ROLL No: [   ]

Total number of pages:[2]
Total number of questions:06

B.Tech. || CHE || 5th Sem
Numerical Methods in Chemical Engineering
Subject Code: BTCH-501
Paper ID:

Max Marks: 60

Time allowed: 3 Hrs
Important Instructions:
- All questions are compulsory
- Assume any missing data

PART A (2×10)

All Cos

Q. 1. Short-Answer Questions:
(a) State the conditions under which Newton- Raphson method fails.
(b) What is inverse of a matrix?
(c) Write the principle of least square.
(d) What is extrapolation? Give example.
(e) Write the linear form of $y = ax^b + c$
(f) Define rank and trace of matrix.
(g) What are symmetric and skew-symmetric matrices?
(h) What do you mean by significant figures?
(i) Write difference between direct and iterative method of solving simultaneous linear equations.
(j) Find the relative error if the number $X = 0.002977$ is truncated to three decimal digits.

PART B (8×5)

Q. 2. Write down the Taylor's series expansion of $f(x) = Cos(x)$ at $x=\pi/3$ on terms   CO1
of $f(x)$, and its derivatives at $x= \pi/4$. Compute the approximation from the
zeroth order to the fifth order and also state the absolute error in each case.

OR

(a) What are different types of errors in numerical computation? Explain   CO1
with examples.   (5)
(b) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its
absolute & relative error.   (3)

Q. 3. (a) Solve for x_1 and x_2 using Newton-Raphson method   CO2   (5)
$5x_1 + x_2 = 4$; $x_1 - 3x_2 = -1$
(b) Using Gauss-Jordan method, find the inverse of the matrix   (3)

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

OR

(a) Solve the system of non-linear equations using Newton-Raphson method   CO2
$x^2+y=11$; $y^2+x=7$ (5)

(b) Solve by Relaxation method, the equations   (3)
$9x - 2y + z = 50$; $x + 5y - 3z = 18$; $-2x + 2y + 7z = 19$

Q. 4.   From the following table, estimate the number of students who obtained   CO3
marks between 40 and 45

Marks	30-40	40-50	50-60	60-70	70-80
Number of Students	31	42	51	35	31

OR

CO3

Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by applying

(a) Trapezoidal rule   (b) Simpson's 1/3 rule and (c) Simpson's 3/8 rule

CO4

Q. 5.   The deflection of a beam is governed by the equation

$\frac{d^4y}{dx^4} + 81y = \emptyset(x)$, where $\emptyset(x)$ is given by the table below

x	1/3	2/3	1
$\emptyset(x)$	81	162	243

and boundary conditions $y(0) = y'(0)=y''(1) = y'''(1) = 0$. Evaluate the deflection at the pivotal points of the beam using three sub-intervals.

OR

CO4

Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y-x}{y+x}$ with $y(0) = 1$, h

$= 0.2$ at $x=0.2, 0.4$

Q. 6.

(a) Use power method to find the larger eigen value of $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (4)   CO2

(b) Explain the significance of Faddeev's method to find the characteristic polynomial.   (4)

OR

CO2

(a) Solve the following equation by Cramer's rule   (4)
$x + y + z = 6.6$; $x - y + z = 2.2$; $x + 2y + 3z = 15.2$

(b) Solve the equations by gauss-Siedal Method
$10w - 2x - y - z = 3$
$-2w + 10x - y - z = 15$
$-w - x + 10y - 2z = 27$ (4)
$-w - x - 2y + 10z = -9$