Q1. Draw a flowchart (only algorithm) for finding all the roots of a polynomial of degree n >2 by using Bairstow Method. Write all steps neatly using appropriate flowcharting symbol in proper sequence.   (10)

Q2. A furnace wall 1 foot thick is at 100^0 initially. The left face is raised to 500^0 and thereafter maintained at that temperature. The gradient at the right wall is maintained at $\partial T/\partial x = -100$ The heat equation is

$$\partial T/\partial t = 0.01\ \partial^2 T/\partial x^2$$

Take space increments $\Delta x = 0.04$. For $0 <= t <= 200$ times Δt.
Write a program in Matlab using an appropriate explicit method of finite difference scheme and tabulate (print) the values for each incremented time. Plot a single graph for 10 and 110 time increments (i.e., Δt) and label them also. Use second order equivalent for space derivative $\partial T/\partial x$.

(12)

Q3. Write a program in C using bit manipulation to superimpose (store) the values of integer variables A, B, C, D in long integer IP variable (4 bytes), the values are A= 10, B= 12, C= 126 and D= 55, the variable IP will look like

1 Byte	1 Byte	1 Byte	1 Byte
10 (A)	12 (B)	126 (C)	55 (D)

$\mathcal{IP}$

(8)

Q4. Derive the Newton-Raphson method for solving a system of two nonlinear equations in two unknowns as
$$f(x, y)=0$$
$$g(x, y)=0$$

OR

Obtain the complex roots of the equation
$$f(z) = z^3 + 1 = 0$$
Correct to three decimal places using Newton-Raphson Method for system of nonlinear equations. Use the initial approximation to a root as $(x_0, y_0) = (0.25, 0.25)$. Write steps for single iteration only.

OR

Write a C program to find the root by Newton-Raphson method to solve the system of equations

$$x^2 + x\,y + y^2 = 7$$
$$x^3 + y^3 = 9$$

Take the initial approximation as $x_0 = 1.5$, $y_0 = 0.5$, perform three iterations and print their values.   (10)