Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.C.A.- SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 2620004 Date: 29-12-2012

Subject Name: Computer Oriented Numerical Methods

Time: 02:30 pm – 05:00 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 **(a)** What is Total Numerical Error? Explain different types of numerical errors with suitable example. **07**

(b) State the convergence criteria for Gauss-Seidel method to solve system of linear equations. How convergence of Gauss-Seidel method can be improved? Use Gauss-Seidel method to find the solution of the following system of equations. **07**

$50x + 2y - 3z + 6w = 190$

$3x + 65y + 2z + w = 80$

$-x + y + 33z + 3w = 60$

$x - 3y + 2z - 55w = 60$

Q.2 **(a)** State Descarte's rule of sign to determine number of positive root for the given polynomial equation. Find a root of the equation $f(x) = x^3 - 3x - 5 = 0$ using Regula Falsi method iterate until an approximate percent relative error e_a falls below 0.1 %, where root lies between [2,3]. **07**

(b) Write the pitfalls of Newton-Raphson method. Solve $\sin x = 1 + x^3$ using Newton – Raphson method considering initial value as (-1.1). **07**

OR

(b) Solve the polynomial equation $f(x) = x^3 - 6x^2 + 11x - 6 = 0$, taking initial value as 0.5, using Birge- Vieta Method up to four significant digit accuracy. **07**

Q.3 **(a)** Fit a straight line to the following data by the method of least square. **07**

x	3.4	4.3	5.4	6.7	8.7	10.6
y	4.5	5.8	6.8	8.1	10.5	12.7

(b) From the following values of density of saturated water for various temperatures of saturated steam, find by interpolation the densities when the temperatures are 130^0c and 275^0c respectively **07**

Temp^0 C (=T)	100	150	200	250	300
Density hg/m^3 (=d)	958	917	865	799	712

OR

Q.3 **(a)** Fit a relation of the form $Q = aH^b$ that best fits the following data: **07**

H	1.2	1.4	1.6	1.8	2.0	2.4
Q	4.2	6.1	8.5	11.5	14.9	23.5

(b) Write algorithm / pseudocode to interpolate y using the given pairs of values of x and y by Newton's divided difference interpolation formula. **07**

Q.4 **(a)** Find the values of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x=1.1 from the following data using Newton's forward difference formula. **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

(b) Evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x}\,dx$, using Simpson's 3/8 rule with six sub intervals. **07**

OR

Q.4 **(a)** Write algorithm / pseudocode to numerically integrate $\int_a^b f(x)dx$ using Trapezoidal and Simpson's 1/3 rule. **07**

Q.4 **(b)** The population of a certain town as obtained from census data is given in the following table : **07**

Year	1951	1961	1971	1981	1991
Population (in thousands)	19.96	36.65	58.81	77.21	94.61

Find the rate of growth of the population in the year 1981.

Q.5 **(a)** What is partial pivoting? State the advantage of applying partial pivoting to Gauss Elimination method. Solve the following system of equations using gauss elimination method. **07**

2x + y + z = 10
3x + 2y + 3z = 18
X + 4y + 9z = 16

(b) Write algorithm / pseudocode to solve given ordinary differential equation provided with initial values using Runge-Kutta 4th order method. **07**

OR

Q.5 **(a)** Find the largest eigen value and corresponding eigen vector of the following matrix using power method using $x_0 = [1,0,0]^T$. **07**

$$A = \begin{bmatrix} 25 & 1 & 0 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}.$$

(b) Given that y' = x - y^2, y(0) = 0, h=0.2 , find y(0.2), y(0.4) and y(0.6) by Runge – Kutta third order method and hence find y(0.8) using Milne-Simpson's predictor corrector method. **07**

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