

Register No.: ..... Name: .....

**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023****COMMON TO 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 table is allowed in the examination hall.****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Find the mean of the probability distribution of the number of heads obtained in two tosses of an unbiased coin.
2. The mean and variance of binomial variate X are 16 and 8. Find  $P(X = 1)$
3. If a continuous random variable has the PDF  $f(x) = \begin{cases} k e^{-x}, & x > 0 \\ 0, & x \leq 0 \end{cases}$ . Then find the value of k.
4. Derive the mean of exponential distribution.
5. Define: i) Critical region ii) Level of significance iii) Critical value
6. A random sample of 49 packets of a certain brand of chocolate bar yields a mean weight of 35 gms with a standard deviation of 11 gms. Construct a 95% confidence interval for the mean weight of this particular brand of chocolate bar.
7. Use Lagrange's method to find a polynomial to the following data:
 

x	1	3	4
y	1	27	64
8. Use Trapezoidal rule to evaluate  $\int_0^1 x^3 dx$  with  $n = 5$ .
9. Using Euler's method find y at  $x = 0.25$  given  $y' = 2xy$ ,  $y(0) = 1$ ,  $h = 0.25$
10. Explain the principle of least squares for determining a line of best fit to a given data.

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

11. a) A binomial distribution with  $n = 5$  satisfies the property  $8P(X = 4) = P(X = 2)$ . Find the probability mass function. (7)
- b) Show that Poisson distribution is the limiting form of Binomial distribution. (7)

## OR

12. a) A random variable X takes the values -1, 1, 3 with equal probabilities and 5 with probability  $\frac{1}{2}$ . Find (7)
- probability distribution of X
  - $P(|X - 3| > 1)$
- b) The average number of phone calls/minute coming into a switchboard between 2 and 4 pm is 2.5. Determine the probability that during one particular minute there will be (7)
- 0 telephone call
  - 4 or fewer telephone calls
  - more than 6 telephone calls

## MODULE II

13. a) Let X be a random variable with PDF  $f(x) = \begin{cases} \frac{x^2}{3}, & -1 < x < 2 \\ 0, & \text{elsewhere} \end{cases}$  (7)
- Find
- mean
  - variance
  - standard deviation
  - $E(4X+5)$
- b) In a normal distribution, 17% of the items are below 30 and 17% are above 60. Find the mean and standard deviation. (7)

## OR

14. a) If a random variable X follows uniform distribution with PDF (7)
- $$f(x) = \begin{cases} \frac{1}{4}, & |x| < 2 \\ 0, & \text{otherwise} \end{cases}$$
- Find
- $P(X < 1)$
  - $P(|X| > 1)$
  - $P(2X + 3 > 5)$
- b) The weekly wages of 1000 workmen are normally distributed around a mean of Rs.70 and with a standard deviation of Rs.5. (7)
- Estimate the number of workers whose weekly wages will be
- between Rs.70 and Rs.72
  - more than Rs.75

## MODULE III

15. a) A certain cubical die was thrown 9000 times and 5 or 6 was obtained 3240 times. On the assumption of certain throwing, do the data indicate an unbiased die? (7)

- b) In order to make a survey of the buying habits, two markets A and B are chosen at two different parts of a city. 400 women shoppers are chosen at random in market A, their average daily expenditure on food is found to be Rs.250 with a SD of Rs.40. The figures are Rs.220 and Rs.55 respectively in market B, where also 400 women shoppers are chosen at random. Test at 1% level of significance whether the average daily food expenditure of two populations of shoppers are equal. (7)

**OR**

16. a) A coin is tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased? (7)
- b) A random sample of 20 daily workers of state A were found to have an average daily earning of Rs.44 with sample variance 900. Another sample of 20 daily workers from state B was found to earn an average of Rs.30 per day with sample variance 400. Test whether the workers in state A earn more than in state B. (7)

**MODULE IV**

17. a) Find a positive root of  $\cos x + 1 = 3x$  using Newton-Raphson method correct to 4 decimal places. (7)
- b) Find the value of y at  $x=21$  from the following table using Newton's interpolation formula. (7)

x	20	23	26	29
y	0.342	0.3907	0.4384	0.4848

**OR**

18. a) Find a real root of the equation  $x^3 - 2x - 5 = 0$  by the method of false position correct to 3 decimal places. (7)
- b) The acceleration of a moving particle is measured in every 5 seconds and is tabulated below. Using Simpson's one third rule find the velocity of the particle. (7)

t	0	5	10	15	20	25	30	35	40
a(t)	40	45.25	48.5	51.25	54.35	59.48	61.5	64.3	68.7

**MODULE V**

19. a) Fit a second-degree parabola to the data (1, -1), (2,4), (3,6) (7)
- b) Solve the following system of equations using Gauss-Seidel iteration method correct to four decimal places. (7)
- $$10x - 5y - 2z = 3, \quad 4x - 10y + 3z = -3, \quad x + 6y + 10z = -3$$

**OR**

20. a) Using fourth order Runge-Kutta method solve the initial value problem  $y' = -2xy^2, y(0) = 1$  in the interval  $(0, 0.2)$  by taking  $h=0.2$  (7)
- b) Solve the initial value problem  $\frac{dy}{dx} = x - y^2, y(0) = 1$  to find  $y(0.4)$  by Adam's method, given  $y(0.1)=0.9117, y(0.2)=0.8494, y(0.3)=0.8061$  (7)

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