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

Question Paper Code :R3M22

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

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.	If $P(X=x)=\frac{k}{x}, x=1,3,4,5$ represents p.m.f , compute the value of 'K'	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.	State various disciplines in queueing model.	CO6-U
5.	Write the normal equations for fitting a parabola $y=ax^2+bx+c$	CO3-App
6.	Write the observation equations when the equation y=ax+b is fit by the method of moments	CO6-U
7.	Using Newton's Raphson for two steps $x^3-2x-5=0$ by taking $x_0=2.3,$ Find x.	CO4-App
8.	Apply Power method for three steps $\begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}$ by taking $X_0=\begin{pmatrix} 1 \\ 1 \end{pmatrix}$	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) Compute the moment generating function of Poisson distribution and — CO1-App (8)

hence Compute it's mean and variance

(ii) The joint probability mass function of (X,Y) is given by $p(x,y) = k(2x+3y)\ x = 0,1,2\ ;\ y = 1,2,3$ Compute marginal distribution function , and conditional distribution — CO1-App (8)

17. (a) (i) Customers arrive at a watch repair shop according to a Poisson process at a rate of one per every 10minutes, and the service time is an exponential random variable with mean 8 minutes. Identify the Model , Compute the following i) the average number of customers in the shop L_s ii) the average time a customer spends in the shop W_s iii) the average number of customers in the queue L_q iv) the probability that the server is idle. — CO2-Ana (8)

(ii) There are 3 typists in an office can type an average of 6 letters per hour. If letters arrive for being typed at the rate of 15 letters per hour — CO2-Ana (8)

a. What fraction of time will all the typists be busy?

b. What is the average number of letters waiting to be typed?

c. What is the average time a letter has to spend for waiting and being typed?

Or

(b) A Super market has 2 girls running up sales at the counters. If the service time for each customer is exponential with mean 4 minutes and if people arrive in Poisson fashion at the rate of 10 an hour. Identify the Model,
Compute
(i) the probability of having to wait for service?
(ii) the expected percentage of idle time for each girl?
(iii) If a customer has to wait, what is the expected length of his waiting time? CO2-Ana (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) 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 $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$, $y(0.6) = 3.68$, Compute $y(0.8)$ by Milne's Predictor & Corrector method CO5-App (16)