MA 5156 Applied Mathematics for Electronics Engineers

Important 13 Mark Questions

Unit I

1. Explain the two different types of fuzzy quantifiers with examples.
2. Obtain the QR factorization of the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$.
3. Construct singular value decomposition for the matrix $A = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$.
4. Obtain the least square solution to the following $x + 2y + z = 1, 3x - y = 2, 2x + y - z = 2, x + 2y + 2z = 1$.
5. Explain the various properties of fuzzy-logic.

Unit II

1. Obtain the solution of $-2x_1 + x_2 + 2x_3 = 9, 6x_1 + 6x_2 + 3x_3 = 27$ by least square method.
2. Write the algorithm of QR factorization and give an example for any 2×2 matrix.
3. Use the simplex method to solve the following LP problem, Maximize $Z = 3x_1 + 3x_2 + 4x_3$
   Subject to the constraints $2x_1 + 3x_2 \leq 8, 2x_2 + 5x_3 \leq 10, 3x_1 + 2x_2 + 4x_3 \leq 15$ and $x_1, x_2, x_3 \geq 0$.
4. A batch of 4 jobs can be assigned to 5 different machines. The set-up time (in hours) for each job on various machines is given below.

		Machines				
		1	2	3	4	5
	1	10	11	4	2	8
Jobs	2	7	11	10	14	12
	3	5	6	9	12	14
	4	13	15	11	10	7

   Find an optimal assignment of jobs to machines which will minimize the total set up time.

Unit III

1. The marks of 1000 students in a university are found to be normally distributed with mean 70 and standard deviation 5. Estimate the number of students whose marks will be (1) between 60 and 75 (2) mare than 75 and (3) less than 3.
2. Find the moment generating function of Binomial distribution and hence find its mean and variance.
3. Solve the BVP $xy'' + y = 0, y(1) = 1, y(1.25) = 1.3513,$ using shooting method and assume the initial values for y'_1, y'_2 as 1.2 and 1.5 respectively.

4. Solve the boundary value problem $y'' = 6x$ with $y(1) = 2, y(2) = 9$ by shooting method. (Assuming a suitable guess value for $y^1(1)$).
5. Apply the fourth order Runge-Kutta method to find $y(0,2)$ given that $f(x,y) = \frac{y-x}{y+x}, y(0) = 1$ by taking $h = 0,1$.

Unit IV

1. Divide a positive quantity c into n parts in such a way their product is a maximum.
2. By dynamic programming solve the LPP:
   Maximize $z = 2x_1 + 5x_2$
   Subject to $2x_1 + x_2 \leq 43, 2x_2 \leq 46, x_{1,} x_2 \geq 0$
3. Seven units capital can be invested in four activities with return from each activity given in the accompanying table. Find the allocation of capital to each activity that will maximize the total return:

Q	$g^1(Q)$	$g^2(Q)$	$g^3(Q)$	$g^4(Q)$
0	0	0	0	0
1	2	3	2	1
2	4	5	3	3
3	6	7	4	5
4	7	9	5	6
5	8	10	5	7
6	9	11	5	8
7	9	12	5	8

4. Calculate the correlation coefficient for the following heights (inches) of fathers X and their sons Y.

X:	65	66	67	67	68	69	70	72
Y:	67	68	65	68	72	72	69	71

5. There are 3 true coins and 1 false coin with 'head' on both sides. A coin is chosen at random and tossed 4 times. If 'head' occurs all the 4 times, what is the probability that the false coin has been chosen and used?

Unit V

1. Person arrive at a telephone booth according to Poisson distribution with an average time of 12 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 4 minutes.
   (i) Find the average number of persons in the system.
   (ii) What is the probability that a person arriving at the booth will have to wait in the queue?
   (iii) What is the probability it will take more than 10 minutes altogether to wait for the phone and complete the call?
   (iv) What is the average length of the queue that forms from time to time?
2. Service station experts a customer every 4 mins on the average services takes 3 mins on average, find the following (i) Average number of customers waiting for

services. (ii) How long can a customer expert to wait for service? (iii) what is the probability that a customer will spend less than 15 mins waiting for getting services? (iv) what is the probability that a customer will spend longer than 10 mins waiting for a getting services.

3. Derive the average number of customers in the system and in the queue from the finite capacity, single server queue model (M/M/1): (k/FIFO).
4. Derive the values of P_0 and P_n from the finite capacity, multiple server queue model (M/M/s): (k/FIFO).
5. 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 is also exponential with an average 36 minutes. Calculate the following:
   (i) The mean queue size (line length)
   (ii) The average number of trains in the queue
   (iii) The probability that the queue size exceeds 10.
   (iv) If the input of trains increases to an average 33 per day, what will be the change in (1) and (3).