

19/05/2025 SE CHEMICAL SEM-IV C-SCHEME NMCE QP CODE: 10082531

Time: 3 Hours

Total Marks: 80

N.B.:

- (i) Question No.1. Is compulsory.
- (ii) Attempt any three questions out of remaining five questions.
- (iii) Assume suitable data and justify the same.

Q 1 Solve any Four. 20

- (a) Solve the following partial differential equation by using Bender Schmidt method.

$u_{xx} = u_t$ subject to $u(0,t)=0$, $u(5,t) = 0$, $u(x,0)=x^2(25-x^2)$ taking $h=1$, up to 3 seconds.

- (b) Define Accuracy and Precision
- (c) Find an iterative formula to find \sqrt{N} and hence find the value of $\sqrt{5}$
- (d) Explain the procedure for finding the root using a bisection method.
- (e) Solve by using least square straight line method.

X	1	2	3	4	6	8
Y	2.4	3	3.6	4	5	6

Q 2 (a) Calculate the volume of superheated steam at 100 atm and 350°C using equation 12

$$\left(P + \frac{a}{V^2}\right)(V-b) = RT$$

Use Newton Raphson method to find the volume and for initial values of V, use ideal gas

equations, where $a = \frac{27R^2T_c^2}{64P_c}$, $b = \frac{RT_c}{8P_c}$, $T_c = 647.11K$, $P_c = 220.76 \text{ atm}$,

$$R = 8.206 \times 10^{-5} \text{ atm/molK.}$$

- (b) Find the root of an equation $f(x) = x^3 - x - 1 = 0$ using secant method. 8

Q3 (a) Find the solution of $2x^3 - 4x + 1 = 0$ using 10

1. Trapezoidal Rule
2. Simpson's 1/3rd rule
3. Simpson's 3/8th rule

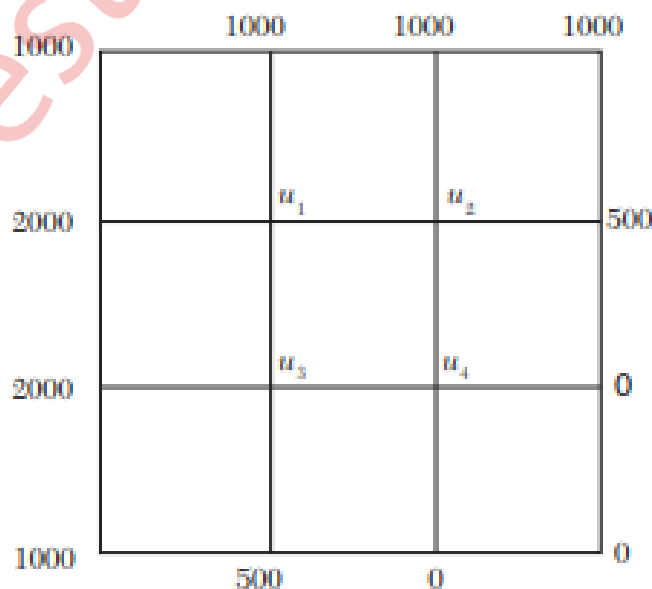
- (b) Solve by Gauss Elimination method: 10

$$3x + 4y + 5z = 18$$

$$2x - y + 8z = 13$$

$$5x - 2y + 7z = 20$$

- Q4 (a) Using Runge kutta fourth order method, find $y(0.8)$ correct to 4 decimal places 10
if $\frac{dy}{dx} = y - x^2$, $y(0.6) = 1.7379$
- (b) Using modified Euler's method solve the equation $\frac{dy}{dx} = 1 - y$, $y(0) = 0$, tabulate the 10
solution at $x = 0.1, 0.2, 0.3$
- Q5 (a) Solve by Crank Nicholson method the equation $u_{xx} = u_t$ subject to the condition 10
 $u(x,0) = 0$, $u(0,t) = 0$, $u(1,t) = t$. taking $h = 0.25$ for one time steps. -
- (b) A dynamic model spherical tank, $\frac{dh}{dt} = \frac{f_0 - f}{\frac{\pi D^2}{4}}$ where, D is a diameter of tank, f_0 is the inlet 10
flowrate, f is the outlet flowrate and h is level in the tank. If tank dimension are given ,
find the liquid level in tank with respect to time. Take step size of 5 sec show calculations
till 20 sec. use Improved Euler's method.
Given:- Diameter of tank = 1m,
Height of the tank = 2m
 $F = 0.04 \sqrt{h}$ in m^3/s .
 $F_0 = 0.06 m^3/s$.
 $t = 0$ sec, $h = 1m$
- Q6) a) Evaluate the function $u(x,y)$ satisfying $\nabla^2 u = 0$ at lattice points given by the boundary value. 12



- b) A process stream containing 100 kg of a mixture of three chemical (A, B, C) is treated by two separators. In the first separator (P), most of A is removed and in the second separator (Q), most of the B is removed. The final outlet (R) contains a C- rich stream. The compositions of the three outlet streams are shown in fig below. Solve it by Gauss Elimination to find P, Q, R.

