Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024

Subject Code: 3130908 Date: 21-11-2024

Subject Name: Applied Mathematics for Electrical Engineering

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Derive the formula for finding $\sqrt[q]{N}$, Using it evaluate $\sqrt[3]{456}$ correct up to four decimal places.	**03**
	(b)	(i) Define a random variable? How many types of random variables are there? (ii) Define forward finite difference.	**04**
	(c)	An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of accidents is 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver?	**07**
Q.2	**(a)**	Evaluate $\int_1^2 \cos x \, dx$ using Trapezoidal rule taking 10 sub intervals.	**03**
	(b)	Evaluate $\int_0^5 \frac{1}{4x+5} dx$ using Simpson 1/3 rule with $h = 0.5$.	**04**
	(c)	Find a real root of the equation $\cos x - xe^x = 0$in the interval [0.5,1] using bisection method, correct up to 3 decimal places.	**07**
		OR	
	(c)	Find a real root of the equation $2x^3 - 3x^2 + 5x - 6 = 0$ using secant method, correct up to 4 decimal places.	**07**
Q.3	**(a)**	Using Newton's divided difference, find the value of $[a, b]$ and $[a, b, c]$ for $f(x) = \frac{1}{x}$.	**03**
	(b)	The following data gives the melting point of an alloy of lead and zinc, where t is a temperature in ℃ and p is the percentage of lead in the alloy.	**04**

$p(\%)$	60	70	80	90
t	226	250	276	304

Find the melting point of the alloy containing 84% of lead using Newton's backward interpolation formula.

			Marks
	(c)	Using least squares method, fit a second-degree parabola $y = ax^2 + bx + c$ to the following data:	**07**

x	10	12	15	20	23
y	14	17	23	21	25

OR

Q.3	**(a)**	Prove that $E = 1 + \Delta$ and $\Delta\nabla = \Delta - \nabla$	**03**
	(b)	Using least squares method, fit a straight line of the form $y = mx + c$ connecting y and x, using the following data:	**04**

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(c) The following table gives corresponding values of x and y. Prepare forward difference table and obtain y at $x = 1700$ **07**

x	1000	2000	3000	4000
y	10250	13850	15350	16000

Q.4 **(a)** If A and B are two events with $P(A) = \frac{1}{3}, P(B) = \frac{1}{4}, P(A \cap B) = \frac{1}{12}$. Find $P(A/B), P(B/A)$ **03**

(b) Two fair dice are thrown simultaneously. Find the probability of getting sum of the numbers less than or equal to eight obtained on the dice. **04**

(c) Given $y' = x^2 - y, y(0) = 1$, find $y(0.1), y(0.2)$ using Runge-kutta method of 4th order (take $h = 0.1$) **07**

OR

Q.4 **(a)** A group of 9 boys and 4 girls is put to test in statistics and the students are ranked as per their performance. Assuming that no two students get the same scores, find the probability that the girls get top 4 scores. **03**

(b) In a distribution, the mean is 65, median is 70, coefficient of skewness is -0.6. find the mode and coefficient of variation. **04**

(c) Determine the value of y at $x = 0.1, 0.2, 0.3$, given that $y(0) = 0$ and $\frac{dy}{dx} = 1 - y$, using modified Euler's method. (take $h = 0.1$) **07**

Q.5 **(a)** The probability distribution of a random variable X is given below. **03**

X	-2	-1	0	1	2
$P(X)$	0.2	0.1	0.3	0.3	0.1

Find $E(X), Var(X)$.

(b) Mr. John plays a game of tossing a dice. If a number less than 3 appears, he gets Rs. a, otherwise, he was to pay Rs. 10. If the game is fair, find a. **04**

(c) Calculate the first four moments of the following distribution about the mean. **07**

x	0	1	2	3	4	5	6	7	8
f	5	10	15	20	25	20	15	10	5

Also, calculate the values of β_1 and β_2 also discuss about the shape of the distribution.

OR

Q.5 **(a)** Define Skewness and Kurtosis **03**

(b) If the density function of a random variable X is given by $f(x) = kx(1 - x), 0 \leq x \leq 1$, find k and Median. **04**

(c) A random variable X is exponentially distributed with parameter 1. Use Chebyshev's inequality to show that $P\{-1 \leq X \leq 3\} \geq \frac{3}{4}$. Find the actual probability also. **07**

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