Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**MCA- II$^{nd}$ SEMESTER–EXAMINATION –JUNE - 2012**

**Subject code: 2620004 Date: 12/06/2012**

**Subject Name: Computer Oriented Numerical Methods (CONM)**

**Time: 10:30 am – 01:00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Figures to the right indicate full marks.**
3. **Use of calculators is allowed provided they are silent and battery operated.**
4. **Intermediate calculation steps and results are to be shown, even while using calculator.**

**Q.1** **(a)** Write an algorithm to implement False-Position method to find the root of any polynomial. **05**

**(b)** Graphically explain the Newton-Raphson method to find the root of the equation f(x)=0. **04**

**(c)** Find the dominant eigen value and the corresponding eigen vector of the following matrix using Power method : **05**

$$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

**Q.2** **(a)** Find the root of the equation $x^3 + 3x^2 + 27x - 25 = 0$ using Birge-Vieta method (Take $r_0 = 0.5$). Perform only three iterations. **07**

**(b)** Write an algorithm for implementing Newton's Forward Difference Interpolation method. **07**

**OR**

**(b)** Use Bisection method to find the root of the following equation $e^{0.4x} - 0.4x - 9 = 0$, in the interval [6,7], correct upto three significant digits. **07**

**Q.3** **(a)** Using Secant method, find the root of the following equation $x^3 + 9x^2 + 23x + 14 = 0$, in the interval [–1.5, –0.5], correct upto three decimal places. **07**

**(b)** Fit a geometric curve of the form $y = ax^b$, to the following data points by the method of least squares : **07**

| x : | $\pi/2$ | $\pi$ | $3\pi/2$ | $2\pi$ | $5\pi/2$ |
|---|---|---|---|---|---|
| y : | 2.9 | 4.0 | 5.7 | 8.9 | 12.4 |

**OR**

**Q.3** **(a)** Use appropriate Newton's interpolation formula to find the value of y at x = 51.5, from the following tabular values : **07**

| x : | 41 | 45 | 49 | 53 | 57 |
|---|---|---|---|---|---|
| y : | 3.4482 | 3.5569 | 3.6593 | 3.7563 | 3.8485 |

**(b)** The results of measurement of electric resistance R of a copper bar at various temperatures t°C are given below : **07**

| t : | 19 | 25 | 30 | 36 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|
| R : | 76 | 77 | 79 | 80 | 82 | 83 | 85 |

Fit a straight line R = a + bt.

**Q.4** **(a)** A curve passes through the points (1,0.2), (2,0.7), (3,1.0), (4,1.3), (5,1.5), (6,1.7), (7,1.9), (8,2.1), (9,2.3) and (10,2.4). Find the volume of the solid generated by revolving the area between the curve, the X-axis and the ordinates x=1 and x=10, about the X-axis, using Simpson's 3/8 rule (Hint : $V=\pi\int_1^{10} y^2 dx$). **07**

**(b)** Given that, **07**

| x : | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
|---|---|---|---|---|---|---|---|
| y : | 7.989 | 8.403 | 8.781 | 9.129 | 9.451 | 9.450 | 10.031 |

Find $dy/dx$ and $d^2y/dx^2$ at x = 1.1.

**OR**

**Q.4** **(a)** Evaluate $\int_0^1 \frac{x^2}{1+x^3} dx$ using two-point Gauss-Quadrature formula. **07**

**(b)** Find numerically the first and second order derivatives at x = 3.8, using the values given below : **07**

| x : | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 |
|---|---|---|---|---|---|---|
| y : | –14.000 | –10.030 | –5.296 | –0.256 | –6.672 | 14.000 |

**Q.5** **(a)** Using Lagrange's interpolation formula, find the value of y when x = 3, from the following data : **07**

| x : | 0 | 1 | 2 | 4 | 5 |
|---|---|---|---|---|---|
| y : | 0 | 16 | 48 | 88 | 0 |

**(b)** Given the following differential equation $dy/dx = \frac{2-y^2}{5x}$, with y(4) = 1. Compute y(4.1), y(4.2) and y(4.3) using Runge-Kutta second order method and obtain y(4.4) using Milne-Simpson's predictor corrector method. **07**

**OR**

**Q.5** **(a)** Explain the pitfalls of Gauss-Elimination method for solving a system of simultaneous linear equations. Hence, solve the following system of equations, using Gauss-Elimination method. **07**

$$x + y + z = 6.6$$
$$x - y + z = 2.2$$
$$x + 2y + 3z = 15.2$$

**(b)** Use Euler's method to solve the following differential equation $dy/dx = \frac{4x}{y} - xy$, with y(0)=3, in the interval [0,1] taking step-size $h$ = 0.2. **07**

**********