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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) (FT/WP) / (S2 PT) Exam April 2025 (2019 Scheme)

Course Code:MAT202

Course Name: PROBABILITY,STATISTICS AND NUMERICAL METHODS

Max. Marks: 100 Duration: 3 Hours

PART A

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

1	If the random variable X has the following probability distribution P(X=x) $=\frac{k}{2^x}, x=0,1,2,3,4$ Find(i) the value of k (ii) the probability that X is even.	3
2	If the sum of the mean and variance of a Binomial distribution for 5 trials is 1.8, find the probability distribution function?	3
3	If X is a Uniformly distributed random variable with mean 1 and variance 4/3 , find $P(\lvert X-2\rvert < 2)$	3
4	Find the Mean and Variance for the p d f $f(x)=\begin{cases} kx^2, & 0<x<1 \\ 0, & else\ where \end{cases}$	3
5	A sample of size 49 is taken from a population with sample mean 35 and sample S.D 11.Find the 99% confidence interval for population mean.	3
6	32% of the people used a particular brand of bike. After providing a special offer 215 out of 1400 randomly selected people found to be consumers of the brand. State the null hypothesis and alternative hypothesis to test whether the data provide sufficient	3

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evidence to conclude that there is an increase in the proportion of people using the brand after providing the offer.

7 Given f(2)=5 , f(2.5)=6 , find the linear interpolating polynomial using Lagrange's formula and also find f(2.2). 3

8 Solve $x^3 = 25$ by Newton –Raphson Method correct to 3 decimal places. 3

9 Solve $y' = x + y , y(0) = 1$ by Euler's method to find y(0.4) with h=0.2. 3

10 Write the Normal equation for fitting the parabola $y = ax^2 + bx + c$. 3

PART B

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

Module -1

11 a) Derive the mean and variance of the Binomial Distribution. 7

b) If X follows a Poisson distribution such that P(X=1) =3/10 and P(X=2)=1/5, Find P(X=4) and P(X=0) 7

12 a) Six dice are thrown 729 times. How many times do you expect at least three dice to show 5 or 6. 6

b) The joint probability mass function of two random variable X and Y is given by 8

$$f(x,y) = \begin{cases} k(x+2y) for\ x = 1,2,3\ and\ y = 1,2 \\ 0 \quad otherwise \end{cases}$$ where k is a constant.

(i)Find the value of k (ii) Find P(X+Y≤ 3) (iii) Find the marginal density function of X and Y (iv) Are X and Y independent ?

Module -2

13 a) Suppose the diameter at breast height of trees of a certain type is normally distributed with mean 8.8 and standard deviation 2.8 (i) What is the probability that the diameter of a randomly selected tree will be at least 10 inches? (ii) What is the probability that the diameter of a randomly selected tree will exceed 20 inches? (iii) 7

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What is the probability that the diameter of a randomly selected tree will be between 5 inches and 10 inches?

b) The amount of time that a surveillance camera will run without having to be rest is a random variable having the exponential distribution with mean 50 days. Find the probability that such a camera will (i)have to be rest in less than 20 days (ii)not have to be rest in at least 60 days. 7

14 a) The cumulative distribution function of a continuous variable X is given by $F(x) = \begin{cases} 0, & x \leq 2 \\ c(x-2), & 2 < x < 6 \\ 1, & x \geq 6 \end{cases}$ *Find* (i) p d f (ii) value of c (iii) $P(1 \leq X \leq 5)$ 7

b) The joint density function of 2 continuous random variable X and Y is 7

$$f(x,y) = \begin{cases} kx^2y \; ; & 1 < x < 4 \;, 0 < y < 4 \\ 0 & otherwise \end{cases}$$

(i) Find the value of the constant k

(ii) Find $P(X \geq 2, Y \leq 2)$

(iii) $P(X+Y < 3)$

Module -3

15 a) A sample of 20 items has mean 42 and standard deviation 5. Test that it is a random sample from a population with mean 45. 7

b) In two large populations there are 30% and 25% respectively of blue eyed people. Is this difference likely to be hidden in sample of 1200 and 900 respectively from the 2 populations? 7

16 a) A sample of size 10 and 14 were taken from two normal populations with SD 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. Test whether the means of the two population are same at 10% level of significance. 7

b) A die is thrown 9000 times and 3220 times shown 5 or 6. Is the die unbiased at 5% level of significance? 7

Module -4

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17 a) Evaluate $\int_0^1 \frac{dx}{1+x}$ by Simpson's rule taking h=1/6 and compare it with the actual integration up to four decimal places. 7

b) Find the polynomial interpolating the following data, using Newton's backward interpolating formula. 7

x	3	4	5	6	7
y	7	11	16	22	29

18 a) Find the root of the equation $cosx - xe^x = 0$ that lies between 0 and 1, using Regular-Falsi method correct to four decimal places. 7

b) Find the equation of the curve that passes through the points (0,2), (1,3), (2,12) and (5,147) by Lagrange's interpolation formula. Also find y (3). 7

Module -5

19 a) Solve the following equation by Gauss-Seidel iteration method. 7

$$8x + y + z = 8\,,2x + 4y + z = 4\,,x + 3y + 5z = 5$$

b) Given $\frac{dy}{dx} = x + y, y(0) = 1$ .Using Euler's method ,find y(0.1),y(0.2) and y(0.3) by taking h=0.1 .Hence obtain y(0.4) using Adams-Moulton predictor-corrector method. 7

20 a) Fit a straight line y= ax + b for the following data by the method of least squares. 7

x	1	2	3	4	5
y	14	27	40	55	68

b) Using Runge-Kutta method of fourth order for, $\frac{dy}{dx} = 1 + xy, y(0) = 2$ find y(0. 1) with h=0.1. 7

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