

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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 any two full questions, each carries 15 marks*

Marks

- 1 a) Derive the formula for mean and variance of Binomial distribution. (7)
 b) 100 fair dice are thrown. Find the expectation of the sum of the numbers thrown. (8)
- 2 a) A continuous random variable X has a pdf $f(x) = kx^2e^{-x}; x \geq 0$. (7)
 Find i) Value of k and ii) Mean of the distribution.
 b) If X is a uniformly distributed R.V. with mean 1 and variance $\frac{4}{3}$, find $P(|X - 2| < 2)$ (8)
- 3 a) The time in hours required to repair a machine is exponentially distributed with mean 20. What is the Probability that the required time : (7)
 i) Exceeds 30 hrs ii) Between 16 hrs and 24 hrs.
 b) Marks of a set of students for a certain subject are approximately normally distributed with mean 62 and variance 9. If 4 students are randomly selected, what is the probability that 3 of them have less than 60 marks? (8)

PART B (MODULES III AND IV)*Answer any two full questions, each carries 15 marks*

- 4 a) Find the Fourier Integral representation of $f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$ (7)
 b) Find the Fourier Sine Transform of $f(x) = e^{-|x|}$. Hence evaluate $\int_0^\infty \frac{\omega \sin \omega x}{1 + \omega^2} d\omega$. (8)
- 5 a) Find the Laplace Transform of : (7)
 (i) $\sin 3t \cos 2t$ (ii) $e^{-2t} \cos^2 t$
 b) Find the Inverse Laplace Transform of: (8)
 (i) $\frac{s-4}{s^2-4}$ (ii) $\frac{4}{s^2-2s-3}$
- 6 a) Find the Fourier Cosine Transform of $f(x) = \sin x; 0 < x < \pi$. (7)
 b) Solve, by using Laplace Transform: $y'' + y = 3 \cos 2t; y(0) = 0, y'(0) = 0$. (8)

PART C (MODULES V AND VI)*Answer any two full questions, each carries 20 marks*

- 7 a) Find a root lying between 0 and $\frac{\pi}{2}$ of $f(x) = \cos x - 3x + 1 = 0$. (correct to 3 decimal places). (6)
 b) Using Lagrange's interpolation formula, fit a polynomial to the given data and hence find $y(2)$ (7)

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x	1	3	4
y	1	27	64

- c) Using Newton's Forward Interpolation Formula, find the value of $\sin 52^\circ$ given that $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, $\sin 65^\circ = 0.9063$. (6)

- 8 a) Solve the following equations by Gauss- Seidel iteration Method. (correct to 3 decimal places). (7)

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

- b) Use Euler's Method with $h = 0.025$, compute the value of $y(0.1)$ for $y' = x - y^2$; $y(0) = 1$. (7)

- c) A river is 80m wide. The depth y in meters at a distance x meter from one bank is given by the following table. (6)

x	0	10	20	30	40	50	60	70	80
y	0	5	8	10	15	12	7	3	1

Find approximately the area of cross section using Simpson's $1/3$ rd rule.

- 9 a) Using Newton-Raphson Method, derive a formula to find $\sqrt[3]{N}$ where N is a real number. Hence evaluate $\sqrt[3]{35}$ correct to three decimal places. (10)
- b) Using Runge- Kutta Method of Fourth Order, $\frac{dy}{dx} = \sqrt{x + y}$; $y(0) = 1$, find $y(0.2)$ with $h = 0.1$ (10)
