2021

Applied Mathematics with Oceanology and

Computer Programming

[P.G.]

(CBCS)

(M.Sc. Third Semester End Examinations-2021)

MTM – 306 B

Full Marks: 50　　　　　　　　　　*Time: 02Hrs*

The figures in the right hand margin indicate marks
Candidates are required to give their answers in their own words as far as practicable
Illustrate the answers wherever necessary

[OPERATIONAL RESEARCH MODELLING - I]

Answer question no 1 and any four from the rest

1. **Answer any four question**　　　　　　　　**4x2=8**

   a) Let us consider the following problem :

   Maximize $z = f_1(y_1) + f_2(y_2) + \ldots\ldots\ldots + f_n(y_n)$.

   Subject to $y_1 y_2 \ldots\ldots\ldots y_n \geq p. p > 0, y_j > 0$ for all j

   Define the state variables and decision functions to solve this problem by dynamic programming method.

b) What are the critical paths and critical activities in network analysis ?

c) What are the benefits of inventory control ?.

d) What are the advantage of networkanalysis ?

e) Explain with example the group replacement and individual replacement.

f) What is the objective of InventoryControl ?

2. Solve the following LP problem by dynamic programming method.

Maximize $z = 8x_1 + 7x_2$

Subject to

$2x_1 + x_2 \leq 8$

$5x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

3. Derive the Economic Order Quantity for the inventory model where, demand rate is uniform, replenishment rate infinite, and shortages allowed.

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4. Arrival rate of telephone calls at a telephone booth are according to Poissondistribution, with an average time of 9 minutes between two consecutive arrivals. The length of the telephone call is assumed to be exponentially distributed, with mean 3 minutes.

i) Find the average queue length that is formed time to time.

ii) The telephone company will install a second booth when convinced that on arrival would expect to have to wait at least four minutes for the phone. Find the increase in flow rate of arrivals which will justify a second booth.

iii) What was the probability that an arrival will have to wait for more than 10 minutes before the phone is free?

iv) What is the probability that he will have to visit for more than 10 minutes before the phone is available and the call is also complete?

5. A project schedule has the following characteristics

Activity	Time (year)	Activity	Time(year)
1 – 2	4	5 – 6	4
1 – 3	1	5 – 7	8
2 – 4	1	6 – 8	1
3 – 4	1	7 – 8	2
3 – 5	6	8 – 10	5
4 – 9	5	9 – 10	7

i) Construct the network.

ii) Complete E and L for each event.

iii) Find the critical path.   2+2+4

6. Find the probability of n customers in the queue at any instant and expected queue length for the queuing model.

$$(M/M/C):(\infty/FCFS/\infty)$$ 8

7. A dealer supplies you the following information with regard to a product dealt in by him :

Annual demand :   10000 units

Ordering cost :   Rs. 10 per order

Inventory carrying cost : 20% of value of inventory per year

Price :   Rs. 20 per unit

The dealer is considering the possibility as allowing some back order (stock-out) to occur . He has estimated that the annual cost of backordering will be 25% of the value of inventory.

   i)   What should be the optimum number of units of the product he should buy in one lot?

   ii)   What quantity of all product should be allowed to be back order? If any.

   iii)   What would be the maximum quantity of invention at any time of the year?

   iv)   If back-order is allowed then what would be the annual cost?   2+2+2+2

[Internal Marks – 10]