Question Paper Code	12306

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023
First Semester
M.E. - Communication Systems
20PCOMA103 - APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS
(Regulations 2020)

Duration: 3 Hours   Max. Marks: 100

PART - A (10 × 2 = 20 Marks)
Answer ALL Questions

Marks,
K-Level, CO

1. Summarize the advantages in matrix factorization methods. — *2,K2,CO1*
2. Define pseudo inverse of a matrix A. — *2,K1,CO1*
3. What is the difference between feasible solution and basic feasible solution? — *2,K2,CO2*
4. Point out the methods to find the initial basic feasible solution for transportation problem. — *2,K2,CO2*
5. What is the difference between initial and boundary value problems? — *2,K2,CO3*
6. Summarize the methods available to solve boundary value problems. — *2,K2,CO3*
7. A box contains 4 bad and 6 good tubes. Two are drawn out from the box at a time. One of them is tested and found to be good .What is the probability that the other one is also good? — *2,K1,CO4*
8. State Bayes' theorem. — *2,K1,CO4*
9. Point out the effective arrival rate in an (M/M/1) :(K/FIFO) model. — *2,K2,CO5*
10. What is meant by Balking in Queuing theory? — *2,K1,CO5*

PART - B (5 × 16 = 80 Marks)
Answer ALL Questions

11. a) Solve the system of equations in the least square sense,
$2x + 2y - 2z = 1$, $2x + 2y - 2z = 3$, $-2x - 2y + 6z = 2$. — *16,K3,CO1*

OR

b) Construct QR decomposition for the matrix $A = \begin{bmatrix} -4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{bmatrix}$. — *16,K3,CO1*

12. a) Identify the solution of the L.P.P by using Simplex method,
Maximize $Z = 5x_1 - 6x_2 - 7x_3$,
Subject to,
$x_1 + 5x_2 - 3x_3 \geq 15$,
$5x_1 - 6x_2 + 10x_3 \leq 20$,
$x_1 + x_2 + x_3 = 5$,
$x_1, x_2, x_3 \geq 0$ — *16,K3,CO2*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **12306**

OR

b) A marketing manager has 5sales man and three are 5 sales districts. *16,K3,CO2* Considering the capabilities of the salesman and the nature of districts the estimates made by the marketing manager for the sales per month (in 1000 Rs)for each salesman in each in each district would be as follows:

	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	6
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesman to the districts that will result in the maximum sales.

13. a) Find $y(0.1), y(0.2), y(0.3)$ for $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$ by using *16,K3,CO3* Runge-Kutta method and hence obtain using $y(0.4)$ Adam's method.

OR

b) Using finite difference method, find $y(0.25), y(0.5)$ and $y(0.75)$ *16,K3,CO3* satisfying the differential equation

$$\frac{d^2y}{dx^2} + y = x$$

Subject to the boundary conditions $y(0) = 0, y(1) = 2$.

14. a) The joint probability mass function of *(X, Y)* is given by *16,K3,CO4* $p(x, y) = k\,(2x + 3y), x = 0, 1, 2; y = 1, 2, 3$. Find all the marginal and conditional probability distributions. Also find the probability distribution of $X + Y$.

OR

b) In a partially destroyed record of an analysis of correlation data, the *16,K3,CO4* following results only are legible. Variance of $X = 1$. The egression equations are $3x + 2y = 26$ and $6x + y = 31$. What was (i) the mean values of X and Y? (ii) The standard deviation of Y and (iii) the correlation coefficient between X and Y.

15. a) Customers arrive at a one-man barber shop according to a Poisson *16,K3,CO5* process with a mean inter arrival time of 12 minutes. Customers spend an average of 10 minutes in the barber's chair.
   (i)   What is the expected number of customers in the barber's shop and in the queue?
   (ii) How much time can a customer expect to spend in the barber's shop?
   (iii) What are the average time customers spend in the queue?
   (iv) What is the probability that the waiting time in the system is greater than 30 minutes?

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create **12306**

    (v) Calculate the percentage of time an arrival can walk straight into the barber's chair without having to wait.

<div align="center">OR</div>

b)   (i) A telephone company is planning to install telephone booths in a new airport It has established the policy that a person should not have to wait more than 10 % of the times he tries to use a phone. The demand for use is estimated to be Poisson with an average of 30 per hour. The average phone call has an exponential distribution with a mean time of 5 min. how many phone should be installed?   *8,K3,CO5*

   (ii) In a single server queuing system with Poisson input and exponential service times, if the mean arrival rate is 3 calling units per hour, he expected service time is 0.25 h and the maximum possible number of calling units in the system is 2, Point out $P_n(n \geq 0)$,average number of calling units in the system and in the queue and the average waiting time in the system and in the queue.   *8,K3,CO5*