and their lengths in Km between city 1 (node 1) and four other cities (node 2 to 5) are shown in figure 12(b). Use Dijkstra's algorithm to find the shortest route between city 1 and the remaining four cities. (13)

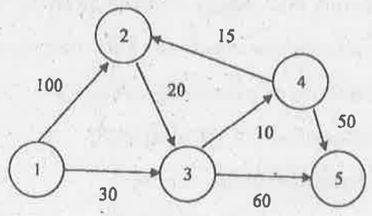

Figure 12 (b)

13. (a) Annual demand for an item is 10000 units. Ordering cost is 10 /order. Inventory carrying cost is Rs. 4 /unit/year. Unit price is Rs. 20 /unit. Shortage cost is Rs. 5 /unit/year. Find optimum order quantity, optimum shortages, maximum inventory and total cost. Would you recommend back ordering considering the total cost when back ordering is not allowed? (13)

Or

(b) Annual demand for an item is Rs. 12000/per year. Ordering cost is Rs. 20/lot. Holding cost is 16% of the price/unit/year. Price breaks are given in Table 15(a). (13)

(i) Find EOQ,

(ii) Find EOQ if ordering cost is changed to Rs. 30/lot.

Table 13 (b)

Order size	Cost/unit (Rs.)
<2000	3
2000-3999	2.9
4000 or more	2.85

14. (a) Workers come to tool store room to receive tools for accomplishing a particular operation. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time is 40 seconds. Determine

(i) The average queue length

(ii) Average length of non empty queue

(iii) Mean waiting time of an arrival

(iv) Assume the charge of a skilled worker is Rs. 4/hour and that of tool store room attendant is Rs. 0.75/hour. Determine whether to go in for an additional tool store room attendant which will minimize the combined cost of attendant's idle time and the cost of worker's waiting time (13)

Or

(b) A company manufactures 30 items per day. The sale of these items depends upon demand which has the distribution shown in table 14(b). The production cost and sale price of each unit are Rs. 40 and Rs. 50 respectively. Any unsold product is to be disposed of at a loss of Rs. 15/ unit. There is a penalty of Rs. 5/unit if the demand is not met. Using the following random numbers determine the total profit/loss for the company for the next 10 days. 10, 99, 65, 99, 95, 01, 79, 11, 16, 20. (13)

Table 14(b)

Sale (units):	27	28	29	30	31	32
Probability:	0.10	0.15	0.20	0.35	0.15	0.05