B.E. METALLURGICAL AND MATERIAL ENGINEERING
SECOND YEAR SECOND SEMESTER - 2019

NUMERICAL ANALYSIS

Time: 3 hours **Full Marks: 100**

Answer any five from the below questions
Answer all the parts of a question in contiguous location

1. (a) Write the algorithm of Fixed Point method. Merits and demerits of Newton-Raphson method.
(b) Find a real root of the equation by Newton-Raphson (correct up to two decimal places).

$$e^x - 2x - 3 = 0$$

(c) Find accurate root using 'Bolzano's Bisection Method.

$$3x + \sin x - e^x = 0 \text{ (Root in between 0 and 1)} \quad (4+2+7+7)$$

2. (a) What are the methods are available to solve linear simultaneous solution? What is LU method?

(b) Solve the system equation by Gausses Elimination method.

$$2x_1 - 6x_2 + 8x_3 = 24$$

$$5x_1 + 4x_2 - 3x_3 = 2$$

$$3x_1 + x_2 + 2x_3 = 16$$

(c) Solve the system equation by Gausses-Jordon method

$$2x_1 + 3x_2 + x_3 = 13$$

$$x_1 - x_2 - 2x_3 = -1$$

$$3x_1 + x_2 + 4x_3 = 15 \quad (2+2+8+8)$$

3. (a) What are Forward Difference Table and Backward Difference table and why it is used?

(b) A rocket moves in space and has traversed the distances s, Find the velocities at $t = 12$ and $t = 5$ and acceleration at $t = 12$ and expected acceleration at $t = 5$ from the following table:

t_{sec}	0	5	10	15	20
$S_{m/sec}$	0	75	900	3225	7800

(c) The following table gives the production of steel in different year while data for two year is not available. Estimate the production in 1992 and 1994.

Year	1990	1991	1992	1993	1994
Production in tones	45	48	?	63	?

(4+8+8)

4. (a) Explain Spline interpolation and what are the basic principles of spline interpolation?

(b) Find the interpolating polynomial by (i) Lagrange's interpolation and (ii) Newton's divided difference formula for the following data and hence show that they represent the same polynomial.

x:	0	1	2	5
y:	2	3	12	147

(4+8+8)

5. (a) What are the differences between Simpson's One-third rule and Composite Simpson's One-third rule? What is the global error and principal error in Trapezoidal rule?

(b) Evaluate the following integral by Trapezoidal rule, Simpson's one-third rule, respectively $\int_0^{\pi} \sqrt{1+3cos^2 x}\, dx$. Correct up to three decimal places.

(c) A river is 80m wide. The depth y (in meters) for the river at a distance x from one bank is given in the following table.

x	0	10	20	30	40	50	60	70	80
y	0	4	7	9	12	15	14	8	9

Find approximately the area of cross section of the river using Romberg's integration over Simpson's rule. (2+1+10+7)

6. (a) Write the algorithm of Trapezoidal rule.

(b) Solve the differential equation $\frac{dy}{dx} = 2x + y$,$y(1) = 2$. By first, second, third and fourth order Runge-Kutta methods at $x = 1.2$

(c) Given below are the following pairs of values of x and y.

x	1	2	4	8	10
y	0	1	5	21	27

Determine numerically $\frac{dy}{dx}$ at $x = 4$. (3+10+7)