

Con. 2442-08.

(3 Hours)

[Total Marks : 100

- N.B. : (1) Attempt any **five** questions.  
 (2) **Figures** to the **right** indicate **full** marks.  
 (3) **Necessary** explanations at the **intermediate stages** must be given.  
 (4) **Assumptions** wherever necessary must be **clearly** stated.  
 (5) Use of **non-programmable** calculator and **statistical** tables is **permitted**.

1. (a) A water purification plant has compiled the following data on water usage. 10

<b>No. of Households (1000) (x)</b>	82	78	84	76	80
<b>Water consumed (in Crores of litres) (y)</b>	94	83	99	85	89

Find the best linear estimate of water consumed when number of households is (i) 7500  
 (ii) 9200.

- (b) 4 Jobs are to be processed on each of the 2 machines  $M_1$  and  $M_2$  in the order  $M_1 M_2$ . There 10  
 processing terms, in minutes, are as given below :—

<b>Job No.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
$M_1$	15	10	12	13
$M_2$	25	9	14	10

Determine the minimum completion time of all Jobs on the 2 machines.

2. (a) An item is produced at the rate of 150 per day. The demand occurs at the rate of 70 per day. 10  
 The set up cost is Rs. 120 per set up, Holding cost is Re 0.04 per unit per day. Find EOQ.  
 (b) The initial cost of the machine is Rs. 20,000 and maintenance ( $M_t$ ) which increase with age, 10  
 is as follows :—

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
$M_t$	60	70	100	120	150

Interest rate is 10%. What is the replacement policy ?

3. (a) The following table gives the actual value  $x$ , in Rs., of an item. Assuming no. trend, forecast 10  
 $x$  by exponential smoothing for the month 6, taking  $\alpha = 0.2$ .

<b>Month No. (n)</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
$x_n$	20	17	18	23	22	25

- (b) Consumption of an item is normally distributed with mean 100 unit and a S. D. 10 units for 10  
 10 units. Its lead time is also normally distributed with mean 5 days and S. D. 1, how many  
 units should be on hand, at reorder level, in order to be 95% sure of not running out before  
 the delivery services.

4. (a) A flight is scheduled to leave Bombay for Delhi at 9 a.m. every day. Past experience shows 10  
 the delay in departure as follows :—

<b>Delay in hours</b>	0	1	1.2	1.4	1.6	1.8	2.0
<b>% of flights delayed</b>	60	20	10	4	3	2	1

If scheduled arrival of Delhi is 10 a.m., use Monte Carlo simulation to determine % of flight  
 reaching late at Delhi.

Carry out 5 iterations using the following random numbers :—

0973 2514 3819 2248 3569 3197  
 8402 3910 9354 0213 8941 2348

16 May, 2008

- (b) A coal rushing company installs special filter in order to reduce the air pollution from its factory. **10**  
 The filter costs, if purchased a new one, Rs. 80,000 including installation and can be sold for the following prices at the end of each year. R = Resale value, in Rs. 1000.

Year	1	2	3	4	5 or more
R	70	60	55	40	20

Compute the optimal replacement plan for the filter—  
 (i) without interest rate (ii) with interest rate of 10%.

5. A municipal corporation has observed for street light tubes, the following, failure tube rates (R) at the end of the month. **20**

Month	1	2	3	4	5
R, in %	10	20	45	70	100

There are 2000 tubes on the city streets. It cost Rs. 10 to replace individual tube which has burnt out. It is proposed to replace all tubes simultaneously at fixed intervals of month which will cost Rs. 2 per tube whether or not it is burnt out and to continue replacement for burnt out tubes during that interval.

- (i) At what intervals of months should all the bulbs be replaced ?  
 (ii) At what group replacement price per tube, would be a policy of strictly individual replacement become preferred to the adopted policy ?

6. (a) The probability distribution of the demand of a certain product is as follows :— **10**

Demand (units)	0	1	2	3	4	5
Probability	0.05	0.10	0.25	0.30	0.25	0.05

The cost per unit is Rs. 80 and selling price is Rs. 110 per unit. If the product is not sold, since it is perishable it can be sold in the next period at lower price of Rs. 40 per unit. Assuming no reordering is possible, how many units should be purchased in order to maximize the expected gain ?

- (b) If money is worth 18%, compounded bimonthly, find the amount of annuity whose annual rent is Rs. 6000 which is payable bimonthly for 5 years. **10**

7. (a) A section of a trunk pipe line is due for repair. The section can be repaired at a cost of Rs. 10,000 which will last for 3 years. Alternately the section can be replaced by a new one at a cost of Rs. 30,000 which will last for 10 years. Assuming cost of capital to be 10% and ignoring the salvage value, what course should be adopted in the above situation ? **10**

- (b) Monthwise demand for first to sixth month of a particular item is given below :— **10**

Month	1	2	3	4	5	6
Actual demand (units 100)	20	14	19	31	17	15

- (i) Forecast demand for seventh month by taking  $d = 0.1, 0.5$  and  $0.9$ .  
 (ii) Compute mean squared error in each case and comment on selection of  $\alpha$ .

8. (a) There are 5 jobs to be processed on 3 machines  $M_1, M_2$  and  $M_3$  in order  $M_1M_2M_3$  for each job. The respective processing times (in hours) are given in the following table. **10**

	$J_1$	$J_2$	$J_3$	$J_4$	$J_5$
$M_1$	2	5	4	10	16
$M_2$	9	12	10	6	7
$M_3$	13	12	16	19	17

It is required to develop a suitable schedule, so as to minimize total make span time. Determine the optimal job sequence.

- (b) Explain the following terms, with illustrations— **10**  
 (i) Lead Time  
 (ii) Maximum Lead Time Demand  
 (iii) Buffer and safety stocks  
 (iv) Reorder level.