Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) (FT/WP) (S2 PT) Examination December 2025/January 2026 (2019 Scheme)

Course Code: MAT202

Course Name: PROBABILITY, STATISTICS AND NUMERICAL METHODS

Max. Marks: 100 Duration: 3 Hours

(Normal distribution table and t-distribution table are allowed)

PART A

(Answer all questions; each question carries 3 marks) Marks

1 Determine the binomial distribution for which mean is 24 and variance is 6. 3

2 A discrete random variable X can take the values 1, 2 and 3. For these values the cumulative distribution function is defined by, 3

$$F(x) = \frac{x^3 + k}{40}, \quad x = 1,2,3$$

Find the value of k.

3 A continuous random variable X is uniformly distributed over $[-4,6]$. Find the mean and variance of X. 3

4 The joint pdf of (X, Y) is given by $f(x,y) = \begin{cases} kx^2y; & 0 < x < 4; 1 < y < 5 \\ 0; & Otherwise \end{cases}$. 3

Find value of k.

5 A population has standard deviation 16. A sample of 50 items are taken from this population which gave a mean of 52.5. Find the confidence interval for the population mean. 3

6 The proportion of males of a population is $p = \frac{1}{4}$. Find the mean and variance of the sample proportion of males obtained from a sample of size 50. 3

7 Find the positive root of the equation $2x^3 - 3x - 6 = 0$ correct to 4 decimal places by Newton - Raphson method. 3

8 Construct the Newton's divided difference table for the following data. 3

x	4	5	7	10	11	13
y	48	100	294	900	1210	2028

9 Use Euler's method with $h = 0.1$, to find $y(0.1)$ if $\frac{dy}{dx} = 2x^2 + y^2, y(0) = 0$. 3

10 Use Runge-Kutta method of order two with h=0.1 ,compute the value of y(0.1) for the equation $y' = y - \frac{2x}{y}$, $y(0) = 1$ 3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Prove that binomial distribution can be approximated to Poisson distribution when n is large, p is small and $np = \lambda$. 6

b) The probability distribution of a discrete random variable X is given below. 8

x	1	2	3	4	5	6
$P(X = x)$	a	a	a	b	b	0.3

1. Given $E(X) = 4.2$, find the value of a and the value of b.
2. Find $E(X^2)$. 3. Find $Var(5 - 3X)$.

12 a) The joint probability mass function of two random variables X and Y is given by 8

$$p(x, y) = \begin{cases} k(x + 4y), & x = 1,2,3; y = 1,2 \\ 0, & otherwise \end{cases}$$

Where k is a constant. 1. Find the value of k.2. Find the marginal distribution functions of X and Y. 3.Are X and Y independent?

b) The monthly breakdown of a computer is a random variable having Poisson distribution with a mean equal to 1.8. Find the probability that this computer will function for a month 6

(1) without a break down (2) with only one break down

(3)with at least one break down.

Module -2

13 a) Derive the mean and variance of exponential distribution. 7

b) Let X be a random variable with probability density function 7

$$f(x) = \begin{cases} cx^2, & |x| \leq 1 \\ 0, & otherwise \end{cases}$$

1. Find the constant c.
2. Find $E(X)$ and $V(X)$.
3. Find $P\left(X \geq \frac{1}{2}\right)$.

14 a) Buses arrive at a specified stop at 15 minutes interval starting at 8 am. If a passenger arrives at the stop at a random time that is uniformly distributed between 8.00 and 8.30 hours, find the probability that the passenger waits 7

(i) less than 6 minutes for the bus (ii) at least 12 minutes for the bus

b) The error involved in making a certain measurement is a continuous random variable X with probability density function 7

$$f(x) = \begin{cases} 0.09375(4 - x^2); & -2 \le x \le 2 \\ 0; & otherwise \end{cases}$$

1.Find $P(X > 0)$ 2. Find $P(-1 < X < 1)$ 3.Find $P(X < -0.5 \; or \; X > 0.5)$.

Module -3

15 a) The mean life of 100 electric bulbs produced by a company is 1570 hrs with a standard deviation of 120hrs. If μ is the mean lifetime of all bulbs produced by the company, test the hypothesis $\mu \neq 1600 \; hrs$ at 5% level of significance. 7

b) A sample of 100 tyres of brand A gave a mean life time of 1200 hrs with standard deviation 70 hrs, while another sample of 120 tyres of brand B gave a mean life of 1150 hrs with a standard deviation of 85 hrs. Can we conclude that brand A tyres are superior to brand B tyres? 7

16 a) In a city a sample of 1000 people were taken and out of them 540 are vegetarians and rest are non-vegetarians. Can we say that both habits of eating are equally popular in the city? 7

b) A random sample of size 16 has mean 53. The sum of squares of deviations from the mean is 135. Can this sample be regarded as taken from a population with mean 56? 7

Module -4

17 a) Using Lagrange interpolation, find the value of $y(40)$ from the following table 7

x	30	35	45	55
y	148	96	68	34

b) Find the positive root of the equation $4x = e^x$ using Regula Falsi method correct to 4 decimal place.

18 a) Compute $y(22)$ using Newton's Forward difference formula, if given 7

x	20	25	30	35	40	45
y	354	332	291	260	231	204

b) Using Simpson's 1/3 rd rule evaluate $\int_0^2 \frac{1}{x^2+x+1} dx$ with $n = 8$. 7

Module -5

19 a) Using Gauss-Seidal iteration method, find an approximate solution to the following system of equations correct to 4 decimal places. 7

$$x + y + 54z = 110;\ \ 27x + 6y - z = 85;\ \ 6x + 15y + 2z = 72.$$

b) Use Runge-Kutta method of order 4 to find $y(0.2)$ if $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$, given $y(0) = 1$. (Choose $h = 0.2$). 7

20 a) Fit a straight line of the form $y = a + bx$ to the following data. 7

x	5	4	3	2	1
y	1	2	3	4	5

b) Find the value of $y(0.4)$ by using Adams-Moulton predictor corrector formula for the differential equation $\frac{dy}{dx} = \frac{1}{2}xy$ given the data: 7

x	0	0.1	0.2	0.3
y	2	1.0025	1.0101	1.0228

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