

**Course Coordinator:** Dr. S.P. Singh **Batch:** B.Tech, M.Tech, PhD. **Max. Marks:** 15; **Time Allowed:** 1 hr

**Part A:**

An electronic manufacturing company requires 120 units per year for a specific product X used in IC manufacturing. Ordering cost is ₹35 per order and the lead time is two days. Inventory carrying cost is 25% of the product price. The supplier of product X provides quantity discount according to the table given below.

Product 'X'	Purchasing Price(₹)
$X < 14$	59
$15 \leq X < 50$	55
$X \geq 51$	50

1. What is the EOQ at base purchase price?
2. What is the optimal quantity?
3. What is the optimal inventory cost?

**PART B:**

A chemical company is involved in the purchasing of concentrated sulphuric acid. The purchase price is ₹175 per gallon. The clerical and data processing costs are ₹600 per order. All the goods are transported by rail. Each time the special line to the factory is opened the company is charged ₹3000. Additionally, a charge of ₹18 per gallon is made. The company uses 40,000 gallons per year. Maintenance cost of stock is ₹350 per gallon per year. Each gallon requires 0.5 sq ft of storage space. If warehouse space is not used, it can be rented out to another company at ₹200 per sq ft per annum. The available warehouse space is 1000 sq ft, the overhead costs being ₹5,000 per annum. Assume that all free warehouse space can be rented out. Based on the above information what is

4. the optimal order quantity (a) 800 (b) 400 (c) 1600 (d) None of these
5. the optimal annual cost is (a) 360000 (b) 7725000 (c) 8085000 (d) 36000
6. the total annual cost can be given as  $\sqrt{2C_c \cdot C_o \cdot D}$  TRUE/ FALSE/ Can't Say

[Note:  $C_c$ ,  $C_o$ , &  $D$  refers to carrying cost, ordering cost, and annual demand respectively]

**PART C:**

Consider the demand for 5 periods (in units) 3000, 3200, 4000, 3600, 4200 and ~~2800~~. Beginning inventory is 800 units. RT capacity is 3600 units and OT capacity is 400 units and subcontracting can be done up to 300 units in a month. Beginning inventory is 200 units. The RT, OT and ICC costs are 30, 45 and ₹5 per unit per month respectively. The outsourcing cost is ₹50 per unit.

[Note: RT-Regular Time; OT-Overtime; ICC-Inventory carrying cost; Apply North-West Method]

7. What is the total available capacity for entire planning period?
8. What is the production quantity using RT, OT & subcontract in the 3<sup>rd</sup> period for 3<sup>rd</sup> and 4<sup>th</sup> period?
9. What is the production quantity using RT, OT & subcontract in the 4<sup>th</sup> period for 4<sup>th</sup> and 5<sup>th</sup> period?
10. What is the unit production cost using RT, OT & subcontract in the 3<sup>rd</sup> period for 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> period?
11. What is the total production cost?

**PART D:**

The Seymore Tiles Manufacturing Company of Noida has forecasted the demand for the year 2017 which is 5000; 10000; 8000; and 2000 units for all quarters. At the beginning of January 1, there are 1,000 units in inventory. Other relevant data available with the firm are: Hiring cost per employee = ₹200, Firing cost per employee = ₹400, Beginning work force = 60 employees, Inventory carrying cost = ₹2/quarter, Stock out cost = ₹5/unit, Regular payroll = ₹1200/employee per quarter, Overtime cost = ₹2/unit. Each employee can produce 100 units per quarter. Demand not satisfied in any quarter is lost. The problem is to optimize the production plan using Linear Programming approach. Answer the below questions.

[Note: Use symbols  $W_i, H_i, F_i, X_i, O_i, I_i, S_i$  for employment level, number of hires, Number of fires, Regular time production, Overtime production, Inventory at the end, and Stockouts during the  $i^{\text{th}}$  quarter, respectively.]

12. Formulate the objective function of the L.P.
13. Formulate the demand constraint.
14. Formulate the inventory balance for all quarters.
15. Formulate the hiring and firing considering with respect to regular time production.

\*\*\*\*\* All the Best \*\*\*\*\*