

Roll No.

24291

B. Tech. 5th Sem. (Civil Engg.)

Examination – December, 2011

NUMERICAL METHODS AND COMPUTING TECHNIQUES

Paper : CE-309-F

Time : Three hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. 1 is *compulsory* and attempt *five* questions in total.

1. (a) Define interpolation and extrapolation. 5
(b) Discuss Bisection method. 5
(c) Show that Newton Rapshon method has quadratic rate of convergences. 5
(d) Discuss the Taylor series method for numerical solution of ordinary differential equation. 5
2. (a) Solve $x^3 - 9x + 1 = 0$ by the method of fixed-point iteration method. 10
(b) Find the square root of a positive number N using Newton Rapshon method (take $N = 12$). 10

3. (a) Solve the following equation by using Gauss Elimination method with partial pivoting : 10

$$3x_1 + 4x_2 - 7x_3 = 23$$

$$7x_1 - x_2 + 2x_3 = -14$$

$$x_1 + 10x_2 - 2x_3 = 33$$

- (b) Solve the Jacobi's iteration method : 10

$$2x_1 + 5x_2 - x_3 = 10$$

$$x_1 + 3x_2 + 6x_3 = -1$$

$$8x_1 - x_2 + 3x_3 = 12$$

4. Calculate by Simpson's $\frac{1}{3}$ Rule an approximate value of

$$\int_{-3}^3 x^4 dx \text{ by taking seven equidistance ordinates. Compare}$$

it with the exact value and the value obtained by using the Trapezoidal Rule. 20

5. Derive the general Quadrature integration formula. From this general formula deduce the Trapezoidal rule formula. 20

6. Discuss the Power method for determining the largest eigenvalue of an $n \times n$ matrix. Also determine the

largest eigenvalue of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$. 20

7. (a) Using Taylor series method find $y(0.1)$ given that

$$\frac{dy}{dx} = x^2 - y, y(0) = 1 \quad 10$$

- (b) Using ~~Runge-Kutta~~ method of 4th order find $y(0.1)$ given that $\frac{dy}{dx} = 3x + \frac{1}{2}$; $y(0) = 1$ taking $h = 0.1$. 10

8. Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x, 0) = 0$; $u(0, t) = 0$ and $u(1, t) = 1$. Determine u for $t = \frac{1}{8}$ in two steps, by using Crank-Nicholson scheme. 20

9. Find the least square approximation of a second degree for the discrete data : 20

x :	-2	-1	0	1	2
$f(x)$:	15	1	1	3	19