

**B.Sc. Prog. / II**

**B**

**OPERATIONAL RESEARCH**

**Paper OR-202— Inventory Management and  
Queueing Theory**

**(Admissions of 2005 & onwards)**

**Time : 3 hours**

**Maximum Marks: 112**

*(Write your Roll No. on the top immediately  
on receipt of this question paper)*

*Attempt five questions in all, selecting at least  
two questions from each Section.*

*Simple calculators are allowed.*

**SECTION A (Inventory Management)**

1. (a) Describe briefly the EOQ concept. What are its limitations? Explain also the terms (i) Lead time, (ii) Reorder point, (iii) Stock-out cost, (iv) Ordering cost / Setup cost. 11
- (b) Each unit of an item costs a company Rs. 40/- with annual holding cost of 18% of unit cost for interest charges, 1% for insurance, 2% allowance for obsolescence, Rs. 2/- for building overhead, Rs. 1.50

**P.T.O.**

for damage and loss and Rs. 4/- for miscellaneous costs. If the annual demand for the item is constant at 1000 units and each order costs Rs. 100/- to place, calculate economic order quantity and total cost of stocking the item. If the supplier delivers batches of 250 units only, how does this affect the costs? Describe an appropriate ordering policy if the lead time is constant at (i) 1 month, (ii) 4 months. 11½

2. (a) Formulate and solve a discrete, deterministic demand inventory model when shortages are not allowed. 11
- (b) Discuss a multi-item deterministic demand inventory model by taking a constraint on the maximum number of orders placed per year into consideration. State the procedure also to find the optimal policy. 11
3. (a) Differentiate between "all unit quantity" and "incremental quantity" discount.

A factory requires 1500 units of an item per month, each costing Rs. 27/-. The cost per order is Rs. 150/- and inventory carrying charges work out to 20% of average inventory. Find out the economic order quantity and the number of orders per year. Would you accept a price discount of 2% on minimum

supply quantity of 1200 units? Compare the total cost in both the cases. 12

(b) Discuss a production scheduling model in detail. 10

4. (a) Formulate and solve a continuous, time dependent, single period, stochastic demand inventory model. 12

(b) From the following details, draw a plan of ABC selective control:

<i>Item</i>	<i>Units</i>	<i>Unit Cost (Rs.)</i>	
1.	9,000	7	
2.	26,000	5	
3.	1,600	12	
4.	800	24	
5.	40,000	3.50	
6.	42,000	2.50	
7.	62,000	2.20	
8.	5,000	5.50	
9.	500	10.00	
10.	31,000	2.40	
11.	13,500	9.10	
12.	6,100	8.20	10 1/2

P.T.O.

SECTION B (*Queueing Theory*)

5. (a) What types of questions are sought to be answered in analysing a queueing system? List various types of configurations of service facility in queueing system. 9½
- (b) Show that  $n$ , the number of arrivals in queue in time follows Poisson distribution, stating assumptions clearly. Show that distribution of time interval between two successive arrivals is exponential, and prove its Markovian property. 13
6. (a) Obtain steady state probability distribution of number of units in the system for a generalized  $(M | M | 1 : \infty | \text{FCFS})$  queueing model. Discuss also the cases (i) Queue with ample server, (ii) Queue with discouragement. 15
- (b) In a tool crib manned by a single assistant, operators arrive at the tool crib at the rate of 10 per hour. Each operator needs 3 minutes on an average to be served. Find out the loss of production due to the time lost in waiting for an operator in a shift of 8 hours if the rate of production is 100 units per shift. 7
7. (a) Derive steady state difference equations for  $(M | M | C | K | \text{FCFS})$  queueing system. 11

- (b) Discuss machine-interference problem. 11
8. (a) Find mean and cumulative distribution function for Erlang distribution. 7
- (b) Obtain the expression for average number of stages in the queue and in the system under steady state for  $(M | E_k | 1 : \infty | \text{FCFS})$  queueing model. 15½