

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Solve any **four** question from the remaining questions.
 (3) Assume **suitable** data wherever **necessary**.
 (4) **Figures** to the right indicate **full marks**.

1. Write short notes on any **four** of the following :-

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- Aggregate Planning and its strategies
- MRP concept and JIT concept
- Scheduling
- Lean and Agile Manufacturing
- PERT and CPM
- Demand Forecasting.

2. (a) A firm manufactures three products A, B and C. Time to manufacture product A is twice that for B and thrice that for C and they are to be produced in the ratio 3 : 4 : 5. The relevant data is given in the following table.

Raw Material	Requirement per unit of product (kg)			Total availability (kg)
	A	B	C	
P	6	5	9	5,000
Q	4	7	8	6,000

If the entire labour is engaged in manufacturing product A, 1,600 units of this product can be produced. There is demand for at least 300, 250 and 200 units of product A, B and C and the profit earned per unit is Rs. 50, Rs. 40 and Rs. 70 respectively.

Formulate the problem as a Linear Programming problem.

(b) Explain the following :-

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- Purchasing and EDI in MPC
- CRP with flow diagram.

3. (a) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times are given in hours as -

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T.

- (b) A machine tool company decides to make four sub-assemblies through four contractors. Each contractor is to receive only one sub-assembly. The cost of each sub-assembly is determined by the bids submitted by each contractor and is shown in the table given below in hundreds of rupees. Assign the different sub-assemblies to contractors so as to minimize the total cost. Also assign the different sub-assemblies to contractors so as to maximise the profit. 10

		Contractors			
		1	2	3	4
Sub-assemblies	1	15	13	14	17
	2	11	12	15	13
	3	13	12	10	11
	4	15	17	14	16

4. (a) Project consists of 8 activities. Precedence relation and activity times are given below. Draw the network diagram and calculate the critical path. Find out the slack for each activity in a Tabular form. 10

Activity	Immediate Predecessor	Activity Time(Weeks)
P	-	12
Q	-	20
R	-	28
S	R	12
T	P, Q	28
U	T, S	12
V	S	8
W	U, V	8

- (b) Construct the dual of the following problem :- 10

Minimize $Z = 3x_1 - 2x_2 + 4x_3$

St $3x_1 + 5x_2 + 4x_3 \geq 7,$

$6x_1 + x_2 + 3x_3 \geq 4,$

$7x_1 - 2x_2 - x_3 \leq 10,$

$x_1 - 2x_2 + 5x_3 \geq 3,$

$4x_1 + 7x_2 - 2x_3 \geq 2,$

$x_1, x_2, x_3 \geq 0$

5. (a) Show that there is an unbounded solution to the following L.P. problem : 10

Maximize $Z = 4x_1 + x_2 + 3x_3 + 5x_4,$

Subject to $4x_1 - 6x_2 - 5x_3 - 4x_4 \geq -20,$

$-3x_1 - 2x_2 + 4x_3 + x_4 \leq 10,$

$-8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20,$

$x_1, x_2, x_3, x_4 \geq 0$

- (b) A firm uses simple exponential smoothing with $\alpha = 0.2$ to forecast demand. The forecast for the first week of January was 400 units, whereas actual demand turned out to be 450 units. 10
- (i) Forecast the demand for the second week of January.
 - (ii) Assume that the actual demand during the second week of January turned out to be 460 units. Forecast the demand up to February third week, assuming the subsequent demands as 465, 434, 420, 498 and 462 units.

6. (a) Compute the material requirements plan for an item 'X' shown below. The item has an independent demand and a safety stock of 40 is maintained. 10

Order Quantity = 70 Lead Time = 4 weeks Safety Stock = 40	WEEK											
	1	2	3	4	5	6	7	8	9	10	11	12
Projected requirement	20	20	25	20	20	25	20	20	30	25	25	25
Receipts		70										
On hand at the end of period (65)												
Planned order release												

- (b) A particular item has a demand of 9000 units/year. The cost of one procurement is Rs. 100 and the holding cost per unit is Rs. 2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine – 10
- (i) the economic lot size,
 - (ii) the number of orders per year,
 - (iii) the time between orders,
 - (iv) the total cost per year if the cost of one unit is Re. 1/-

7. (a) The time estimates (in weeks) for the activities of a P.E.R.T. network are given below :- 10

Activity	Optimistic time t_o	Most Likely time t_m	Pessimistic time t_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- (i) Draw the network diagram and identify all paths.
 - (ii) Determine expected project length
 - (iii) Calculate the standard deviation and variance of the project in Tabular form.
- (b) Describe the SFC (Shop Floor Control) in MPC. Explain the techniques of SFC in detail. 10