

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 CH, CE, FT, ME, RB**  
**(2020 SCHEME)**

Course Code : 20MAT202

Course Name : Probability, Statistics and Numerical Methods

Max. Marks : 100

Duration:3 Hours

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

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

1. A distributor of seeds determines from extensive tests that 5% of a large batch of seeds will not germinate. He sells the seeds in packets of 200 and guarantees 90% germination. Using Poisson distribution determine the probability that a particular packet will violate the guarantee.
2. A random variable  $X$  takes the values 1, 2, 3 and 4 such that  $2P(X = 1) = 3P(X = 2) = P(X = 3) = 5P(X = 4)$ . Find the probability distribution of  $X$ .
3. Find the PDF of a random variable  $X$  if  $F(x) = \begin{cases} 1 - \frac{1}{x^2} & ; x > 1 \\ 0 & ; x \leq 1 \end{cases}$ . Also find  $P(X < 3)$ .
4. If  $X$  has uniform distribution in  $(-3, 3)$ , find (i)  $P(0 < X < 2)$  (ii)  $P(|X| < 2)$ .
5. A random sample of 500 pineapples was taken from a large consignment and 65 of them were found to be bad. Show that the standard error of the proportion of bad ones in a sample of this size is 0.015 ?
6. State the null and alternate hypothesis and state whether the test is left-tailed, right-tailed or two-tailed for the following statement:  
"A researcher wants to test whether the mean GPA of students Engineering graduates of the state is greater than 6.0"
7. Using Simpson's rule, compute  $\int_0^{0.6} e^{-x^2} dx$  using six sub intervals.
8. Find the value of  $(24)^{\frac{1}{3}}$  using Newton's Raphson method.
9. Find the normal equations for fitting a parabola using the method of least squares.
10. Use Euler's method to solve  $\frac{dy}{dx} = x + xy + y$ ,  $y(0) = 1$ . Compute at  $x = 0.15$  by taking  $h = 0.05$ .

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

11. a) A random variable
- $X$
- follows the PMF as given below
- 7

|        |      |      |     |     |     |     |
|--------|------|------|-----|-----|-----|-----|
| $x$    | 4    | 5    | 6   | 7   | 8   | 9   |
| $f(x)$ | 1/12 | 1/12 | 1/4 | 1/4 | 1/6 | 1/6 |

Compute the mean and variance of  $2X - 1$  7

- b) Prove that the binomial distribution tends to Poisson distribution as
- $n$
- tends to infinity.

**OR**

12. a) Out of 800 families with 4 children, how many would you expect to have
- 7

(i) 2 boys and 2 girls

(ii) at most two girls. (Assume equal probabilities for boys and girls).

- b) Derive the mean and variance of Poisson distribution.
- 7

**MODULE II**

13. a) On a laboratory assignment, if the equipment is working, the PDF of the observed outcome,
- 7

$$X \text{ is } f(x) = \begin{cases} 2(1-x) & ; 0 < x < 1 \\ 0 & ; \text{Otherwise} \end{cases}$$

- (i) Calculate
- $P(X \leq 1/3)$
- .

- (ii) What is the probability that
- $X$
- will exceeds 0.5? (iii). Given
- $X \geq 0.5$
- , what is the probability that
- $X$
- will be less than 0.75?

- b) The weekly wages of 1000 workmen are normally distributed around a mean of 70 \$ and with a standard deviation of 5 \$. Estimate the number of workers whose weekly wages will be : 7
- i) between 70 \$ and 72 \$.
  - ii) more than 75 \$.
  - iii) less than 63 \$.

**OR**

14. a) If  $f(x) = \begin{cases} ke^{-x/\sigma} & ; 0 \leq x \leq \infty \\ 0 & ; \text{elsewhere} \end{cases}$  is the PDF of a random variable, find the following. 7
- (i) value of  $k$ .
  - (ii) show that  $E(x) = Var(X) = \sigma$ . 7
- b) A random normal variable has mean  $\mu = 62.4$ . Find its standard deviation if the probability is 0.2 that it will take a value greater than 79.2?

**MODULE III**

15. a) The mean yield of wheat from a district A was 210lbs with standard deviation 10lbs per acre from a sample of 100 plots. In another district B, the mean yield was 220lbs with standard deviation 12lbs from a sample of 150 plots. Assuming that the standard deviation of the yield in the entire state was 11lbs, test whether there is any significant difference between the mean yield of crops in the two districts. 7
- b) In a random sample of 400 persons from a large population, 120 are females. Can it be said that males and females are in the ratio 5:3 in the population? Use 1% level of significance? 7

**OR**

16. a) Before an increase in excise duty on tea, 400 people out of a sample of 500 people were found to be tea drinkers. After an increase in excise duty, 400 people were tea drinkers in a sample of 600 people. Use standard error of proportion, state whether there is a significant decrease in the consumption of tea? 7
- b) A sample of 100 students is taken from a college and their heights are measured. The mean height of sample of students was found to be 168.5. It is known that the standard deviation of height for the population is 10. Can we accept the assumption that the mean height of the college student is 170? 7

**MODULE IV**

17. a) Find a real root of  $x^3 + x - 1 = 0$  lying between 0 and 1 by Newton Raphson method (correct to three decimal places). 7
- b) Use Trapezoidal rule to evaluate  $\int_0^1 x^3 dx$  considering five sub intervals. 7

**OR**

18. a) Use Newton's divided difference interpolating polynomial, estimate  $f(4)$  from the following data: 7

|            |   |   |    |     |
|------------|---|---|----|-----|
| $x$        | 0 | 1 | 2  | 5   |
| $y = f(x)$ | 2 | 3 | 12 | 147 |

- b) Compute the approximate value of  $f(0.25)$  using Newton's forward interpolation formula from the following data: 7

|     |   |        |        |        |        |
|-----|---|--------|--------|--------|--------|
| $x$ | 0 | 0.5    | 1      | 1.5    | 2      |
| $y$ | 1 | 1.0513 | 1.1052 | 1.1618 | 1.2214 |

**MODULE V**

19. a) Using Jacobi's method, solve the system of equations 7
- $$\begin{aligned} 8x - 3y + 2z &= 20 \\ 4x + 11y - z &= 33 \\ 6x + 3y + 12z &= 36 \end{aligned}$$

- b) Fit a straight line of the form  $y = ax + b$  for the following data. 7

|       |   |   |   |    |    |
|-------|---|---|---|----|----|
| $x :$ | 1 | 2 | 3 | 4  | 5  |
| $y :$ | 5 | 7 | 9 | 10 | 11 |

**OR**

20. a) Using Gauss-seidal method solve the following system of equations correct to 3 decimal places. 7
- $$\begin{aligned} 10x + y + z &= 12 \\ 2x + 10y + z &= 13 \\ 2x + 2y + 10z &= 14 \end{aligned}$$

- b) Using Runge-Kutta method of fourth order, evaluate  $y(0.7)$ , given  $\frac{dy}{dx} = y - x^2$ , given  $y(0.6) = 1.737$  (choose  $h = 0.1$ ). 7

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