Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code: 1720110

Subject Name: Numerical Methods

Date:01/07/2011 **Time: 10:30 am – 01:00 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)** Define absolute and relative errors.Let the exact or true value=20/3 and the approximate value = 6.666, find the relative and absolute errors. Also find the number of significant digits. **07**

(b) Determine the root of $f(x) = x^6 - x - 1 = 0$ correct to three decimal places using Bisection method. **07**

Q.2 **(a)** The table below gives the temperature T (in ℃) and lengths *l* (in mm) of a heated rod. If $l = a_0 + a_1 T$,find the best values for a_0 and a_1. **07**

T	20℃	30℃	40℃	50℃	60℃	70℃
l	800.3	800.4	800.6	800.7	800.9	801.0

(b) Find a root of the equation $xsinx + cosx = 0$ using Newton-Raphson method correct to three decimal places. **07**

OR

(b) Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ using False-position method. **07**

Q.3 **(a)** Solve the following equations by Gauss elimination method: **07**

$$2x + 4y - 6z = -4, x + 5y + 3z = 10, x + 3y + 2z = 5$$

(b) Find the inverse of the matrix $\begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{bmatrix}$ and also solve the system of equations $AX = B$, where $B = \begin{bmatrix} 6 \\ 3 \\ 6 \end{bmatrix}$. **07**

OR

Q.3 **(a)** Solve the following equations by Gauss-Seidal method: **07**

$$8x + 2y - 2z = 8, x - 8y + 3z = -4, 2x + y + 9z = 12$$.

(b) Using Lagrange's interpolation formula find a polynomial which passes the points (0,-12), (1,0), (3,6), (4,12). **07**

Q.4 **(a)** Evaluate the integral $\int_0^{1.2} e^x dx$, taking six intervals by using trapezoidal rule upto three significant figures. **07**

(b) Evaluate $\int_2^6 \log_{10} x \, dx$ by using Simpson's one-third rule and Simpson's three-eight rule, taking $n = 6$. **07**

OR

Q.4 **(a)** Evaluate $\int_0^1 \frac{1}{1+x} dx$, correct to three decimal places by using trapezoidal and Simpson's one-three rules with $h = 0.25$. **07**

(b) The velocity v of a particle at distance s from point on its path is given by the following table:Find the time taken to travel 60 meter, using Simpson's three-eight rule. **07**

s(meter)	0	10	20	30	40	50	60
v(meter/sec)	47	58	64	65	61	52	38

Q.5 **(a)** Apply Euler's method to approximate the solution of the initial value problem $\frac{dy}{dx} = -2ty^2$ with $y(0) = 1$ in the interval $0 \le t \le 0.5$, using $h = 0.1$. **07**

(b) Use the second-order Runge-Kutta method with $h = 0.1$, find y_1 and y_2 for $\frac{dy}{dx} = -xy^2, y(2) = 1$. **07**

OR

Q.5 **(a)** Use the modified Euler's method to solve the differential equation $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$. Take the step size $h = 0.1$. **07**

(b) Use the Runge-Kutta method of order four with $h = 0.1$ on (2,3) for the initial problem $\frac{dy}{dx} = -xy^2, y(2) = 1$.. **07**