CBCS SCHEME

USN

16/17MDE/MMD/MST/MTP/MTR/MCM/MEA/MAR/CAE11

First Semester M.Tech. Degree Examination, Aug./Sept. 2020
Applied Mathematics

Time: 3 hrs. Max. Marks: 80

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 Absolute, relative and percentage errors. If $u = 3v^7 - 6v$, find the % error in u at $v = 1$ if the error is 0.05. **(06 Marks)**

b. Evaluate the exponential series such that their sum gives value of e^x at $x = 1.3$ to four decimal place accuracy and find the number of terms required. **(10 Marks)**

OR

2 a. Explain in brief:
i)Accuracy and precision ii) Truncation error iii) Round off error. **(06 Marks)**

b. Derive the expression $v(t) = \frac{mg}{c}\left[1 - e^{-\left(\frac{c}{m}\right)t}\right]$ for a parachutist who jumps out of a stationary hot air balloon. Compute the velocity prior to opening the chute when the mass is 70kg, the drag co-efficient is 12.5 and the gravitational force is 9.8 m/s^2. Calculate the terminal velocity also taking a step size of 2 secs for computation. **(10 Marks)**

Module-2

3 a. Derive Newton's formula to find $\sqrt{N}$. Hence find $\sqrt{15}$ to four decimal place accuracy. **(06 Marks)**

b. Apply Muller's method to find the root of the equation $x^3 - 3x - 5 = 0$, taking initial guesses as 1, 2, 3. Perform 3 iterations. **(10 Marks)**

OR

4 a. Determine a root of the equation $2x = \cos x + 3$ correct to 3 decimal places by fixed point iteration method with the initial approximation $x_0 = \frac{\pi}{2}$. **(06 Marks)**

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

Module-3

5 a. Derive the expression for $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at $x = x_0$ using Newton's forward and backward interpolation formulas. **(06 Marks)**

b. Apply Romberg's integration method to evaluate $\int_0^1 \frac{dx}{1+x}$ taking step size h = 0.5, 0.25, 0.125. **(10 Marks)**

OR

6 a. From the following data compute the first and second derivatives at x = 3, given the following data :

x	3	3.2	3.4	3.6	3.8	4
y	–14	–10	–5.3	0.26	6.67	14

(06 Marks)

b. Apply Rombrg's method to evaluate $\int_0^{0.5}\left(\frac{x}{\sin x}\right)dx$ correct to 3 decimal places. **(10 Marks)**

Module-4

7 a. Solve using Gauss Jordan method :

$x + y + z = 9$
$2x - 3y + 4z = 13$
$3x + 4y + 5z = 40.$ **(06 Marks)**

b. Using Househodler's method reduce the following matrix to the tridigonal form given the matrix : $\begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$. **(10 Marks)**

OR

8 a. Use Triangularisation method to solve the following system of equations :

$2x + y + 4z = 12$
$8x - 3y + 2z = 20$
$4x + 11y - z = 33.$ **(06 Marks)**

b. Apply inverse power method to find the smallest eigen value in magnitude of the matrix. Perform four iterations.

$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$. **(10 Marks)**

Module-5

9 a. For the matrix $A = \begin{bmatrix} 2 & 4 \\ 5 & 6 \end{bmatrix}$ and basis $S = \{u_1, u_2\} = \left\{\begin{bmatrix} 1 \\ -2 \end{bmatrix}, \begin{bmatrix} 3 \\ -7 \end{bmatrix}\right\}$ of R^2. The matrix A defines a linear operator on R^2. Find the matrix B that represents the mapping A relative to the basis S. **(06 Marks)**

b. Find the matrix of the orthogonal projection where

$W = \text{span}\left\{\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}\right\}$; $\text{proj}_W : \mathbb{R}^3 \to \mathbb{R}^3$. **(10 Marks)**

OR

10 a. For $T(X_1, X_2) = (3X_1 + X_2, 5X_1 + 7X_2, X_1 + 3X_2)$, show that T is one to one linear transformation. Does T map R^2 onto R^3? **(06 Marks)**

b. Find the equation $y = \beta_0 + \beta_1 x$ of the least squares line that best fits the data points (2, 1), (5, 2), (7, 3) and (8, 3). **(10 Marks)**

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