Seat No.: _____ Enrolment No.______

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA. Sem-II Examination July 2010

Subject code: 620005

Subject Name: Computer Oriented Numerical Methods

Date: 07 /07 /2010 **Time: 11.00 am – 01.30 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)** Explain the following terms : Blunders, Formulation Errors, Data Uncertainty. Explain Total Numerical Error. How can one control numerical errors ? **05**

(b) Graphically derive Newton-Raphson method to find the root of the equation f(x)=0. Also, explain graphically the pit-falls of the Newton-Raphson method. **05**

(c) Economize e^x series to obtain four significant digit accuracy. **04**

Q.2 **(a)** Can Birge-Vieta method be used to find roots of any f(x)=0 ? Find the root of the equation $x^3 + 2x^2 + 10x - 20 = 0$ correct upto three significant digits using Birge-Vieta method (Hint : Take $r_0 = 1$). **07**

(b) Give graphical representation of the Successive Approximation method to find the root of the equation f(x)=0, for cases of divergence as well as convergence. **07**

OR

(b) Use Bisection method to find the smallest positive root of the following equation $x^4 - x - 10 = 0$, correct upto four significant digits. **07**

Q.3 **(a)** From the following table, find P when t = 142 °C and 175 °C, using appropriate Newton's Interpolation formula. **07**

Temp (t) °C :	140	150	160	170	180
Pressure (P) kgf/cm^2 :	3.685	4.854	6.302	8.076	10.225

(b) Fit a geometric curve to the following data by the method of least squares : **07**

x :	1	2	3	4	5
y :	7.1	27.4	62.1	110.0	161.0

OR

Q.3 **(a)** Derive the formula for Newton's Divided Difference Interpolating Polynomial. **07**

(b) Obtain the cubic spline approximations for the function f(x)=0 from the following data : **07**

x :	-1	0	1	2
y :	-1	1	3	35

Q.4 **(a)** The values of pressure and specific volume of super heated steam are as follows : **07**

Volume (V) :	2	4	6	8	10
Pressure (P) :	105.00	42.07	25.30	16.70	13.00

Find the rate of change of pressure with respect to volume when V = 2 and V = 8.

(b) Evaluate $\int_0^{1.2} \log(1+x^2)dx$ using **07**

(i) Trapezoidal rule

(ii) Simpson's $3/8$ rule, taking h = 0.2 for both cases

OR

Q.4 **(a)** The velocity v of a particle at distances from a point on its linear path is given below : **07**

s (m) :	0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
v (m/sec) :	16	19	21	22	20	17	13	11	9

Estimate the time taken by the particle to traverse the distance of 20 metres, using Simpson's $1/3$ rule.

(b) For the following pairs of x and y, find numerically the first and second order derivatives at x = 1.9. **07**

x :	1.0	1.2	1.4	1.6	1.8	2.0
y :	0	0.128	0.544	1.296	2.432	4.000

Q.5 **(a)** Find numerically the largest eigen value and the corresponding eigen vectors of the following matrix, using the Power method : **07**

$$\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$

(b) Given the following differential equation $dy/dx = \frac{1}{x^2} - \frac{y}{x}$, with y(1) = 1. Compute y(1.1), y(1.2) and y(1.3) using Runge-Kutta third order method and obtain y(1.4) using Milne-Simpson's predictor corrector method. **07**

OR

Q.5 **(a)** State the necessary and sufficient condition for the convergence of Gauss-Seidel method for solving a system of simultaneous linear equations. Hence, solve the following system of equations, using Gauss-Seidel method, correct upto four decimal places. **07**

$$30x - 2y + 3z = 75$$
$$2x + 2y + 18z = 30$$
$$x + 17y - 2z = 48$$

(b) Given the following differential equation $dy/dx = (x+y)e^{-x}$, with y(–0.1) = 0.9053. Compute y(0), y(0.1) and y(0.2) using Runge-Kutta second order method and obtain y(0.3) using Adam-Bashforth-Moulton's predictor corrector method. **07**

****