CBCS SCHEME

20MCM11

USN

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Numerical Methods for Engineers

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Use Newton Raphson method to find real root of $x \sin x = -\cos x$ near $x = \pi$ carryout upto 4 decimal places. **(10 Marks)**

b. Define Absolute, Relative and percentage Error. **(10 Marks)**

OR

2 a. Use secant method to find the root of the equation up to 5 approximation for $xe^x = \cos x$ with 3 decimal places. **(10 Marks)**

b. Solve: $x^3 - 5x + 1 = 0$ by False position method of chords in the interval (0, 1). **(10 Marks)**

Module-2

3 a. Find the roots of the equation by Muller's method $y(x) = x^3 - 3x - 5 = 0$ lies between 2 and 3. **(10 Marks)**

b. Evaluate using Gauss quadrature 3 point formula $I = \int_0^1 \frac{dx}{1+x}$. **(10 Marks)**

OR

4 a. Determine a, b, c such that formula $\int_0^h f(x)dx = h\left\{a f(0) + b f\left(\frac{h}{3}\right) + c f(h)\right\}$ is exact for polynomials of high order as possible and determine the order of the truncation error. By Newton Cotes method. **(10 Marks)**

b. Evaluate $I = \int_0^1 \frac{dx}{1+x^2}$ by Romberg Integration choosing 3 values of h. **(10 Marks)**

Module-3

5 a. Determine the inverse of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 5 \end{bmatrix}$ using partition method. **(10 Marks)**

b. Solve by Triangularization method

$x_1 + x_2 + x_3 = 1$

$4x_1 + 3x_2 - x_3 = 6$

$3x_1 + 5x_2 + 3x_3 = 4$ **(10 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

6 a. Solve by Cholesky method.

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ -10 \end{bmatrix}$$

(10 Marks)

b. Solve by Cramer's rule

$x_1 + 2x_2 - x_3 = 2$

$3x_1 + 6x_2 + x_3 = 1$

$3x_1 + 3x_2 + 2x_3 = 3$

(10 Marks)

Module-4

7 a. Estimate the Eigen values of matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$. Using Gerschgorin Bounds lies in $|\lambda| \le 5$. $|\lambda| \le 6$. The union of circle $|\lambda - 1| \le 3$; $|\lambda - 1| \le 5$, $|\lambda + 1| \le 4$; $|\lambda - 1| \le 2$; $|\lambda + 1| \le 2$.

(10 Marks)

b. Find the Eigen value and corresponding Eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by power method. Taking the initial Eigen value $[1, 1, 1]^T$.

(10 Marks)

OR

8 a. Using House Holder's method reduces the symmetric matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ to tri-diagonal form.

(10 Marks)

b. Solve by Jocobi method $A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$.

(10 Marks)

Module-5

9 a. If $U = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$ $V = \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix}$ $W = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix}$. Show that U, V, W are peace wise orthogonal vectors.

(10 Marks)

b. Solve AX = B by least square sence and find P = AX if $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$

(10 Marks)

OR

10 a. If $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ find the Eigen values and Eigen vectors.

(10 Marks)

b. Find all possible roots using Graeffe's root squaring method for $x^3 - 6x^2 + 11x - 6 = 0$ by squaring thrice.

(10 Marks)