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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R, S) / S4 (WP) (R) / S2 (PT) (S, FE) Examination May 2024 (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 $f(x) = k2^x$ is the probability distribution of a random variable that can take values $x = 0, 1, 2, 3$ then find k . 3
 - 2 Suppose $E(X) = 5$ and $E[X(X-1)] = 25$. Find $E(X^2)$. 3
 - 3 If the probability density function of a random variable X is $f(x) = \frac{3}{2}(1-x^2)$, $0 \leq x \leq 1$ then find its mean. 3
 - 4 Find mean and variance of the Uniform distribution $f(x) = \frac{1}{10}$, $10 \leq x \leq 20$. 3
 - 5 A random sample of 200 items from a large population gives mean value 50 and standard deviation 9. Determine the 95% confidence interval of the mean of the population. 3
 - 6 For the population of individuals who own iPhone, $p = 0.25$ is the proportion that has a given app. For a random sample of size $n = 4$, find mean and standard deviation of the sampling distribution of the population proportion. 3
 - 7 Write the formula for finding $\sqrt{5}$ using Newton-Raphson's Method. 3
 - 8 Construct Newton's forward difference table for the below data. 3
- | | | |
|-------|-------|-------|
| 1931 | 1941 | 1951 |
| 40.62 | 60.80 | 79.95 |
- 9 Using Euler's method, find $y(0.2)$ if $y' = x + y$, $y(0) = 1$. 3
 - 10 Obtain the values of y at $x = 0.1$ using Runge-Kutta method of second order for the differential equation $y' = -y$, $y(0) = 1$. 3

PART B*(Answer one full question from each module, each question carries 14 marks)***Module -1**

- 11 a) If a random variable X has the probability mass function 8

X	1	2	3	4
f(x)	2k	3k	k	4k

then find (i) k, (ii) $P(0 < X < 3)$, (iii) $p(4)$, (iv) Distribution function

- b) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 2. Calculate the proportion of days on which (i) neither car is used (ii) some demand is refused. 6
- 12 a) The joint probability mass function of X and Y is given by $p(x, y) = \frac{x+2y}{18}$ 8
if $(x, y) \in \{(1, 1), (1, 2), (2, 1), (2, 2)\}$. Find (i) Marginal distributions (ii) Verify whether X and Y are independent.
- b) Let $X \sim B(n, p)$. If $n = 6$, $9P(X=4) = P(X=2)$, then find p. 6

Module -2

- 13 a) If a continuous random variable has the probability density function 8
 $f(x) = k e^{-2x}$, $x > 0$ then find (i) the value of k, (ii) $P(0 < X < 3)$, (iii) $P(X > 0.5)$ and (iv) Distribution function
- b) The weight of certain brand of shampoo packets are uniformly distributed between 9.3 gm and 10.5 gm. In a random lot of 100 packets how many packets (i) exceed 10 gm (ii) are below 10.2 gm. 6
- 14 a) In a normal distribution 7% of the items are under 35 and 10% of the items are above 55. Calculate the mean and variance. 8
- b) Verify whether X and Y are independent if $f(x, y) = 24xy$, $0 \leq x \leq 1$, $0 \leq y \leq 1$, $x + y \leq 1$. 6

Module -3

- 15 a) The mean weight obtained from a random sample of size 100 is 64 gm. The standard deviation of the weight distribution of the population is 3 gm. Test the statement that the mean weight of the population is 67 gm at 5% level of significance. 7
- b) A manufacturer claims that only 10% of his items are defective. But critics claim that more than 10% are defective. A sample of 60 items has 20 defective materials. Test the manufacturer's claim at 5% level of significance. 7
- 16 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 samples of 1200 and 900 respectively from the 2 populations? 7

Module -4

- 17 a) Compute $\int_0^1 \frac{1}{1+x^2} dx$ using Simpson's one third rule with $h = 0.25$. 6
- b) Using Lagrange's formula find $y(9.5)$. Given $y(7) = 3, y(8) = 1, y(9) = 1$ and $y(10) = 9$. 8
- 18 a) Compute $y(13)$ using Newton's Backward difference formula, if given 6

x	3	6	9	12	15
y	-18	27	36	45	54

- b) Find the positive root of $x^3 = 2x+5$ by Regula-Falsi method up to 3 places of decimals. 8

Module -5

- 19 a) Using Runge- Kutta method of IV th order find $y(0.1)$. Given $\frac{dy}{dx} = y-x$ with $y(0) = 2$ 7
- b) Solve by Gauss-Seidel method the following system : 7
- $$\begin{aligned} 28x + 4y - z &= 32 \\ x + 3y + 10z &= 24 \\ 2x + 17y + 4z &= 35 \end{aligned}$$
- 20 a) Fit a straight line to the points $(0,2), (2,0), (3,-2), (5,-3)$ using method of least squares. 7
- b) Using Adam's method find $y(0.4)$. Given $\frac{dy}{dx} = \frac{1}{2}xy, y(0)=1, y(0.1)=1.01, y(0.2)=1.022, y(0.3)=1.023$ 7
