

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 $t = 142^\circ\text{C}$ and 175°C , using appropriate Newton's Interpolation formula. **07**

Temp (t) $^\circ\text{C}$:	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 $\frac{3}{8}$ 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 $\frac{1}{3}$ 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 $\frac{dy}{dx} = \frac{1}{x^2} - \frac{y}{x}$, with $y(1) = 1$. 07
 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.

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

$$\begin{aligned} 30x - 2y + 3z &= 75 \\ 2x + 2y + 18z &= 30 \\ x + 17y - 2z &= 48 \end{aligned}$$

(b) Given the following differential equation $\frac{dy}{dx} = (x+y)e^{-x}$, 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
