**Seat No.: _____** **Enrolment No._____**

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–IV (NEW) - EXAMINATION – SUMMER 2017**

**Subject Code: 2140706** **Date: 03/06/2017**

**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.**

**Q.1 Short Questions** **14**

**1** If $a$ is in error by $\delta a$ and $b$ is in error by $\delta b$, then what is the error in $a - b$?

**2** If $a$ is in error by $\delta a$ and $b$ is in error by $\delta b$, then state the formula to estimated error in $a \cdot b$?

**3** State a draw-back of secant method.

**4** Find an interval in which a solution of $f(x) = x^2 - 3$ is guaranteed.

**5** Under what condition a matrix $A$ possess inverse?

**6** Which of the iterative method from Gauss-Seidal method and Jacobi method converges faster?

**7** What is meant by the curve of best fit?

**8** State formula for Simpson's $(1/3)^{rd}$ rule to find approximate value of an integration of a function $f(x)$ over $[a, b]$.

**9** Using difference table how can you predict the function representing the data is a polynomial of degree 3?

**10** State the formula to find the first order backward difference.

**11** For the two data sets represented by $x$ and $y$, write the regression co-efficient of $y$ on $x$.

**12** Which measures are called the measures of central tendency?

**13** Find the coefficient of variation for a data with mean 34 and standard deviation 2.25.

**14** What is the rate of convergence of Newton-Raphson method?

**Q.2 (a)** Round off 5.37425 to three significant digits. Find relative error and percentage error due to rounding. **03**

**(b)** Solve to three decimal place accuracy the equation $6x^3 - 2x^2 + 9x - 3 = 0$, using Secant method. **04**

**(c)** State the condition of convergence for iterative method $x = g(x)$. Find to four decimal place accuracy a solution to $x = \frac{1}{2} + \sin x$ using the method. **07**

**OR**

**(c)** State the condition of convergence for Newton-Raphson method. Find the cube root of 5, to four decimal place accuracy, using the method. **07**

**Q.3 (a)** Find a solution of $f(x) = x^2 - 2x - 2$ in the interval $[2,\ 3]$, showing at least four steps of bisection method. **03**

**(b)** Solve the given system of linear equations, using Gauss elimination method: $x + y + z = 9, 2x - 3y + 4z = 13, 3x + 4y + 5z = 40$. **04**

**(c)** Find inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$, using Gauss-Jordan method. **07**

**OR**

**Q.3** **(a)** State the conditions on function $f: \mathbb{R} \to \mathbb{R}$ under which it has a solution in an interval $[a, b],\ a < b < \infty$. **03**

**(b)** Using Budan's theorem, predict the number of real roots of $p(x) = x^3 - 7x + 7$ in the open interval $(0, 2)$. **04**

**(c)** Write the iterative scheme to solve simultaneously a system of three linear algebraic equations using Gauss-Seidal method with required condition. Apply the scheme to solve the following system to three digit accuracy: **07**
$x + 5y - 3z = 18;\ \ 9x - 2y + z = 50; -2x + 2y + 7z = 19.$

**Q.4** **(a)** If $P$ is the pull required to lift a load $W$ by means of a pulley block, find a linear approximation of the form $P = mW + c$ connecting $P$ and $W$, using the following data: **03**

| $P$ | 13 | 18 | 23 | 27 |
|---|---|---|---|---|
| $W$ | 51 | 75 | 102 | 119 |

where $P$ and $W$ are taken in $kg \cdot wt$.

**(b)** Evaluate $\int_0^6 \frac{dx}{1+x}$ ; using Trapezoidal rule with $h = 1$. **04**

**(c)** For the values given in the following table, find the Lagrange's interpolating polynomial: **07**

| $x$ | 4 | 5 | 7 | 10 |
|---|---|---|---|---|
| $y$ | 12 | 25 | 32 | 41 |

**OR**

**Q.4** **(a)** Prepare the difference table for the function $y = x^2 + e^x$ for $x = 0, 1, 2, 3, 4$ up to three order and label the terms using forward difference operator. **03**

**(b)** Evaluate $\int_0^3 \frac{dx}{1+x^2}$ ; using Simpson's $\left({}^{3}/_{8}\right)^{th}$ - rule with $h = 0.5$. **04**

**(c)** Fit a second degree parabola $y = a + bx + cx^2$ to the following data: **07**

| $x$ | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
|---|---|---|---|---|---|---|---|
| $y$ | 1.2 | 1.4 | 1.9 | 2.4 | 2.8 | 3.3 | 4.2 |

**Q.5** **(a)** Using Euler's method, find an approximate value of $y$ corresponding to $x = 1$, given that $\frac{dy}{dx} = x^2 + y$ and $y = 1$ when $x = 0$. Use the step size $h = 0.25$. **03**

**(b)** Using modified Euler's method, find an approximate value of $y$ corresponding to $x = 0.2$, given that $\frac{dy}{dx} = x^2 + y^3$ and $y = 1$ when $x = 0$. Use the step size $h = 0.1$. **04**

**(c)** Calculate the co-efficient of correlation between the given series of data for $x$ and $y$ in the following table: **07**

| $x$ | 54 | 57 | 55 | 57 | 56 | 52 | 59 |
|---|---|---|---|---|---|---|---|
| $y$ | 36 | 35 | 32 | 34 | 36 | 38 | 35 |

**OR**

**Q.5** **(a)** Find the expectation for the following discrete probability distribution: **03**

| $x$ | 10 | 14 | 18 | 25 | 35 |
|---|---|---|---|---|---|
| $p(x)$ | 0.125 | 0.225 | 0.325 | 0.200 | 0.125 |

**(b)** Find the third moment about mean for the following frequency distribution: **04**

| $x$ | 5 | 7 | 10 | 18 | 26 |
|---|---|---|---|---|---|
| $frequency - f$ | 5 | 14 | 22 | 6 | 3 |

**(c)** Find an approximate value of $y$ for $x = 0.3$ in steps of 0.1, using Runge-Kutta method of fourth order, if $\frac{dy}{dx} = xy$, given that $y = 1.2$ when $x = 0.1$. **07**

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