Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2023

Subject Code:3130908 Date:12-01-2024

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.**

Q.1 **(a)** Using Newton's method, find a real root of $x\log_{10} x = 1.2$ correct to 4 decimals. **03**

(b) Using Lagrange's interpolation formula, fit a polynomial to the data **04**

x	-1	1	2
y	7	5	15

(c) The following are data from the steam table. **07**

Temperature ^{0}C	140	150	160	170	180
Pressure kg/cm^2	3.685	4.854	6.302	8.076	10.225

Find the pressure at temperature 142 ^{0}C and 175 ^{0}C.

Q.2 **(a)** Four letters of the word 'THURSDAY' are arranged in all possible ways. Find the probability that the word formed is 'HURT'. **03**

(b) Find the missing term in the following table: **04**

x	1	2	3	4	5
y	7	--	13	21	37

(c) The velocity v of a particle at a distance s from a point on its path is given by the table: **07**

s (ft)	0	10	20	30	40	50	60
v (ft/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel 60 ft by using Simpson's 1/3 rule. Compare the result with Simpson's 3/8 rule.

OR

(c) Given $y' = xy + y^2$, $y(0) = 1$, use Taylor's series method to get the values of $y(0.1), y(0.2)$ and $y(0.3)$. **07**

Q.3 **(a)** From a lot of 10 items containing 3 defectives, a sample of 4 items is drawn at random. Let the random variable X denote the number of defective items in the sample. Find the probability distribution of X. **03**

(b) Compute f(9.2) from the following data by using Newton's divided difference interpolation formula: **04**

x	8	9	9.5	11
f(x)	2.079442	2.197225	2.251292	2.397895

(c) Using Runga -Kutta method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, with $y(0) = 1$ at $x = 0.2, 0.4$. **07**

OR

Q.3 **(a)** Prove that $\Delta \log f(x) = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$. **03**

(b) An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accident is 0.01, 0.03 and 0.15 in the respective category. One of the insured drivers meets with an accident. What is the probability that he is a scooter driver? **04**

(c) Fit a curve of the form $y = a\,x^b$ to the following data: **07**

x	20	16	10	11	14
y	22	41	120	89	56

Q.4 **(a)** A bag contains 3 red and 4 white balls. Two draws are made without replacement. What is the probability that both the balls are red? **03**

(b) Is the function f(x) defined by **04**

$$f(x) = e^{-x} \quad ; x \geq 0$$
$$= 0 \quad ; x < 0$$

is a probability density function. If so, find the probability that the variate having this density falls in the interval (1,2).

(c) Evaluate $\int_1^2 \frac{2x\,dx}{1+x^4}$, using 3 – point Gauss quadrature formula and compare with the actual value. **07**

OR

Q.4 **(a)** The arithmetic mean of 3 sets are 25, 10 and 15 whose corresponding number of observations are 200, 250 and 300. Find the combined arithmetic mean. **03**

(b) Fit the line of best fit to the following data: **04**

x	0	5	10	15	20	25
y	12	15	17	22	24	30

(c) Apply modified Euler's method to find y(0.2) and y(0.4) given $y' = x^2 + y^2$, y(0) = 1 by taking h = 0.2 **07**

Q.5 **(a)** Calculate mean, variance and standard deviation for the series $1^2, 2^2, ..., n^2$. **03**

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$, using Trapezoidal rule with h = 0.2 **04**

(c) Calculate Karl Pearson's coefficient of skewness from the following data: **07**

Wages (Rupees)	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of workers	8	16	30	45	62	32	15	6

OR

Q.5 **(a)** Calculate first and second moments about zero for the observations 3, 8, 11, 12, 20. **03**

(b) The probability of occurrence of an event A is 0.7, the probability of non-occurrence of B is 0.5 and that of at least one of A and B not occurring is 0.6. Find the probability that at least one A and B occurs. **04**

(c) Using Picard's method solve $\frac{dy}{dx} = x - y, y(0) = 1$ and find y (0.2) to five places of decimals. **07**

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