

Register No: .....

Name: .....

**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R,S), MAY 2024****Common for ECE & EEE****(2020 SCHEME)****Course Code : 20MAT204****Course Name : Probability, Random Process and Numerical Methods****Max. Marks : 100****Duration:3 Hours**

Scientific calculator and statistical tables are allowed in the examination hall.

**PART A***(Answer all questions. Each question carries 3 marks)*

1. The mean and variance of binomial variate X are 16 and 8. Find  $P(X=1)$ .
2. Check whether the function  $f(x) = \frac{x}{15}$ ,  $x = 0, 1, 2, 3, 4, 5$  can be PMF? Justify your answer.
3. The service time in a customer care center is exponentially distributed with a mean 2 minutes. (i) Write the PDF of the service time distribution. (ii) Find the probability that the service time exceeds 3 minutes.
4. If the probability density of a random variable is given by:
 
$$f(x) = \begin{cases} mx^2 & ; 0 < x < 1 \\ 0 & ; \text{elsewhere} \end{cases}$$
 Find (i) the value of  $m$ .  
 (ii)  $P\left(\frac{1}{4} < X < \frac{1}{2}\right)$ .  
 (iii)  $P\left(X > \frac{2}{3}\right)$ .
5. Explain Poisson process.
6. Define autocovariance of a random process.
7. Using Simpson's rule, compute  $\int_0^{0.6} e^{-x^2} dx$  using six sub intervals.
8. Find the approximate value of  $\sqrt{5}$  using Newton-Raphson method.
9. Use Euler's method to solve  $\frac{dy}{dx} = x + xy + y$ ,  $y(0) = 1$ .  
Compute  $y$  at  $x = 0.15$  by taking  $h = 0.05$ .
10. Write down the normal equations to fit a curve of the form  $y = a + bx + cx^2$  by the method of least squares.

**PART B***(Answer one full question from each module, each question carries 14 marks)***MODULE I**

11. a) Out of 2000 families with 4 children, how many would you expect to have
  - (i) at least one boy 7
  - (ii) 1 or 2 girls
 b) Derive the mean and variance of Poisson distribution. 7

**OR**

12. a) Find  $\alpha$  and  $\beta$  if  $Y = \alpha X + \beta$  has mean 4 and variance 16 where X is a random variable with mean 8 and variance 4. 7  
 b) The mean and variance of a binomial variate are X are 16 and 18. Find (i)  $P(X = 1)$  7  
 and (ii)  $P(X \geq 2)$

**MODULE II**

13. (a) For the distribution with PDF,  $f(x) = \begin{cases} kx(2-x) & ; 0 \leq x \leq 2 \\ 0 & ; \text{elsewhere} \end{cases}$  7  
 Find (i) value of  $k$  (ii)  $P(1 \leq X \leq 2)$  (iii)  $Var(X)$ .  
 (b) A bus arrives every 10 minutes at a bus stop. Assuming that the waiting time for X for bus is uniformly distributed. Find the probability that a person has to wait for the bus (i) for more 7

than 7 minutes, (ii) between 2 and 7 minutes and (iii) for more than 5 minutes.

**OR**

14. (a) Derive the expressions for  $E(X)$  and  $Var(X)$  of the Uniform distribution,  $U(x, \alpha, \beta) = \frac{1}{\beta - \alpha}$  ;  $\alpha < x < \beta$ . 7
- (b) Let  $X$  be a normal distribution with mean 20 and standard deviation 5. Find the probability that (i)  $P(X > 23)$  and (ii)  $P(|X - 20| < 5)$ . 7

**MODULE III**

15. A random process  $X(t)$  is defined by  $X(t) = 2 \cos(5t + \theta)$  where  $\theta$  is uniformly distributed in  $[0, 2\pi]$ . Find mean, autocorrelation and autocovariance. 14

**OR**

16. a) Find the mean, variance and total power of WSS process  $X(t)$ , given the auto correlation  $R_{xx}(\tau) = \frac{55\tau^2 + 90}{2.2\tau^2 + 3}$ . 7
- b) The autocorrelation of the random telegraph signal process is given by  $R(\tau) = a^2 e^{-2\alpha|\tau|}$ . Determine the power density spectrum of the random telegraph signal. 7

**MODULE IV**

17. a) Evaluate  $\int_0^{\frac{\pi}{2}} \cos x \, dx$  using Trapezoidal rule with 6 sub intervals. 7
- b) Solve the equation  $3x + \sin x - e^x = 0$  by regula falsi Method. 7

**OR**

18. a) Compute  $\int_0^1 \frac{1}{1+x^2} dx$  using Simpson's method with step size  $h = 0.25$ . 7
- b) From the following data, find  $y$  at  $x = 43$  using Newton's forward interpolation formula. 7

$x$	40	50	60	70	80	90
$y$	184	204	226	250	276	304

**MODULE V**

19. a) Using Gauss Seidel method, solve the following system of equations. 7
- $$8x + y + z = 8$$
- $$2x + 4y + z = 4$$
- $$x + 3y + 5z = 5$$

b) Fit a straight line of the form  $y = ax + b$  by the method of least squares, to the following data:

$x$	1	2	3	4	5
$y$	6	7	9	10	12

**OR**

20. a) Use Runge-Kutta second order method find the value of  $y$  at  $x = 0.6$ , given  $\frac{dy}{dx} = y - x^2 + 1$ ,  $y(0) = 0.5$  and taking step size  $h = 0.2$ . 7
- b) Solve  $y' = x^2(1 + y)$  for  $x = 1.4$  using Adams-Moulton method, 7 given  $y(1) = 1$ ,  $y(1.1) = 1.233$ ,  $y(1.2) = 1.548$ ,  $y(1.3) = 1.979$ .

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