Reg. No: | | | | | | | | | | | | |

Question Paper Code :R3M22

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Third Semester

Computer Science and Engineering

R21UMA322-PROBABILITY, QUEUEING THEORY AND NUMERICAL METHODS

(Common to IT, IOT & CYBER SECURITY)

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

PART A - (10 x 2 = 20 Marks)

1.	Define Exponential distribution	CO1-App
2.	If Correlation coefficient $r = 0.4, \sigma_x = 5, \sigma_y = 8$, find the covariance value	CO1-App
3.	Explain Kendall's Notation (a/b/c): (d/e) of a queueing model	CO6-U
4.	Suppose that customers arrive at a Poisson rate of one per every 12 minutes and that the service time is exponential at a rate of one service per 8 minutes. What is the average number of customer in the system and what is the average time of a customer spends in the system	CO6-U
5.	Write the normal equations for fitting a parabola $y = ax^2 + bx + c$	CO3-App
6.	What is the principle of least squares?	CO6-U
7.	Applying Power method for three steps $\begin{pmatrix} 4 & -1 \\ 0 & 5 \end{pmatrix}$ by taking $X_0 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$	CO4-App
8.	Write the condition of Gauss Seidal Method for solving simultaneous linear equation	CO4 -App
9.	Using Euler's method Compute y(0.1) given $\frac{dy}{dx}$ =1+ y^2, y(0) =0	CO5- App
10.	Using Taylor's series method Compute y(0.2) given $y'' = xy \quad y(0) = 1, y'(0) = 1$	CO5- App

PART – B (5 x 16= 80Marks)

16. (a) (i) A RV X has the following distribution , Compute a, p(0<x<3), Mean and distribution function — CO1-App (8)

x	0	1	2	3	4	5	6	7	8
P(X	a	3a	5a	7a	9a	11a	13a	15a	17a

(ii) Calculate the Correlation coefficient for the following data — CO1-App (8)

X	55	56	57	57	58	50	60	62
Y	77	78	75	78	76	72	79	81

Or

(b) (i) The joint probability mass function of (X,Y) is given by $p(x, y) = k(x + 2y) \quad x = 0,1,2 \; ; \; y = 0,1,2$ Compute marginal distribution function , and conditional distribution — CO1-App (8)

(ii) Compute the moment generating function of Binomial distribution and hence Compute it's mean and variance — CO1-App (8)

17. (a) A super market has two girls attending to sales at the counters. If the service time for each customer is exponential with mean 4 minutes and if people arrive in a poisson process at the rate of 10 per hour — CO2-App (16)

a. What is the probability of having to wait for service?
b. What is the expected percentage of idle time for each girl?
c. Find the average queue length and the average number of units in the system?
d. If a customer has to wait, What is the expected length of his waiting time?
e. What is the expected number of idle girls at any time?

Or

(b) A petrol pump station has 4 pumps. The service times follow the exponential distribution with a mean of 6 minutes and cars arrive for service in a Poisson process at the rate of 30 cars per hour. Identify the Model , Compute the following i) the Probability that an arrival would have to wait in line? ii) the average waiting time, average time spent in the system and the average number of cars in the system iii) For what percentage of time would a pump be idle on an average? — CO2-App (16)

18. (a) (i) Applying least square method techniques fit a straight line $y = a + bx$ CO3-App (8)

X	1	3	5	6	8	10	12
Y	2.4	5.3	8.3	9.1	11	12.2	15.4

(ii) Applying group average method fit a second degree parabola $y = a + bx + cx^2$ for the following data CO3-App (8)

X	10	15	20	30	35	45	55
Y	7	8	9.5	12.9	14.7	18.6	23

Or

(b) (i) Applying method of moments fit a straight line by group average method CO3-App (8)

X	10	20	30	40	50	60
Y	5.3	90.6	176	261.	347	432

(ii) Applying least square method techniques fit the curve $y = ax^b$ with the following data: CO3-App (8)

X	2	4	5	7	10	15	18
Y	8.6	9.7	10	10.6	11.3	12.1	13

19. (a) (i) Compute the real positive root of $x \log_{10} x = 1.2$ by Newton's Raphson method correct to 3 decimal places CO4-App (8)

(ii) Compute the real positive root of $3x - \cos x = 1$ by Iterative method CO4-App (8)

Or

(b) (i) Using Gauss Seidel method , CO4-App (8)
Solve 28x+4y-z = 32; x+3y+10z = 24 ; 2x+17y+4z = 35;

(ii) Applying Power method to compute numerically largest eigen value of CO4-App (8)

$$\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$

20. (a) (i) Using R.K Method of 4th order, solve $\frac{dy}{dx} = \frac{y}{1 + x^2}$ with y (0) = 1, Compute y (0.1) by taking h=0.1 CO5-App (8)

(ii) G Given $\frac{dy}{dx} = y + 2x$ with y (0) = 1, Compute y approximately for x=0.5 by Euler's method in five steps CO5-App (8)

Or

(b) Given $\frac{dy}{dx} = 2e^x - y$, y(0) =2 , y(0.1) = 2.010 , y(0.2) =2.040, y(0.3) = 2.090 Evaluate y(0.4) By Adams – Bashforth Method CO5-App (16)