Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1720110 **Date: 04-01-2014**

Subject Name: Numerical Methods

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)** Discuss concept of significant digits. What is difference between Accuracy and Precision? Evaluate $e^{0.5}$ using $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots \ldots \ldots \ldots + \frac{x^n}{n!}$, correct answer using ε_a to prespecified error ε_s as three significant digits. **07**

(b) Determine the real root of $f(x) = 5x^3 - 5x^2 + 6x - 2$ using bisection. Employ initial guesses of $x_l = 0$ and $x_u = 1$ and iterate until the estimated error ε_a falls below a level of $\varepsilon_s = 10\%$ **07**

Q.2 **(a)** Fit a parabola of second degree for the following data **07**

X:	0	1	2	3	4
F(x):	1	1.8	1.3	2.5	6.3

(b) What do you mean by algebraic and transcendental equation? Find the root of $f(x) = 3x - e^x + \sin x$ using Newton-Rahpson method correct answer to three decimal digits. **07**

OR

(b) Discuss graphically False position method and Use it to find root of x tanx = -1correct up to 3 decimal places. **07**

Q.3 **(a)** The work produced by a constant temperature, pressure-volume thermodynamic process can be computed as $w = \int p\, dV$ where W is work, p is pressure and V is volume. Using a combination of the trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule, use the following data to compute the work. **07**

p:	336	294.4	266.4	260.8	260.5	249.6	193.6	165.6
V:	0.5	2	3	4	6	8	10	11

(b) Discuss partial pivoting and complete pivoting. Solve the following system of equations using Guass- Elimination method **07**

$3.15x - 1.96y + 3.85z = 12.95$

$2.13x + 5.12y - 2.89z = -8.61$

$5.92x + 3.05y + 2.15z = 6.88$

OR

Q.3 **(a)** What is numerical integration? Derive trapezoidal and simpson's 1/3 rule. **07**

(b) What do you mean by diagonally dominant system? Solve the following system of equations using Guass-Seidel method **07**

$28x+4y-z = 32 \quad x+3y+10z = 24 \quad 2x+17y+4z = 35$

Q.4 **(a)** Find cubic polynomial f(x) for the given data: **07**

X:	0	1	2	3
F(x):	1	2	33	244

And hence find f(2.5).

(b) What is Interpolation? By Lagrange interpolation formula fit a polynomial the given data: **07**

X:	-1	0	2	3
Y:	-8	3	1	12

OR

Q.4 **(a)** What is disadvantage of Lagrange Interpolation? Construct the divided difference table for the data **07**

X:	0.5	1.5	3.0	5.0	6.5	8.0
F(x):	1.625	5.875	31.0	131.0	282.125	521.0

Hence, find the interpolating polynomial and the value of f(7).

(b) Fit an equation of the form $y = ab^x$ to the following data: **07**

X:	2	3	4	5	6
Y:	144	172.8	207.4	248.8	298.6

Q.5 **(a)** Use Euler's method to solve the initial value problem $\frac{dy}{dt} = 1 - t + 4y, y(0) = 1$ in the interval $0 \le t \le 0.5$ with h = 0.1. **07**

(b) Use Runge-Kutta method of order two to integrate dy/dx = siny with y(0) = 1 from x = 0 to 0.5 in two steps. **07**

OR

Q.5 **(a)** Use the modified Euler's method to find the approximate value of y(1.5) for the solution of the initial value problem dy/dx = 2xy, y(1) = 1. Take h = 0.1. Determine the relative and percentage error. **07**

(b) Use the Runge-Kutta method of order four and with h = 0.1, find an approximate solution of $dy/dx = x^2+y$ at x = 0.2, given that y = -1 when x = 0. **07**

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