

7. Discuss the Schmidt method and Crank-Nicholson numerical Methods for one dimension heat equation
 $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. 20

UNIT – IV

8. Describe in brief of Fuzzy logic and Neural Network and their application in various Structural problems. 20
9. The deflection of a beam is governed by the $\frac{d^4 y}{dx^4} + 81y = 243x$, $y(0) = y'(0) = y''(1) = y'''(1) = 0$. Evaluate the deflection at the pivot points of the beam using $h = \frac{1}{3}$. 20

Roll No.

23724

M. Tech. 1st Sem. Civil Engg.
(Computer Aided Structural Engg.)
CBCS Scheme
Examination – January, 2023
NUMERICAL METHODS FOR STRUCTURAL
ENGINEERING
Paper : 21MTCASE2C4

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 : Attempt any *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Define Inherent and Truncation Errors.
(b) State Intermediate Value Theorem with example.
(c) What do you mean by rate of convergence of Iterative Method ? What is the rate of convergence of Newton-Raphson Method ?

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- (d) Define Initial and Boundary value problem with suitable example.
- (e) Define partial pivoting in Gauss Elimination Method
- (f) Write the diagonal five-point formula (DFPF) for Laplace's equation.
- (g) What is Crank Nicolson Method ? Why is it known as implicit method ?
- (h) Write the Simpson 1/3 and 3/8 Rule for numerical Integration. 20

UNIT - I

2. (a) If $R = \frac{4xy^2}{z^3}$ and error in x, y, z be 0.001. Find the maximum relative error at $x = y = z = 1$. 10
- (b) Fit a straight line by method of least square to the following data : 10
- | | | | | | |
|----------|-----|----|----|----|----|
| x : | 1.0 | 2 | 3 | 4 | 5 |
| $f(x)$: | 14 | 27 | 40 | 55 | 68 |

3. (a) Find the real root of $x^3 - 2 = 0$ correct to three decimal places using Newton-Raphson method 10

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- (b) Using Lagrange's interpolation, find the $f(x)$ from the following data :

x :	-1	0	2	3
$f(x)$:	-8	3	1	12

10

Hence determine the value of $f(x)$ when $x = 1$.

UNIT - II

4. (a) Solve system of linear equations using Gauss-Seidel Iterative method $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$. 10

- (b) Find the inverse of the coefficient matrix of the $x + y + z = 1$, $4x + 3y - z = 6$, $3x - 5y + 3z = 4$ by Gauss-Jordan Method with partial pivoting and solve the system. 10

5. Find the largest eigenvalue in modulus and corresponding eigenvector of the matrix
$$\begin{bmatrix} -15 & 4 & 3 \\ 10 & -12 & 6 \\ 20 & -4 & 2 \end{bmatrix}$$
; taking $X_0 = [1, 1, 1]^T$. 20

UNIT - III

6. Apply Runge-Kutta method to find the approximate value of y for $x = 0.2$ in step length $h = 0.1$, if $\frac{dy}{dx} = x + y^2$, $y(0) = 1$. 20

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