S.E (Chem) (REV) CBGS.
(CPNM)
Computer Programming & Numerical Methods (Lab)

QP Code :**NP-18693**

(3 Hours) [Total Marks : 80

N.B. : (1) Question No. 1 is **compulsory**, Answer any **three** questions from **remaining**.
(2) Assume data if **necessary** and specify the assumptions **clearly**.
(3) Answer to the **sub-questions** of an individual question should be **grouped** and written **together** i.e. **one** below the other.

1. (a) Explain how to use 'do–while' loop in Sci-Lab with appropriate example. 5
(b) Using finite difference method obtain the discrete formula for the second order derivative, 5

$$\frac{d^2x}{dt^2}$$

(c) Solve following equations using successive substitution method. 5

$$y + z = 5$$
$$4x + y - z = 3$$
$$x - y + z = 2$$

(d) Calculate the value of y (0·2) for the equation $dy/dx = y^2 - x$ if y (0) = 1·0, take step size of 0·1 and use Euler's method. 5

2. A dynamic model for flow through cylindrical tank, 20

$$\frac{dh}{dt} = \frac{Fo - F}{\frac{\pi}{4} D^2}$$

where, D is diameter of tank, Fo is inlet flowrate, F is outlet flowrate and h is level in the tank. If tank dimensions are as given below, find the liquid level in the tank with respect to time. Take step size of 5 seconds and show calculations till 20 seconds. Use modified Euler's Method, or second order Runge – Kutta Method.

Data :
Diameter of tank = 1m
Height of tank = 2m
$F = 0{\cdot}04\sqrt{h}$ in m^3/s where h is in m.
$F_0 = 0{\cdot}06\ m^3/s$
At t = 0 sec, h = 1 m.

3. (a) Solve following set of equations using Gauss–seidel and Gauss–Jordon method :— 12

$$x + 2y + 3z = 14$$
$$x + y - z = 0$$
$$2x + y - z =$$

(b) Write Laplace equatio[illegible] it in difference form using Taylor's series expansion. 8

[TURN OVER

Con. 11695-

4. (a) Chemical equilibria for a reaction $A + B \rightleftharpoons 3C$ is represented by following equation. 15

$$K = \frac{C_A C_B}{C_c^3}$$

where, k = equilibrium constant = 2

$$C_A = (1 - X_A)$$
$$C_B = C_{BO}(1 - X_B) \approx C_{AO}(1 - X_A)$$
$$C_C = C_{CO} + 3C_{AO} X_A \approx 3 C_{AO} X_A$$
$$C_{AO} = 1.$$

Find the conversion X_A using Newton – Raphson method. Take $X_A = 0{\cdot}5$ as initial guess.

(b) Show that the following system does not have a solution :— 5

$$3x_1 + 2x_2 - x_3 - 4x_4 = 10$$
$$x_1 - x_2 + 3x_3 - x_4 = -4$$
$$2x_1 + x_2 - 3x_3 = 16$$
$$-x_2 + 8x_3 - 5x_4 = 3$$

5. (a) Solve the following system by Gaussian Elimination with and without partial pivoting and comment on the result. 12

$$2{\cdot}51x + 1{\cdot}48y + 4{\cdot}53z = 0{\cdot}05$$
$$1{\cdot}48x + 0{\cdot}93y - 1{\cdot}30z = 1{\cdot}03$$
$$2{\cdot}68x + 3{\cdot}04y - 1{\cdot}48z = -0{\cdot}53$$

(b) Solve the following system by LU decomposition :— 8

$$A = \begin{bmatrix} 4 & 0 & -1 & 3 \\ 2 & 1 & -2 & 0 \\ 0 & 3 & 2 & -2 \\ 1 & 1 & 0 & 5 \end{bmatrix} \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} \quad b = \begin{bmatrix} 0 \\ 1 \\ 4 \\ -2 \end{bmatrix}$$

 $Ax = b$

6. (a) Find the root of $f = 4(x - 1)^3$ via secant method with $0{\cdot}4 \le x \le 1{\cdot}3$. Required accuracy is 0·02. Show the progress of method on graph. 10

(b) Apply Regula-Falci method to find root in the interval [0·5, 1·5] for the function. 10

$$f = 30x^5 - 180x^4 + 330x^3 - 180x^2 = 0$$

accurate upto third decimal place.
