Time: 3 Hours                                                                                      Total marks: 70

Instructions:   1. Answer two sections separately
                2. Figures to the right indicate full marks
                3. Support your answers by diagrams/ figures where required

## Section-I

Q.1(a)   Explain briefly following features of operations research:                          06

    (i)  Decision making

    (ii) Scientific approach

    (iii) Inter-disciplinary team approach.

Q.1(b)   Using MODI method, check whether the following transportation problem is    06
optimal or not.

|    | W1 |   | W2 |   | W3 |   | W4 |    | Capacity |
|----|----|---|----|---|----|---|----|----|----------|
| F1 | 19 | 5 | 30 |   | 50 |   | 10 | 2  | 7 |
| F2 | 70 |   | 30 |   | 40 | 7 | 60 | 2  | 9 |
| F3 | 40 |   | 8  | 8 | 70 |   | 20 | 10 | 18 |
| Requirement | 5 |  | 8 |  | 7 |  | 14 |  | 34 |

OR

Q.1(a)   Using the simplex method solve the following problem:                            08

Max. $Z= 4X_1+3X_2+5X_3$

S.t. constraints  $4X_1 + 3X_2 \leq 10$

$$3X_2 + 5X_3 \leq 12$$

$$5X_1 + 4X_2 + 6X_3 \leq 18$$

$$X_1, X_2, X_3 \geq 0$$

Q.1(b)   Explain Hungarian Method for Assignment Problem.                               04

Q.2(a)   From the following data of activities, draw a network, plot critical path and   07
calculate project duration.

| Activity | 1-2 | 1-4 | 1-5 | 2-3 | 3-8 | 4-6 | 4-7 | 5-6 | 6-9 | 7-8 | 8-9 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Duration (weeks) | 8 | 7 | 7 | 9 | 5 | 10 | 7 | 7 | 10 | 10 | 6 |

Q.2(b)   With reference to inventory control, define order quantity, safety stock, re-   04
order point and lead time.

OR

Q.2(a)  How are CPM and PERT are different? State their applications.          05

Q.2(b)  Derive the EOQ equation from first principles.          06
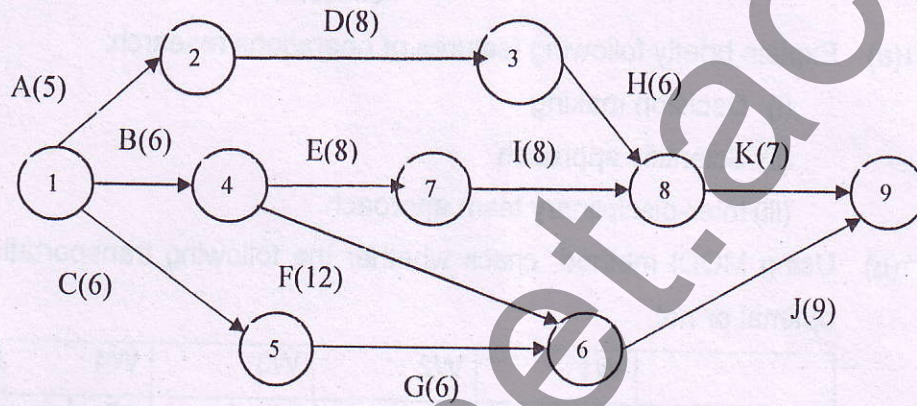
Q.3  Answer any two:          12

(i)  Write a short note on 'zero inventory' concept.

(ii)  Consider the following network. Compute Earliest Start Time (EST) for each activities of the network.



(iii)  Four different jobs are to be carried out on four machines. Due to very high cost of loading and un-loading, changeovers are not permitted. The cost of manufacturing different jobs on machines are shown in table below. Find out assignments of jobs for minimum cost.

|    | M1 | M2 | M3 | M4 |
|----|----|----|----|----|
| J1 | 7  | 9  | 13 | 8  |
| J2 | 10 | 7  | 77 | 8  |
| J3 | 6  | 9  | 12 | 9  |
| J4 | 12 | 6  | 10 | 5  |

(iv)  What is unbalanced transportation problem? How will you attempt to solve it? Explain with suitable example.

Section-II

Q.4(a)  Describe and compare mass production v/s batch production system.          06

Q.4(b) The manager of a company considers four months sales data to forecast the demand for the 5th period. He finds that the best forecast is derived by using 35% of actual sales for most recent month, 30% of two months ago, 25% of three months ago and 10% of four months ago, calculate the forecast for 5th month using data as under: 06

| Month | 1 | 2 | 3 | 4 | 5 |
|-------|-----|-----|-----|-----|---|
| Sales | 125 | 120 | 130 | 125 | ? |

OR

Q.4(a) Explain the Job shop system of production. State the characteristics of it. State why scheduling of job shop becomes complex? 06

Q.4(b) With reference to PPC explain routing, sequencing and scheduling. 06

Q.5(a) What are the important elements of TQM? Explain them briefly. 05

Q.5(b) The data collected for 12 samples measured for a dimension of component is shown as under. Calculate control limits for $\bar{X}$ and R and draw the charts. The values for $A_2 = 0.58$, $D_3 = 0$ and $D_4 = 2.11$ 06

| Sample No. | Sample observation (X) | | | | |
|------------|----|-----|-----|-----|-----|
| 1 | 44 | 67 | 77 | 80 | 89 |
| 2 | 44 | 47 | 70 | 74 | 92 |
| 3 | 21 | 26 | 82 | 83 | 83 |
| 4 | 38 | 56 | 71 | 79 | 86 |
| 5 | 44 | 53 | 59 | 61 | 80 |
| 6 | 53 | 76 | 77 | 80 | 134 |
| 7 | 58 | 58 | 70 | 93 | 136 |
| 8 | 16 | 18 | 25 | 40 | 58 |
| 9 | 13 | 28 | 37 | 60 | 82 |
| 10 | 67 | 107 | 111 | 116 | 151 |
| 11 | 62 | 88 | 91 | 107 | 110 |
| 12 | 59 | 76 | 92 | 107 | 134 |

OR

Q.5(a) With reference to acceptance sampling explain double sampling plan. State its advantages and limitations. 06

Q.5(b) Explain how quality control and quality assurance are different. 05

Q.6 Answer any two:

(i) Explain the step wise procedure of Value Analysis. How is it different from Value Engineering?

(ii) Design a single sampling plan with following data:
 - Consumer's risk- 0.07
 - Producer's risk- 0.05
 - Acceptance quality level-0.035
 - Lot tolerance percent defective-0.11

(iii) What do you understand by standardization and simplification? How do these concepts help manage materials in an organization?

(iv) Discuss the importance of dispatching, progress reporting and expediting in PPC.

***