Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022

Subject Code:3130908 Date:20-02-2023

Subject Name:Applied Mathematics for Electrical Engineering

Time:02:30 PM TO 05:00 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)**	Construct the forward difference table for $f(x) = x^2; x = 0,1,2,3,4$ and find the values of $\Delta f(2), \Delta^2 f(1), \Delta^3 f(0)$.	**03**
	(b)	From a collection of 10 bulbs, of which 4 are defective, 3 bulbs are selected at random and fitted into lamps. Find the probability that (i) The room is lit. (ii)All three bulbs glow.	**04**
	(c)	If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form $P = mW + c$ connecting P and W using the following data:	**07**

P	12	15	21	25
W	50	70	100	120

Where P and W are taken in kg-wt. Compute P when W=150kg.

Q.2	**(a)**	Find the positive root of $x^4 - x - 10 = 0$, correct to three decimal places by using iteration method.	**03**
	(b)	Find a positive root of the equation $x - cosx = 0$, using the bisection method correct up to two decimal places.	**04**
	(c)	Use Newton's divided difference formula to find $f(x)$ from the following data.	**07**

x	0	2	3	4	6	7
$f(x)$	0	8	0	-72	0	1008

OR

	(c)	Use Lagrange's formula to fit a polynomial to the data given below:	**07**

x	-1	0	2	3
y	8	3	1	12

And hence find$y(2)$.

Q.3	**(a)**	Evaluate $\int_0^1 e^{-x^2} dx$, using the Trapezoidal rule with $n = 10$.	**03**
	(b)	Find the real root of the equation $f(x) = xe^x - 2 = 0$ which lies between 0.8 and 0.9 correct to three decimal places using false position method.	**04**
	(c)	Use Euler's method to obtain an approximate value of $y(0.4)$ for the differential equation $y' = x + y, y(0) = 1, with\ h = 0.1$.	**07**

OR

Q.3	**(a)**	Obtain second approximation solution of the initial value problem $\frac{dy}{dx} = x^2 + y^2$ for $x = 0.4$ correct to four decimal places, given that $y(0) = 0$, using Picard's method.	**03**
	(b)	Evaluate $\int_0^3 \frac{dx}{1+x}$ with $n = 6$ by using Simpson's $\frac{3}{8}$ rule.	**04**

(c) The population of the town in decimal census was as given below estimate the population for the year 1895. **07**

Year	1891	1901	1911	1921	1931
Population (in thousand)	46	66	81	93	101

Q.4 **(a)** Three unbiased coins are tossed. Find the probability of getting (i)Exactly two heads.(ii)At least one tail.(iii)At most two heads. **03**

(b) In a group of 1000 persons, there are 650 who can speak Hindi, 400 can speak English, and 150 can speak both Hindi and English. If a person is selected at random, what is the probability that he speaks(i)Hindi only,(ii)English only,(iii)Only of the two languages,(iv)At least one of the two languages? **04**

(c) Let X be a continuous random variable with probability density function $f(x) = kx(1-x), 0 \leq x \leq 1$. Find k and determine a number b such that $P(X \leq b) = P(X \geq b)$. **07**

OR

Q.4 **(a)** Construct the distribution function of the discrete random variable X whose probability distribution is as given below: **03**

X	1	3	2	4	5	6	7
P(X= x)	0.10	0.15	0.25	0.20	0.15	0.10	0.05

(b) A random variable X has the probability mass function given by **04**

X	1	2	3	4
P(X= x)	0.1	0.2	0.5	0.2

Find (i)$P(2 \leq x \leq 4)$, (ii)$P(x > 2)$,(iii)P(X is odd), (iv)P(X is even).

(c) In a bolt factory, machines A, B, C manufacture 25%, 35% and 40% of the total output and out of the total manufacturing, 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. Find the probabilities that it is manufactured from (i) Machine A, (ii)Machine B,(iii) Machine C. **07**

Q.5 **(a)** A machine produces an average of 500 items during the first week of the month and on average of 400 items during the last week of the month, the probability for these being 0.68 and 0.32 respectively. Determine the expected value of the production. **03**

(b) Let X be a random variable with $E(X) = 10$ and $Var(X) = 25$. Find the positive values of a and b such that $Y = aX - b$ has an expectation of 0 and variance of 1. **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**

OR

Q.5 **(a)** Calculate the arithmetic mean for the following data. **03**

x	0	1	2	3	4	5	6	7	8	9	10
f	2	8	43	133	207	260	213	120	54	9	1

(b) The first four moments of distribution about $x = 2$ are 1, 2.5, 5.5 and 16. Calculate the four moments about μ. **04**

(c) Calculate coefficient of skewness by Karl Pearson's method for the following data. **07**

x	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800
f	6	10	18	20	15	12	10	9