Question Paper

Exam Date & Time: 03-Mar-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. EXAMINATIONS - FEBRUARY/MARCH 2023
SUBJECT: MAT 1171/ MAT_1171 - ENGINEERING MATHEMATICS - I
(MAKEUP)

Answer ALL questions.

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) From the following table of values of x and y, obtain $\frac{dy}{dx}$ for $x = 1.2$. (4)

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

1B) Solve $\frac{dy}{dx} - \frac{2y}{1+x} = x^2 + 2x + 1$ (3)

1C) Using Lagrange's interpolation, calculate the profit in the year 2000 from the following table: (3)

Year	1997	1999	2001	2002
Profit in Lakhs of ₹	43	65	159	248

2A) Using Runge-Kutta method of order 4, solve $y' = x + y^2$ with $y(0) = 1$ at $x = 0.1, 0.2$ in steps of length $h = 0.1$. (4)

2B) Solve $(2xy + y\, e^x)\, dx + (x^2 + e^x)\, dy = 0$ (3)

2C) Using Simpson's $\frac{1}{3}$ rule, evaluate $\int_0^1 \frac{x^2}{1+x^3}\, dx$ with h = 0.25. (3)

3A) Using Gauss elimination method, solve the following system of linear equations: (4)

$$5x - y + z = 10$$
$$2x + 4y = 12$$
$$x + y + 5z = -1$$

3B) Solve $(D^2 - 6D + 10)y = cos\, 2x$ (3)

3C) Using Newton-Raphson method, find the real root of $x^3 - 5x + 3 = 0$ in (1,2). Correct to four decimal places. (3)

4A) Using Gram Schmidt Orthogonalization process, construct an orthonormal basis from the set of vectors (5)

$\{(1,1,1),(2,-1,2),(1,2,3)\}$ for $\mathbb{R}^3$.

4B) Using Rayleigh's power method, find the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ by taking the initial vector $[1\ 1\ 0]^T$. Perform four iterations. Correct to 2 decimal places. (5)

5A) Using Taylor series method, find $y(4.1)$ and $y(4.2)$ to four decimal places, given $5x\frac{dy}{dx} + y^2 - 2 = 0$ with $y(4) = 1$. (5)

5B) Using Gauss-Jordan method, find the inverse of following matrix (5)

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

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