CBCS SCHEME

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20MCM11

First Semester M.Tech. Degree Examination, July/August 2022
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. Find the root of the equation $x\log_{10}x - 1.2 = 0$ by Newton- Raphson method. **(10 Marks)**

b. By using Bisection method, find real root of the equation $x^3 - 2x - 5 = 0$. **(10 Marks)**

OR

2 a. Find the root of the equation $x^{2.2} = 69$ as a root between 5 and 8 by Regula – Falsi method. **(10 Marks)**

b. Determine the real root of the equation $xe^x = 1$ using the secant method. **(10 Marks)**

Module-2

3 a. Use Muller's method to find the smallest positive root of the equation : $f(x) = x^3 - 13x - 12 = 0$ with $x_0 = 4.5$, $x_1 = 5.5$ and $x_2 = 5$. **(10 Marks)**

b. Calculate first and second derivative of the function tabulated in the following table at the point x = 2.2 and also find $\frac{dy}{dx}$ at x = 2.0.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7083	3.3201	4.0562	4.9530	6.0496	7.3891	9.0250

(10 Marks)

OR

4 a. Using Romberg's integration method, evaluate $\int_0^1 \frac{1}{1+x}dx$ correct to 4 decimal places with h = 0.5, 0.25, 0.125. **(10 Marks)**

b. Using Simpson's $\frac{1}{3}^{rd}$ rule, evaluate $\int_0^1 \sqrt{1-x^2}\,dx$ by taking number of subintervals 8. **(10 Marks)**

Module-3

5 a. Solve the system of equations using Cramer's rule :

$$3x + y + 2z = 3$$
$$2x - 3y - z = -3$$
$$x - 2y + z = 4.$$

(10 Marks)

b. Using Triangularization method, obtain the solution of the system of equations :

$$2x + 3y + z = 9$$
$$x + 2y + 3z = 6$$
$$3x + y + 2z = 8.$$

(10 Marks)

OR

6 a. Using Partition method, find the inverse of the matrix :

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

(10 Marks)

b. Solve the system of equations by Gauss – Jordan method :

$$\begin{aligned} x_1 + x_2 + x_3 + x_4 &= 2 \\ 2x_1 - x_2 + 2x_3 - x_4 &= -5 \\ 3x_1 + 2x_2 + 3x_3 + 4x_4 &= 7 \\ x_1 - 2x_2 - 3x_3 + 2x_4 &= 5. \end{aligned}$$

(10 Marks)

Module-4

7 a. Solve by Jacobi method :

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

Perform two iterations. **(10 Marks)**

b. Find the dominant eigen values and the corresponding eigen vector of the matrix :

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

using power method, taking the initial eigen vector $[1\ 1\ 1]^T$. **(10 Marks)**

OR

8 a. Use Given's method to find eigen value of the tridiagonal matrix :

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$

(10 Marks)

b. Find all the eigen value of the matrix :

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

using Ruti – Shauser method. **(10 Marks)**

Module-5

9 a. Show that $\{V_1, V_2, V_3\}$ is an orthonormal basis of $\mathbb{R}^{3}$ ^{3} where

$$V_1 = \begin{bmatrix} 3/\sqrt{11} \\ 1/\sqrt{11} \\ 1/\sqrt{11} \end{bmatrix} \quad V_2 = \begin{bmatrix} -1/\sqrt{6} \\ 2/\sqrt{6} \\ 1/\sqrt{6} \end{bmatrix} \quad V_3 = \begin{bmatrix} -1/\sqrt{66} \\ -4/\sqrt{66} \\ 7/\sqrt{66} \end{bmatrix}.$$

(10 Marks)

b. Find a least square solution of AX = b for

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix} \quad b = \begin{bmatrix} -3 \\ -1 \\ 0 \\ 2 \\ 5 \\ 1 \end{bmatrix}.$$

(10 Marks)

OR

10 a. Let w be the subspace of R^4 with basis
$S = \{u_1, u_2, u_3\}$ where $u_1 = (1, -2, 0, 1)$,
$u_2 = (-1, 0, 0, -1)$ and $u_3 = (1, 1, 0, 0)$.
Use the Gram – Schmidt process to transform S to an orthonormal basis for W. (10 Marks)

b. Find a least – square solution of the inconsistent system Ax = b for

$$A = \begin{bmatrix} 4 & 0 \\ 0 & 2 \\ 1 & 1 \end{bmatrix} \quad b = \begin{bmatrix} 2 \\ 0 \\ 11 \end{bmatrix}.$$

(10 Marks)

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