

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. IST Semester–Remedial Examination – July- 2011****Subject code: 712901N****Subject Name: Mathematics for Researchers****Date: 07/07/2011****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) Derive Bessel's formula using the derivative. **07**
 (b) Discuss Adams–Bashforth method. **07**

- Q.2** (a) Define total square error using Trigonometric Polynomials **07**
 (b) Find the Finite Fourier sine & cosine transform of **07**
 $f(x) = x(\pi - x)$ in $0 < x < \pi$

OR

- (b) Find a Fourier series with period 3 to represent $f(x) = 2x - x^2$ in the range $(0, 3)$ **07**

- Q.3** (a) Find the first and second derivatives of the function $y = f(x)$ **07**
 tabulated below at the point, $x = 1.1$

x	1	1.2	1.4	1.6	1.8	2.0
f(x)	0.00	0.1280	0.5440	1.2960	2.4320	4.00

- (b) Evaluate $\int_4^{5.2} \log x dx$ by taking seven ordinates using **07**
 (i) Trapezoidal rule
 (ii) Simpson's $\frac{1}{3}$ rd rule and
 (iii) Simpson's $\frac{3}{8}$ th rule.

OR

- Q.3** (a) The elevation above a datum line of seven points of a road are given **07**
 below

X	0	300	600	900	1200	1500	1800
Y	135	149	157	183	201	205	193

Find the gradient of the road at the middle point.

- (b) Find the relative and absolute error if the number **07**
 $x = 0.004997$ is (i) Truncated to three decimal digits.
 (ii) Rounded off to three decimal digits.

- Q.4** (a) Apply LU decomposition method to solve the equation. **07**
 $3x + 2y + 7z = 4$
 $2x + 3y + z = 5$
 $3x + 4y + z = 7$

- (b) Using the Iterative method to find the inverse of 07

$$A = \begin{bmatrix} 1 & 10 & 1 \\ 2 & 0 & 1 \\ 3 & 3 & 2 \end{bmatrix} \text{ by taking } B = \begin{bmatrix} 0.4 & 2.4 & -1.4 \\ 0.14 & 0.14 & -0.14 \\ -0.85 & -3.8 & 2.8 \end{bmatrix}$$

OR

- Q.4** (a) Using Cayley-Hamilton theorem, find the inverse of the Matrix. 07

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$$

- (b) Using Given's method, reduce the following matrix to the tri_diagonal form: 07

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

- Q.5** (a) Find the value of $y(1.1)$ from $y'' + y^2 y' = x^3$, $y(1) = 1$, $y'(1) = 1$ using Taylor's series method. 07

- (b) Using Euler's method, find an approximate value of y corresponding to $x = 1$, given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$. 07

OR

- Q.5** (a) Apply R_K method to find approximate value of y for $x = 0.2$ in steps of 0.1, if $\frac{dy}{dx} = x + y^2$, given that $y = 1$ when $x = 0$ 07

- (b) Solve the Poisson's equation $u_{xx} + u_{yy} = -\frac{8}{xy}$, 07
 $0 < x < 1$, $0 < y < 1$ given that $u(0, y) = 0$, $u(x, 0) = 0$,
 $u(1, y) = 100$, $u(x, 1) = 100$ and $h = \frac{1}{3}$
