Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1720110 **Date: 08-12-2014**

Subject Name: 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)** Define absolute and percentage errors. Let the exact value $= 20/3$ and its approximate value $= 6.666$. Find the relative and percentage errors. Also find the number of significant digits. **07**

(b) Use Newtonôs divided difference formula to find $f(x)$ from the following data: **07**

x:	0	2	3	4	6	7
$f(x)$:	0	8	0	-72	0	1008

Q.2 **(a)** Find the real root of $x\tan x + 1 = 0$ using Bisection method correct up to the three decimal places. **07**

(b) Define different types of errors with suitable illustration. **07**

OR

(b) Explain convergence criteria for Gauss- Seidal method. Use it to solve the system $30x - 2y + 3z = 75$, $2x + 2y + 18z = 30$, $x + 17y - 2z = 48$ correct up to four decimal places. **07**

Q.3 **(a)** Derive Simpson $1/3^{rd}$ rule. Estimate $\int_{0.5}^{1.3} e^{x^2}\,dx$ using Simpson rule with i) four strips ii) eight strips. **07**

(b) Using improved Eulerôs method, solve $y' = -2xy^2$ with initial condition $y(0) = 1$ and compute $y(1)$ taking step size 0.2 . **07**

OR

Q.3 **(a)** Find the value of y at $x = 21$ and $x = 28$ from the following data: **07**

x:	20	23	26	29
y:	0.3420	0.3907	0.4384	0.4848

(b) Fit a straight line to the following data: **07**

x:	100	120	140	160	180	200
y:	0.45	0.55	0.60	0.70	0.80	0.85

Q.4 **(a)** Explain Newton-Rapshon method graphically. Use it to find the real root of $xe^x - 2 = 0$ correct up to three decimal places. **07**

(b) Define Numerical integration. The velocity v of a particle at distance s from a point on its linear path is given in the following data: **07**

$s(m)$	0	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
$v(m/\sec)$	16	19	21	22	20	17	13	11	9

OR

Q.4 **(a)** Use Runge- Kutta method of fourth order to find $y(1.1)$, given that **07**

$\frac{dy}{dx} = x - y,\ y(1) = 1$ with $h = 0.05$.

(b) **07**

Find the inverse of $A = \begin{bmatrix} 2 & 4 & -6 \\ 1 & 5 & 3 \\ 1 & 3 & 2 \end{bmatrix}$ and also solve the system $AX = B$, where

$B = \begin{bmatrix} -4 \\ 10 \\ 5 \end{bmatrix}$.

Q.5 **(a)** Given that $y(1) = 1.3$ and $y' = 3x + y$. Use second order Runge- Kutta method to approximate y when $x = 1.2$ with $h = 0.1$ **07**

(b) Fit cubic spline for following data: **07**

$x:$	$x_0 = 1$	$x_1 = 2$	$x_2 = 3$	$x_3 = 4$
$y:$	$y_0 = 1$	$y_1 = 2$	$y_2 = 5$	$y_3 = 11$

OR

Q.5 **(a)** Define Interpolation. Find the Lagrangeôs interpolating polynomial from the following data: **07**

$x:$	0	1	4	5
$f(x):$	1	3	24	39

Hence find $f(0.7)$.

(b) Discuss False - Position method graphically. Use it to find real root of $x^3 - 5x + 1 = 0$ correct up to four decimal places. **07**

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