JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year II Semester Examinations, June - 2022
MATHEMATICS - III
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, MIE, PTM, CEE, MSNT)

Time: 3 Hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1.a) For the continuous probability function $f(x) = kx^2 e^{-x}$ when $x \geq 0$, find (i) k (ii) Mean (iii) Variance.

b) Derive the mean and variance of random variable X having probability distribution

$$f(x) = \frac{e^{-\lambda} \lambda^x}{x!}, x = 0, 1, 2, ..., \lambda > 0$$ [9+6]

2.a) Obtain the moment generating function of the random variable X having the probability

density function $f(x) = \begin{cases} x, 0 \leq x \leq 1 \\ 2 - x, 1 \leq x \leq 2 \\ 0, elsewhere \end{cases}$

b) Suppose that the temperature is normally distributed with expectation 50 ^{0}C and variance 4 ^{0}C. What is the probability that the temperature T will be between 48 ^{0}C and 58 ^{0}C. [8+7]

3.a) State Central Limit Theorem and using it approximate P($0.03 \leq \bar{X} \leq 0.15$), where $\bar{X}$ is the mean of a random sample size n=15 from a distribution whose PDF is

$f(x) = \frac{3}{2} x^2, -1 < x < 1$.

b) (i) Find the value of $P(-t_{0.025} < T < t_{0.05})$

(ii) Find 'k' such that $P(k < T < -1.761) = 0.045$. [8+7]

4.a) A sample of 400 items is taken from a population whose standard deviation is 15. The mean of the sample is 25. Test whether the sample has come from a population with mean 26.8. Also calculate that 98% confidence limits of the population mean.

b) A random sample of size 25 from a normal population has the mean $\bar{m} = 47.5$ and the standard deviation $s = 8.4$. Does this information support or refute the claim that the mean of the population is $\mu = 42.1$? [7+8]

5.a) A die is tossed 180 times with the following results.

x	1	2	3	4	5	6
f	28	36	36	30	27	23

Is it a balanced die?

b) Suppose we wish to study the effect of computer-aided instruction (CAI) on the performance of college students. We randomly divide the incoming class into three sections. Section A is taught in a conventional way, Section B is nearly completely automated, and in Section C a mixed approach is used.

The following test scores are observed:

Section A	Section B	Section C
77	70	79
68	69	74
72	73	77
75	74	80
60	59	73
59	63	60
82	80	79

Perform analysis of variance and determine whether the differences among the means obtained for the three sections are significant at $\alpha = 0.05$. [7+8]

6.a) Find the real root of the equation $x^4 + 2x^3 - x - 1 = 0$ by Regula Falsi method correct to three decimal places.

b) Using Gauss Seidel method and solve the equations
$4x + y + z = 7$,
$8x + 5y + 3z = 21$,
$2x + y + 6z = 10$ [7+8]

7. Using least squares method fit a quadratic curve to the following data. [15]

x	-2	-1	0	1	2
f(x)	13	6	3	4	9

8.a) Evaluate $\int_{0}^{1} \dfrac{dx}{x^3 + x + 1}$ using i) Trapezoidal rule ii) Simpson's $3/8^{th}$ rule.

b) Using R-K method of order four, solve $y'' - xy' - y = 0, y(0) = 1, y'(0) = 0$ to find $y(0.2)$ and $y'(0.2)$. [7+8]

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