PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Sixth Semester)

Branch – **MATHEMATICS**

OPERATIONS RESEARCH – II

Time: Three Hours | Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 Which of the following is not correct?
(i) Queuing theory deals with situations where customers arrive, wait for the service, get the service and leave the system.
(ii) Customers, in queuing theory might include humans, machines, ships, letters and so on.
(iii) A queue refers to physical presence of the customers waiting to be served.
(iv) A study of queuing theory helps the manager to establish an optimum level of service.

2 For a "Poisson exponential, single server and infinite population" queuing model, which of the following is not correct?
(i) $E(n) = E(m) - \lambda/\mu$, (ii) $E(m) = \lambda E(w)$,
(iii) $E(n) = \lambda E(v)$ (iv) $E(v) = E(w) + 1/\mu$

3 Staff replacement policy
(i) arises due to resignation, retirement ,or death of a staff member from time to time,
(ii) is like replacement policy for items whose values deteriorate gradually
(iii) can be easily formulated because people retired at known items,
(iv) does not yield the optimum replacement interval.

4 If EOQ is calculated but an order is then placed which is smaller than these, will the total inventory cost
(i) decrease (ii) increase (iii) either decease or increase. (iv) no change

5 As simulation is not an analytical model, therefore, result of simulation must be viewed as_____.
(i) approximation (ii) exact
(iii) unrealistic (iv) simplified

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per hour. After starting your assumptions, find the average member of customers waiting for the service of the clerk?

OR

b A TV repairman finds that the time spend on his jobs has an Exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come in, and if the arrival of sets is approximately poisson with an average rate of 10 per 8-hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought-in?

7 a A hospital clinic has a doctor examining every patient brought in for a general check-up. The doctor spends 4 minutes on each phase of the check-up although the distribution of time spent on each phase is approximately exponential. If each patient goes through four phases in the check-up and if the arrivals of the patients to the doctor's office are approximately Poisson at the average rate of three per hour,What is the average time spent by a patient waiting in the doctor's office? What is the average time spent in the check-up? What is the most probable time spent in the check-up?

OR

Cont...

b At a certain airport it takes exactly 5 minutes to land an aero plane, once it is given the signal to land. Although incoming planes have scheduled arrival times the wide variability in arrival times produces an effect which makes the incoming planes appear to arrive in a Poisson fashion at an average rate of 6 per hour. This produces occasional stickups at the airport which can be dangerous and costly. Under these circumstances, how much times will a pilot expect to spend circuling the field waiting to land?

8 a A firm is considering replacement of a machine, whose cost is Rs. 12,200 and the scrap value, Rs. 200. The running (maintenance and operating) cost in rupees are found from experience to be as follows:

Year :	1	2	3	4	5	6	7	8
Running cost :	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced?

OR

b A pipeline is due for repairs. It will cost Rs. 10,000 and last for 3 years. Alternatively, a new pipeline can he laid at a cost of Rs. 30,000 and lasts for 10 years. Assuming cost of capital to be 10% and ignoring salvage value, which alternative should be chosen?

9 a A contractor undertakes to supply Diesel engines to a truck manufacture at the rate of 25 per day. There is a clause in the contract penalizing him Rs. 10 per engine per day. Late for missing the scheduled delivery date. He finds that the cost of holding a complete engine in stock is Rs.16 per month. His production process is such that each month he starts a bath of engines through the shops, and all these engines are available for delivery any time after the end of the month. What should his inventory level be at the beginning of each month ?

OR

b Neon lights in an industrial park are replaced at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs Rs. 100 to initiate a purchase order. A neon light kept in strong is estimated to cost about Re. 0.02 per day. The lead time between placing and receiving an order is 12 days. Determine the optimum inventory policy for ordering the neon lights.

10 a Customers arrive at a milk booth for the required service. Assume that inter-arrival and service times are constant and given by 1.8 and 4 time units, respectively. Simulate the system by hand computations for 14 time units. What is the average waiting time per customer? What is the percentage idle time of the facility? (Assume that the system starts at t=0.)

OR

b Write in detail about process of Simulation.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Evaluate the following:

(i) the mean queue size and

(ii) the probability that the queue size exceeds 10. If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii)?

OR

b A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per hour. After stating your assumptions, answer the following :

(i) What is the average number of customers waiting for the service of the clerk ?

(ii) What is the average time a customer has to wait before getting service?

12 a In a heavy machine shop, the overhead crane is 75 per cent utilized. Time study Observations gave the average slinging time as 10.5 minutes with a standard deviation of 8.8 minutes. What is the average calling rate for the services of the crane, and what is the average delay in getting service? if the average service time is cut to 8.0 minutes, with the standard deviation of 6.0 minutes, how much reduction will occur, an average, in the delay of getting served ?

OR

b In Queueing Model {(M/G/1):(∝/GD)}, find the steady state probability p_n and hence find L_s , L_q , W_s and W_q

13 a A manufacturer is offered two machines A and B. machine A is priced at Rs. 5,000, and running costs are estimated at Rs. 800 for each of the first five years, increasing by Rs. 200 per year in the sixth and subsequent years. Machine B, which has the same capacity as A, costs Rs. 2,500 but will have running costs Rs. 1,200 per year for six years, increasing by Rs. 200 per year thereafter. If money is worth 10% per year, which machine should be purchased? (Assume that the machine will eventually be sold for scrap at a negligible price.)

OR

b The following failure rates have been observed for a certain type of transistors in a digital computer :

End of the week :	1	2	3	4	5	6	7	8
Probability of failure of date :	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00

The cost of replacing an individual failed transistor is Rs. 1.25. the decision is made to replace all these transistors simultaneously at fixed intervals, and to replace the individual transistors as they fail in service. If the cost of group replacement is 30 paise transistor, what is the best interval between group replacements ? At what group replacement price per transistor would a policy of strictly individual replacement become preferable to the adopted policy ?

14 a The demand for an item in a company is 18,000 units per year, and the company can produce the items at a rate of 3,000 per month. The cost of one set-up is Rs.500.00 and the holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs.20.00 per month. Evaluate

(i) optimum production batch quantity and the number of strategies.
(ii) optimum cycle time and production time.
(iii) maximum inventory level in the cycle and
(iv) total associated cost per year if the cost of the item is Rs.20 per unit.

OR

b A chemical company holds its inventory of raw materials in special containers, with each container occupying 10 square feet of floor space. There are only 5,000 square feet of storage space available. Each year, this company uses 9,000 special containers of raw materials, paying Rs.8 per container of raw material. If ordering cost is Rs. 40 per order and annual holding costs are 20 per cent of the average inventory value, how much is it worth for this company to increase its container of raw material strong area ? How many days (maximum) supply of inventory can be stored with the 5,000 square feet stronge limitation, assuming that this company works a 300-day year ?

15 a The automobile company manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions:

Production(per day)	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters.

Using following random numbers:

80,81,76,75,64,43,18,26,10,12,65,68,69,61,57.

Simulate the process to find out:

i) What will be the average number of scooters making in the factory?
ii) What will be the average number of empty space on the lorry?

OR

b Explain Monte Carlo simulation procedure.

Z-Z-Z END