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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019**

Course Code: MA202

Course Name: PROBABILITY DISTRIBUTIONS, TRANSFORMS AND NUMERICAL METHODS

Max. Marks: 100

Duration: 3 Hours

Normal distribution table is allowed in the examination hall.

PART A (MODULES I AND II)

Answer two full questions.

- 1 a) A random variable X takes the values -3,-2,-1,0,1,2,3 such that $P(X=0)=P(X>0) = P(X<0)$ and $P(X=-3) = P(X=-2) = P(X=-1) = P(X=1) = P(X=2) = P(X=3)$. Obtain the probability distribution and the distribution function of X (7)
- b) If the sum of the mean and variance of a binomial distribution for 5 trials is 1.8 Find the probability distribution function. (8)
- 2 a) It is known that 2% of the accounts in a company are delinquent. If 5 accounts are selected at random, compute the following probabilities (i) atmost 2 accounts will be delinquent (ii) atmost 4 accounts will be delinquent (7)
- b) Find the value of k and hence find the mean and variance of the distribution (8)
 $f(x) = kx^2e^{-x} \quad 0 < x < \infty$
- 3 a) If X is uniformly distributed over $(-\alpha, \alpha)$, $\alpha < 0$. Find α so that (i) $P(x > 1) = 1/3$ (7)
(ii) $P(|x| < 1) = P(|x| > 1)$
- b) 5% of the observation in a normal distribution are below 5 and 25% of the observations are between 5 and 25. Find mean and SD (8)

PART B (MODULES III AND IV)

Answer two full questions.

- 4 a) Find the fourier transform of $f(x) = \begin{cases} 1 - |x| & \text{if } |x| \leq 1 \\ 0 & \text{if } |x| > 1 \end{cases}$ and also find fourier inverse transform (7)
- b) Using fourier sine integral for $f(x) = e^{-ax}$ show that $\int_0^{\infty} \frac{\lambda \sin \lambda x}{\lambda^2 + a^2} d\lambda = \pi e^{-ax}$ (8)
- 5 a) Find the fourier sine transform of e^{-x} , $x > 0$. Hence evaluate $\int_0^{\infty} \frac{x \sin x}{1+x^2} dx$ (7)

- b) Find the Laplace transform of (i) $te^{-t}\sin t$ (ii) $\frac{\sin^2 t}{t}$ (8)
- 6 a) Solve $\frac{d^2y}{dt^2} - 4\frac{dy}{dt} + 5y = 4e^{3t}$ given that $y = 2$, $\frac{dy}{dt} = 7$ when $t = 0$ (7)
- b) Using convolution theorem find $L^{-1} \frac{s}{(s^2+a^2)^2}$ (8)

PART C (MODULES V AND VI)

Answer two full questions.

- 7 a) Using Newton Raphson method find correct to four decimal places, the root between 0 and 1 of the equation $x^3 - 6x + 4 = 0$ (8)
- b) The population of a town is as follows (12)
- | Year | 1941 | 1951 | 1961 | 1971 | 1981 | 1991 |
|-----------------------|------|------|------|------|------|------|
| Population (in lakhs) | 20 | 24 | 29 | 36 | 46 | 51 |
- Estimate the population increase during the period 1946 to 1976
- 8 a) Apply Lagrange's formula to obtain the value of y when x=35 given that (6)
- | | | | | |
|---|-----|-----|----|----|
| x | 30 | 34 | 38 | 42 |
| y | -30 | -13 | 3 | 18 |
- b) Solve the equation using Gauss elimination method (7)
- $$2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16$$
- c) Solve the system of equations $4x + 2y + z = 14, x + 5y - z = 10, x + y + 8z = 20$ (7)
- using Gauss-Seidal iteration method
- 9 a) A solid of revolution is formed by rotating about the x axis, the area between the x axis, the line $x=0$ and $x=1$ and a curve through the points with the following coordinates (7)
- | | | | | | |
|---|--------|-------|-------|-------|-------|
| X | 0.0 | 0.25 | 0.50 | 0.75 | 1.00 |
| Y | 1.0000 | .9896 | .9589 | .9089 | .8415 |
- Estimate the volume of the solid formed using Trapezoidal rule
- b) Using Euler's method find $y(0.2)$ and $y(0.4)$ given $\frac{dy}{dx} = x + y, y(0) = 1$ and $h = 0.2$ (6)
- c) Use the fourth order Runge-Kutta method to find $y(0.2)$ from $\frac{dy}{dx} = y - x, y(0) = 2$ (7)
- taking $h=0.1$