Question Paper

Exam Date & Time: 24-Apr-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. (MAKEUP)EXAMINATIONS - APRIL 2023
SUBJECT: MAT-1171 - ENGINEERING MATHEMATICS - I
(REGULARS - LATE ADMISSION BATCH)

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

Answer all the questions.

1A) From the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ 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 $\frac{dy}{dx} + xy = y^2 e^{x^2/2} \log x$ (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 $y' = -2xy^2, y(0) = 1$ with $h = 0.2$ on the interval $[0, 0.4]$. (4)

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

2C) A velocity v of a particle a distance s from a part as its path is given by: (3)

s (mts)	0	10	20	30	40	50	60
v (m/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel 60 metres by using Simpson's one-third rule.

3A) Test for consistency and hence solve by Gauss elimination method: (4)

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

3B) Solve $(D^2 - 2D + 1)y = e^x \log x$ by the method of variation of parameters. (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)

4A) Using Gram Schmidt orthogonalization, construct an orthonormal basis from the following set of vectors (4)

$B = \{(1,1,1), (1,0,1), (1,1,-1)\}$. for $\mathbb{R}^3$.

4B) Solve $(x-1)^3 \frac{d^3y}{dx^3} + 2(x-1)^2 \frac{d^2y}{dx^2} - 4(x-1)\frac{dy}{dx} + 4y = 4\log(x-1)$ (3)

4C) (3)

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

5A) Define orthogonal set of vectors, Prove that the set of all non-zero orthogonal vectors is linearly independent. (4)

5B) Using Taylor series method, find $y(4.1)$ and $y(4.2)$ to four decimal places, given $5x\frac{dy}{dx} + y^2 - 2 = 0$ (3)

with $y(4) = 1$.

5C) Using Gauss-Jordan method, find the inverse of following matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 2 \\ 3 & 1 & 1 \end{bmatrix}$. (3)

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