BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH **SEMESTER : I**
BRANCH: MECHANICAL ENGINEERING **SESSION : MO/2023**

SUBJECT: ME521 COMPUTATIONAL METHODS IN ENGINEERING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Symbols have their usual meaning.

			CO	BL
Q.1(a)	Solve the following equations by Gauss Elimination method : $2x + y + z = 10$ $3x + 2y + 3z = 18$ $x + 4y + 9z = 16$	[7]	1	3
Q.1(b)	Find the Eigen value of the matrix: $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$	[3]	1	6

Q.2(a) Use the following data to calculate the value of f(x) using Lagrange interpolation method. [5] 2 3

x	0	1	2	5
y	2	5	7	8

Q.2(b) Construct the Hermite's polynomial which fits the following data: [5] 5 3

x	f(x)	f'(x)
-1	1	-1
0	0	1
1	1	0

Q.3(a) **Solve** $\int_0^6 \frac{dx}{1+x^2}$ **by using** [5] 2 3
(i) Trapezoidal rule
(ii) Simpson's 1/3 rule
(iii) Simpson's 3/8 rule

Q.3(b) Evaluate $\int_0^1 e^{-x^2}$ dx by using the Gaussian Quadrature formula with n=3. [5] 3 5

Q.4(a) Find the value of y at x=1.50 with the help of Heun's method when y(1)=1 taking h=0.25 and the differential equation given as : [5] 3 5
$\frac{dy}{dx} = \frac{x+1}{y}$.

Q.4(b) Create the value of y(1.4) and y' (1.4) for the equation [5] 4 6
$y'' - 3y' + 2y = -2x + 3$ by Adams – Bashforth Moulton method (without modifier) using the table given below:

x	y	y'
1	0.95	6.5
1.1	2	11
1.2	3.2	14.2
1.3	4.8	18.3

Q.5(a) Arrange the result doing one iteration only for : [10] 5 6

$u_{xx} + u_{yy} = 0$ in the range of

$0 \le x \le 4$, $0 \le y \le 4$ and $h=k=1$

While

$u(o,y) = 0$, $u(4,y) = 8 + 2y$, $u(x,0) = 0.5\,x^2$ and $u(x,4) = x^2$.

:::::23/11/2023 E:::::