Question Paper

Exam Date & Time: 03-Mar-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

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

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

Answer all the questions.

1A) For the given data construct the interpolating polynomial using forward difference formula, and hence find f(0.5). (4)

x	-2	-1	0	1	2	3
f(x)	15	5	1	3	11	25

1B) Solve $(x^3y^2 + xy)dx = dy$ (3)

1C) Evaluate (3)

$$\int_0^1 \sqrt{1+x^4}\,dx$$

using Simpson's 1/3-rule, with h = 1/6.

2A) Using Runge-Kutta Method of order 4, find $y(0.4)$, given $y' = -2xy^2,\ y(0) = 1$ with $h = 0.2$. (4)

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

2C) Compute the value of x, when y=8 by Lagrange's inverse interpolation formula (3)

x:	-2	-2	1	2
y:	-7	2	0	11

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

$2x + y + 4z = 12;\ \ 4x + 11y - z = 33;\ 8x - 3y + 2z = 20.$

3B) Solve $(D^2 - 6D + 25)y = sin\ x$ (3)

3C) Using Newton-Raphson method, find a root of the equation $x\ sinx + cosx = 0$, correct to four decimal places (take $x_0 = \pi$) (3)

Take x in radians.

4A) Using Gram Schmidt orthogonalization, construct an orthonormal basis from the following set of vectors $B = \{(1,1,1), (1,0,1), (1,1,-1)\}$. for $\mathbb{R}^3$. (5)

4B) (5)

Find all the eigenvalues of the matrix $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ and find the eigenvector corresponding to any one of the eigenvalues.

5A) Using Taylor series method, find $y(0.1)$ and $y(0.2)$ to four decimal places given $\frac{dy}{dx} + 1 = x^2 y\,,\ y(0) = 1.$ (5)

5B) Using row reduced echelon form, find the rank of the matrix (5)

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

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