[This question paper contains 4 printed pages]

5195 　ᷦ 　　　　　　　*Your Roll No*

B.Sc. Prog./II 　　　　　　J

OPERATIONAL RESEARCH

OR–202 – Inventory Management and Queuing 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*

SECTION A
(Inventory Management)

1   (a) What functions does inventory perform, in any organization ? State the two basic inventory decisions, management must take as they attempt to accomplish the function of inventory described by you

　　(b) A purchase manager places order each time for a lot of 500 units of a particular item From the available data, the following results are obtained –

Inventory carrying charge = 40%

Cost per unit = Rs 40/-

Ordering cost per order = Rs 600/-

Annual demand = 6 orders each of 500 items

P T O

Find out the loss to the organization due to his ordering policy   (11,11)

2   (a) Derive an expression of EOQ for a generalized economic lot size model by stating all assumptions and notations

        Also determine the reorder level when lead time is finite i e $\tau > 0$

   (b) What is selective inventory control ? Explain ABC analysis in detail   (16,6½)

3   (a) Formulate and solve a single period, descrete and stochastic demand, time independent inventory model

   (b) Discuss any production scheduling model in detail   (12½,10)

4   (a) Develop a multi-item deterministic inventory model with constraint on floor space Shortages are not allowed Also outline the procedure for determining the optimal order quantity schedule

   (b) Formulate and solve a mathematical inventory model for ' incremental quantity discount' when demand is continuous and deterministic and shortages are not allowed

        For one of the bought out item, the following are the relevant data –

Ordering cost = Rs 500/-, Cost per item = Rs 100/-
Annual demand = 1000 units, Inventory carrying
charge = 40%

The purchase manager placed five orders of equal
quantity in one year in order to avail the "all unit"
quantity discount of 5% on the cost of the item.
Work out the gain or loss to the organization due
to his ordering policy for this item   (10,12½)

SECTION B
(Queuing Theory)

5. (a) If arrivals are random, then show that the no of
        arrivals in a fixed interval of time will follow
        Poisson distribution Also obtain the distribution of
        interarrival time

    (b) Find $n(t)$, t_i and $W_q^{(n)}$ for the following deterministic
        queuing system –

        $$\frac{1}{\lambda} = 4, \quad \frac{1}{\mu} = 6 \quad K = 5$$

        (The symbols have their usual meaning) Show
        graphically also   (12½,10)

6   (a) For (M|M|1 ∝|FCFS) queuing model, obtain in
        steady state, the expressions for the following -

        (i) Expected no of customers in the queue

        (ii) Probability distribution of waiting time in the
             queue and average no of customers in the
             queue

                                              P T O

(b) A bank has two tellers working on saving accounts The first teller handles withdrawls only The second teller handles deposits only It has been found that the service time distribution for both deposits and withdrawls is exponential with mean service time 3 minutes per customer. Depositors are found to arrive in Poisson distribution throughout the day with mean arrival rate of 16 per hour Withdrawers also arrive in Poisson fashion with mean arrival rate of 14 per hour What would be the effect on average waiting time for depositors and withdrawers if each teller could handle both withdrawls and deposits. What could be the effect if this could be accomplished by increasing the mean service time to 3 5 min   (12,10½)

7 · (a) Discuss (M|M|1) queuing model with finite population size and FCFS queue discipline in context of machine interference problem

   (b) Obtain Erlong distribution by "phase method" and find its cumulative distribution function

                                                          (11,11½)

8 (a) Obtain an expression for steady state probability generating function of the no of phases in the system for $(M|E_k|1 \ \infty|FCFS)$ queuing model

   (b) Derive the steady state equations describing (M|M|C|K|FCFS) queuing system   (14,8)

                                          (200)****