Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2021**

**Subject Code:2140706 Date:03/01/2022**

**Subject Name:Numerical and Statistical Methods for Computer 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)** Explain the following terms: **03**

(i) Inherent Error
(ii) Truncation Error
(iii) Round-off Error

**(b)** Write an Algorithm for Bisection method. **04**

**(c)** Derive Newton-Raphson method analytically. Use it to find a root between 0 and 1 of the equation $e^x \sin x - 1 = 0$, correct up to four decimal places. **07**

**Q.2** **(a)** Evaluate $\int_{-1}^{1} e^x dx$ using trapezoidal rule for $n = 4$. **03**

**(b)** Fit a straight line to the following data. Also find $y$ at $x = 2.5$. **04**

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $y$ | 1 | 1.8 | 3.3 | 4.5 | 6.3 |

**(c)** Apply Budan's theorem to find the number of roots of the equation **07**

$$x^3 - 3x^2 - 4x + 13 = 0$$

in the intervals $[-3,-2]$, $[-2,-1]$, $[-1,0]$, $[0,1]$, $[1,2]$ and $[2.3]$.

**OR**

**(c)** Find all the roots of $x^3 - x - 1 = 0$ using Bairstow's method. Start with the initial factor $x^2 + x + 1$. **07**

**Q.3** **(a)** Find a real root of the equation $cos\ x + 1 = 3x$ correct up to three decimal places by the iteration method. **03**

**(b)** Use Lagrange formula to find $f(3)$ from the following table: **04**

| $x$ | 0 | 1 | 2 | 4 |
|---|---|---|---|---|
| $f(x)$ | 1 | 3 | 9 | 81 |

**(c)** Find the cubic spline in the interval [0,2] for the following data: **07**

| x | 0 | 2 | 4 | 6 |
|---|---|---|---|---|
| y | 1 | 9 | 41 | 41 |

Given $M_0 = 0$ and $M_3 = -12$.

**OR**

**Q.3** **(a)** Find the positive root of $x - 2sin\ x = 0$ using secant method. Correct up to three decimal places starting from $x_0 = 2$ and $x_1 = 1.9$. **03**

**(b)** Use Newton's divided difference formula to determine $f(5)$ for the following data: **04**

| $x$ | 1 | 2 | 4 | 6 |
|---|---|---|---|---|
| $f(x)$ | 14 | 15 | 5 | 9 |

**(c)** Fit a second degree parabola using least squares method to the following data: **07**

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| y | 1 | 1.8 | 1.3 | 2.5 | 6.3 |

**Q.4** **(a)** Evaluate $\int_0^{18} ydx$ from the following table using Simpson's 3/8 rule: **03**

| x | 0 | 3 | 6 | 9 | 12 | 15 | 18 |
|---|---|---|---|---|---|---|---|
| y | 0 | 22 | 29 | 31 | 20 | 4 | 0 |

**(b)** Write an algorithm for Simpson's 1/3 rule. **04**

**(c)** Apply Runge-Kutta method of order four to find an approximate value of $y$ when $x = 0.2$ in steps of 0.1 if $\frac{dy}{dx} = x + y^2$ given that $y = 1$ when $x = 0$. **07**

**OR**

**Q.4** **(a)** If the two lines of regression are $4x - 5y + 30 = 0$ and $20x - 9y - 107 = 0$, which of these lines are lines of regression of $x$ on $y$ and $y$ on $x$? Find $r_{xy}$ and $\sigma_y$ when $\sigma_x = 3$. **03**

**(b)** Discuss about the pitfalls in Gauss elimination method. **04**

**(c)** Solve the following system by Gauss-Seidel method: **07**

$$5x + y - z = 10; \quad 2x + 4y + z = 14; \quad x + y + 8z = 20$$

**Q.5** **(a)** Calculate the 3-yearly moving averages of the following data: **03**

| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sales (millions of rupees) | 3 | 4 | 8 | 6 | 7 | 11 | 9 | 10 | 14 | 12 |

**(b)** The runs scored by two batsmen A and B in 9 consecutive matches are given below: **04**

| A | 85 | 20 | 62 | 28 | 74 | 5 | 69 | 4 | 13 |
|---|---|---|---|---|---|---|---|---|---|
| B | 72 | 4 | 15 | 30 | 59 | 15 | 49 | 27 | 26 |

Which of the batsmen is more consistent?

**(c)** Define central moments. Calculate the first four moments from the following data: **07**

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

**OR**

**Q.5** **(a)** Calculate the correlation coefficient between x and y using the following data: **03**

| x | 2 | 4 | 5 | 6 | 8 | 11 |
|---|---|---|---|---|---|---|
| y | 18 | 12 | 10 | 8 | 7 | 5 |

**(b)** Find the standard deviation for the following distribution: **04**

| Marks | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|---|---|---|---|---|---|---|---|
| No. of Students | 5 | 12 | 15 | 20 | 10 | 4 | 2 |

**(c)** Find the two regression lines from the following table: **07**

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 43 | 46 | 82 | 98 | 123 | 167 | 199 | 213 | 245 | 272 |

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