Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA Sem-II Examination June 2011

Subject code: 620005

Subject Name: Computer Oriented Numerical Methods

Date: 24/06/11 **Total Marks: 70** **Times: 2:30pm to 5:00pm**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Intermediate calculation steps and results are to be shown, even while using calculator.**

Q.1 **(a)** Explain different types of numerical errors with suitable examples. **04**

(b) What are the similarities and differences between Secant method and False Position method of finding root of a given equation f (x) = 0. Which one is best? Why? **05**

(c) Approximate the value of $\ln(5.75)$ correct upto four decimal places using Taylor series expansion. **05**

Q.2 **(a)** Find the root of the equation $3x - \cos x - 1$ using the Bisection method. Perform iterations until the approximate relative error falls below 0.5%. (Or $\varepsilon_s = 0.5\%$). **07**

(b) Geometrically explain Newton - Raphson method to find a root of the equation f (x) = 0 and hence derive the general formula. Also, discuss the pit-falls of Newton - Raphson method. **07**

OR

(b) Find the root of the equation $x^4 + 24x - 50 = 0$ correct up to three significant digits using Birge-Vieta method. Assume the initial value of the root = 1.5. **07**

Q.3 **(a)** Employ appropriate interpolation techniques to find the values of y at x = 5.603 and x at y = 0.78 from the following data. **07**

x	5.600	5.602	5.605	5.607	5.608
y	0.77557	0.77683	0.77871	0.77997	0.78059

(b) It has been observed that the rate of flow of water through a fire engine hose is a quadratic in pressure *p*, at the nozzle end. The observed data is **07**

p	1.0	1.6	2.5	4.0	6.0
Q	9.3	11.9	15.1	18.0	22.9

Fit a parabola in the form $Q = ap^2 + bp + c$ by least square method.

OR

Q.3 **(a)** Derive an expression for Newton's forward difference formula passing through (n + 1) equispaced points $(x_0, y_0), (x_1, y_1) \ldots . (x_n, y_n)$. **07**

(b) Fit the following data with the power model ($y = ax^b$). Use the resulting power equation to predict *y* at *x* = 9. **07**

x	2.5	3.5	5	6	7.5	10	12.5	15	17.5	20
y	13	11	8.5	8.2	7	6.2	5.2	4.8	4.6	4.3

Q.4 **(a)** The function y = sin(x) is tabulated below. Find the value of Cos(1.74) and Cos(1.84) using interpolation technique. **07**

x	1.70	1.74	1.78	1.82	1.86
sin(x)	0.9917	0.9857	0.9782	0.9691	0.9585

(b) A body is in the form of a solid of revolution, whose diameter *d* in cm of its sections at various distances *x* cm from one end is given in the table below. Compute the volume of the solid. **07**

x:	0	2.5	5.0	7.5	10.0	12.5	15.0
d:	5.00	5.5	6.00	6.75	6.25	5.5	4.00

OR

Q.4 **(a)** Evaluate $\int_{0.2}^{1.4}\left(\sin x - \log x + e^{x}\right)dx$ with h = 0.1 by **07**

(i) Trapezoidal rule (ii) Simpson's 1/3rd rule.

(b) Find the velocity and acceleration of a moving particle at t = 2 and t = 12 sec using following data. **07**

Time (sec)	2	4	6	8	10	12
Distance (m)	0.25	1	2.2	4	6.5	8.5

Q.5 **(a)** State the condition of convergence of Gauss – Seidel method for solving a system of linear equations. Using Gauss-Seidel method find the solution of the following system correct up to 4 decimal places. **07**

$$1.02x_1 - 0.05x_2 - 0.10x_3 = 0.795;$$
$$-0.11x_1 + 1.03x_2 - 0.05x_3 = 0.849;$$
$$-0.11x_1 - 0.12x_2 + 1.04x_3 = 1.398$$

(b) Given that $dy/dx = 1 + xy; y(0) = 1$, find $y(0.1)$ by Runge-Kutta second order method, $y(0.2)$ and $y(0.3)$ by Runge-Kutta third order and hence y(0.4) by Milne-Simpson's predictor corrector method. **07**

OR

Q.5 **(a)** Find numerically largest eigen value and corresponding eigen vector of the following matrix using power method by taking $X_0 = [1,1,0]^T$. **07**

$$\begin{bmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{bmatrix}$$

(b) Given that $dy/dx = \sqrt{x^2 + y}$; $y(0) = 0.8$, $y(0.2) = 0.9903$. Compute $y(0.4)$ and $y(0.6)$ by Runge-Kutta fourth order and $y(0.8)$ by Adam-Bashforth-Moulton's predictor corrector method. **07**

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