Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 720110 **Subject Name: Numerical Methods**

Date: 09 / 07 /2010 **Time: 11.00am – 1.30pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain: Rounding–off Error. **06**

Write down the approximate value of $\frac{2}{3}$ correct to four significant figures and also find (i) Absolute Error, (ii) Relative Error and (iii) Percentage Error.

(b) Enlist various methods for solution of algebraic equations. **06**

Find a root of $x^3 - 9x + 1 = 0$ by the Bisection method correct to three significant figures.

Q.2 **(a)** The following table gives the results of the measurements of train resistance; V is the velocity in miles per hour, R is the resistance in pounds per ton: **06**

V:	20	40	60	80	100	120
R:	5.5	9.1	14.9	22.8	33.3	46.0

If R is related to V by the relation $R = a + bV + cV^2$, find $a,\ b,\ c$.

(b) Find a root of $x + \ln x - 2 = 0$ by False position method correct to three significant figures. **06**

OR

(b) What are pitfalls of Newton- Raphson method? **06**

Find an approximate value of $\sqrt[3]{29}$ by Newton – Raphson Method correct to four significant figures.

Q.3 **(a)** Solve the following system of equations by Gauss-elimination method: **06**

$$2x + 3y + z = 9;\ x + 2y + 3z = 6;\ 3x + y + 2z = 8$$

correct to three significant figures.

(b) Obtain the inverse of the following matrix: **06**

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

and hence find the solution of system of equations:

$$x + 3y + 2z = 17;\ x + 2y + 3z = 16;\ 2x - y + 4z = 13.$$

OR

Q.3 **(a)** Solve the following system of equations by Gauss-Seidel method: **06**

$$x + y + 4z = 9;\ 8x - 3y + 2z = 20;\ 4x + 11y - z = 33$$

correct to three significant figures.

(b) Write down the Lagrange Interpolating Formula. **06**

Find the interpolating polynomial which corresponds to the following data:

x :	-1	0	2	3	5
$f(x)$:	9	5	3	11	15

Also, find the value of $f(4.2)$.

Q.4 **(a)** Write down the any two quadrature formulae. **06**

Use Simpson's one-three rule and Simpson's three–eight rule to compute $\int_{1}^{1.6} \ln x \; dx$ correct to four decimal places by taking six sub intervals.

(b) The velocity v (km/ min) of a car which starts from rest, is given at fixes time t (min) as follows: **06**

t:	2	6	8	12	18	20
v:	10	25	29	20	2	0

Estimate approximate the distance covered in 20 minutes by Trapezoidal rule for unequal interval.

OR

Q.4 **(a)** Using Simpson's one-three rule and Trapezoidal rule, Compute $\int_{0.1}^{0.7} \left(e^x + 2x\right) dx$ **06**

correct to five decimal places by taking six sub- intervals.

(b) A solid of revolution is formed by rotating about the x axis, the area between the x axis, the lines $x = 0$, $x = 1$ and a curve through the points with the following co-ordinates: **06**

x:	0.00	0.25	0.50	0.75	1.00
y:	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed using Simpson's one-three rule.

Q.5 **(a)** Solve the following differential equation by Euler's modified method: **06**

$$\frac{dy}{dx} = x + y, \quad y(0) = 1$$

at $x = 0.3$ with the step size $h = 0.1$.

(b) Using Runge – Kutta method of fourth order, solve the ODE **06**

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}, \quad y(0) = 1 \text{ at } x = 0.2,\ 0.4.$$

OR

Q.5 **(a)** The pressure and volume of a gas are related by the equation $pV^{\lambda} = k$, where λ, k being constants. Fit this equation to the following set of observations: **06**

p (kg/cm²):	0.5	1.0	1.5	2.0	2.5	3.0
V (liters):	10	25	29	20	2	0

(b) Solve the following ODE using Euler's Method: **06**

$$\frac{dy}{dx} = x + y, \quad y(0) = 1$$

choose $h = 0.1$ and compute $y(1)$ and $y(1.2)$.

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