Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –Ist SEMESTER–EXAMINATION – JULY- 2012

Subject code: 712901N **Date: 05/07/2012**

Subject Name: Mathematics for Researchers

Time: 2:30 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)** Using Fourier transforms, prove that **07**

$$\int_0^{\alpha} \frac{(x\cos x - \sin x)^2}{x^6} dx = \frac{\pi}{15}$$

(b) Briefly explain the working rules of Runge's method to solve the differential equation $\frac{dy}{dx} = f(x, y), Y(x_0) = Y_0$ **07**

Q.2 **(a)** Discuss Fourier integral theorem. **07**

(b) Explain $f(x) = 1 + \sin x$ as a Fourier series with interval 2 in the range $-1 < x < 1$ **07**

OR

(b) Find the fourier transform of $f(x) = x^2, |x| < a$ $= 0, |x| > a$ **07**

Q.3 **(a)** What is round off? Discuss its rules for n_significant digits. **07**

(b) A body is in the form of a solid of revolution. The diameter D in cms of its section at distance x cm. From one end are given below. Estimate the volume of the solid. **07**

x	0	2.5	5.0	7.5	10.0	12.5	15.0
D	5	5.5	6.0	6.75	6.25	5.5	4.0

OR

Q.3 **(a)** Find the $f'(6)$ from the following data. **07**

x	0	2	3	4	7	8
f(x)	4	26	58	112	466	922

(b) Discuss working steps of Crout's method. **07**

Q.4 **(a)** Write down the properties of Eigen value function. **07**

(b) Apply Gauss_Jordan method to find the inverse of the following matrix. $\begin{bmatrix} 2 & 1 & 2 \\ 2 & 2 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ **07**

OR

Q.4 **(a)** Define Escalator Method. **07**

(b) Find by power method. The Larger Eigen value of the following matrix. **07**

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

Q.5 **(a)** Employ Picard's method to solve $\frac{dy}{dx} = -xy$ with $x_0 = 0, y_0 = 1$ up to third approximation. **07**

(b) Solve $y' = 1 - y, y(0) = 0$ by modified Euler's method and obtain y at $x = 0.1,0.2,0.3$ **07**

OR

Q.5 **(a)** Use Milne's method to find $y(0.3)$ from $y' = x^2 + y^2, y(0) = 1$ **07**

(b) Solve the boundary value problem for $x = 0.5, \frac{d^2y}{dx^2} + y + 1 = 0, y(0) = y(1) = 0$ by taking n=4. **07**

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