CBCS SCHEME

USN | | | | | | | | | | | **20MCM11**

First Semester M.Tech. Degree Examination, Feb./Mar. 2022

Numerical Methods for Engineers

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Define :
i) Absolute error
ii) Relative error
iii) Percentage error

If $u = \frac{5xy^2}{z^3}$ find the relative error at x = y = z = 1, when the errors in each of x, y, z is 0.001. **(10 Marks)**

b. Use Regula – Falsi method to determine the root of the equation $4e^{-x}\sin x - 1 = 0$ given that the root lies between 0 and 0.5. **(10 Marks)**

OR

2 a. Perform 4 iterations of the Newton Raphson method to obtain the approximate value of $(17)^{1/3}$ starting with the initial approximation of $x_0 = 2$. **(10 Marks)**

b. Perform 5 iterations of the Bisection method to obtain a root of the equation : $f(x) = \cos x - xe^x$. **(10 Marks)**

Module-2

3 a. Using Muller's method, find the root of the equation $f(x) = x^3 - x - 1 = 0$ with the initial approximations $x_{i-2} = 0$, $x_{i-1} = 1$, $x_i = 2$. **(10 Marks)**

b. From the following table of values of x and y obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x = 1.2, given,

x	y
1.0	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

(10 Marks)

OR

4 a. Use Romberg's method to compute $I = \int_0^1 \frac{1}{1+x}dx$ correct to three decimal places. **(10 Marks)**

b. Determine a, b, c such that the formulae $\int_0^h f(x)dx = h\left\{af(0) + b(f)\left(\frac{h}{3}\right) + cf(h)\right\}$ is exact for polynomials of higher order as possible and determine the order at the truncation error. **(10 Marks)**

Module-3

5 a. Apply Cramer's rule to solve the equations :

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

(10 Marks)

b. Using the Triangularization method, find the inverse of the matrix :

$$A = \begin{bmatrix} 50 & 107 & 36 \\ 25 & 54 & 20 \\ 31 & 66 & 21 \end{bmatrix}.$$

(10 Marks)

OR

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

$$A = \begin{bmatrix} 13 & 14 & 6 & 4 \\ 8 & -1 & 13 & 9 \\ 6 & 7 & 3 & 2 \\ 9 & 5 & 16 & 11 \end{bmatrix}.$$

(10 Marks)

b. Apply Gauss-Elimination method to solve the equations :

$$x + y + z = 9$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40.$$

(10 Marks)

Module-4

7 a. Using Jacobi method, solve the system :

$$6x + y + z = 20$$
$$x + 4y - z = 6$$
$$x - y + 5z = 7.$$

(10 Marks)

b. Find the largest Eigen value and the corresponding Eigen vector of the matrix :

$$A = \begin{bmatrix} -15 & 4 & 3 \\ 10 & -12 & 6 \\ 20 & -4 & 2 \end{bmatrix}$$

by power method. Using initial Eigen vector $[1, 1, 1]^T$.

(10 Marks)

OR

8 a. Find all the Eigen values of the matrix :

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

Using Rutishauser method.

(10 Marks)

b. Using House Holder's transformation reduce the symmetric matrix

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

into tri – diagonal matrix.

(10 Marks)

Module-5

9 a. Find a least – squares 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)**

b. Show that $\{u_1, u_2, u_3\}$ is an orthogonal set, where

$$u_1 = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix} \quad u_2 = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix} \quad u_3 = \begin{bmatrix} -1/2 \\ -2 \\ -7/2 \end{bmatrix}.$$ **(10 Marks)**

OR

10 a. Find all the roots of the polynomial $x^4 - x^3 + 3x^2 + x - 4 = 0$ using the Graeffe's root squaring method. **(10 Marks)**

b. If $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

Find the eigen values and eigen vectors. **(10 Marks)**

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