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Ex/Ch.E/T/215/2017

BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION, 2017

(2ND YEAR, 1ST SEMESTER)

NUMERICAL METHODS

TIME: Three Hours — Full Marks: 100

(50 marks for each Part)

Use a separate answer script for each part

PART –I

Answer any *five* questions

All questions carry equal marks

Assume any missing data

1. Solve the system of equations using Gauss-Jordan method and find the inverse of the coefficient matrix:

$$\begin{bmatrix} 2 & 1 & 3 \\ 4 & -3 & 5 \\ -3 & 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ -7 \\ 3 \end{bmatrix}$$

2. Use Gauss elimination with partial pivoting to solve the following set of equation:

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 10 \\ 18 \\ 16 \end{bmatrix}$$

3. Apply Newton-Raphson method to determine approximate value of $19^{\frac{1}{3}}$ correct to five decimal places with initial approximation$x_0 = 2$. Perform five iterations.

4. Find the Lagrange interpolating polynomial of degree 2 approximating the function y = ln x defined by the following table of values:

X	2	2.5	3
lnx	0.69315	0.91629	1.09861

Hence determine the value of ln2.7 and estimate the error in the values of y.

5. Evaluate $I = \int_0^1 \frac{1}{1+x^2} dx$ correct to three decimal places using both Trapezoidal and Simpson's rules with h= 0.25 and 0.125 respectively.

6. Find the cubic polynomial which takes the values: y (1) = 24, y(3) = 120, y (5) = 336, y(7) = 720 and obtain the value of y(2) and y(8).

PART – II (50 marks)

Use separate answer script for each part

Answer any <u>FIVE</u> questions

All question carry equal marks

1. Fit the curve $PV^a = k$ to the following data and determine the best values a and k using linear least square method.

P (kg/cm^2)	0.5	1.0	1.5	2.0	2.5	3.0
V (liters)	1.62	1.00	0.75	0.62	0.52	0.46

2. Find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at $x = 1.5$ from given data.

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24	38.875	59.0

3. Consider the following data table to $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at $x = 3.0$.

x	0.5	1.0	1.5	2.0	2.5	3.0
y	-0.347	0.0	0.608	1.386	2.291	3.296

4. Find $y(1.0)$ for $y' = x - y^2$, $y(0) = 1$ with $h = 0.25$ correct up to four decimal places using Modified Euler method.

5. Find $y(0.4)$ using Runge Kutta of order four by solving the differential equation $y' = -2xy^2$, $y(0) = 1$ with step length of 0.2.

6. Solve the boundary value problem: $(1+x^2)y'' + 4xy' + 2y = 2$, $y(0) = 0$, $y(1) = ½$ by finite difference method with $h = {}^1/_3$. Clearly show all the equations and steps.