This question paper contains 7 printed pages.]

Your Roll No. ....

1224

B.Sc. (Hons.) / II   A

PHYSICS – PAPER XIV

(Computer Fundamentals and Programming)

Time : 3 Hours   **Maximum Marks : 38**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **all** questions.

Non-programmable scientific calculators are allowed.

1.   Answer any **five** of the following :

(a)   Write an assembly language program to find 2's complement of a 8 bit number stored in memory location 2300H.

(b)   Explain the function of ALE and IO/$\overline{M}$ pins of the 8085 microprocessor.

(c) Write the outputs of the following programs :

i   Program Problem2;
    Var
    j, x : Integer;
    Begin
        j := 4;
        x := 0;
        case j of
        1 : x := x+1;
        2 : x := x+2;
        3 : x := x+3;
        4 : x := x+4;
    End;
    Writeln ('value of x=', x);
    End.

ii Program Problem3;
    Var
    a, b, l, m, n: real;
    Begin
        a := 2.154;
        b := 10.0;
        l := a + b;
        m := a*b;
        n := a/b;
        …;
        …;
        …;
        write(l);
        writeln(m : 6);
        writeln(n : 4 : 2);
        …;
        …;
    End

(d) Using iterative method find the dominant eigenvalue and the corresponding eigenvector of the following matrix (Do four iterations) :

$$A = \begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$$

(e) What is floating point representation of a number ? List the advantages of defining numbers in this way. Write 1101.10111 in floating point representation.

(f) Write the advantages and disadvantages of Predictor-Corrector methods as compared to Runge-Kutta method.

(g) Consider the system of linear equation

$$x_1 + x_2 = 2$$

$$x_1 + 1.01x_2 = 2.01$$

(h) If the clock frequency is 3 MHz, how much time is required to execute an instruction requiring 2 machine cycles and 4 T-states ?

(5×2)

2. (a) What are flags ? Mention different types of flags used in 8085 microprocessor. Which flags are affected by

(i) ANA C and (ii) DAD D instruction   4

(b) Write a program in assembly language to multiply 2 and 5 to get the product 10.   3

OR

(a) A microprocessor employs 4 kB of RAM and 4 kB of ROM chips. If the RAM and ROM chips used are 1 K × 8 bits and 512 × 8 bit respectively. How many RAM and ROM chips are required ? What will be the address range for RAM and ROM, if the MSB is 0 for ROM and 1 for RAM ? **4**

(b) Write an assembly language program to subtract two 16-bit numbers (7FC0H from 6B89H). **3**

3. (a) What are the different types of data supported by PASCAL ? Distinguish between structured and simple data types. **3**

(b) Write a PASCAL program to input a list of 20 real numbers and find the average of the list. The program should print the numbers in the list with each number accompanied by the word ABOVE, EQUAL or BELOW, depending on whether the number in question is greater than, equal to or less than the average. **4**

OR

(a) Write a PASCAL program to find the roots of an equation of the form $ax^2 + bx + c = 0$ and mention whether the roots are real or imaginary. **3**

(b) Write the differences and similarities between FUNCTION and PROCEDURE in PASCAL. What is recursion ? Write a FUNCTION to find factorial of a number. **4**

4. (a) Describe Gauss Seidel method for the solution of n linear equations in n unknowns. **2**

   (b) Find a root of the equation **2**

   $$x^3 - x - 1 = 0$$

   by any method correct to three significant figures.

   (c) Find the solution of the given system of linear algebraic equations by using Gauss-Elimination method : **3**

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

   $$x + y - 6z = -12$$

   $$3x - y - z = 4$$

OR

   (a) Find a root of the equation

   $$x^3 - 6x + 4 = 0$$

   by Newton Raphson method correct to three significant digit. **2**

   (b) Using iterative method find the dominant eigenvalue and the corresponding eigenvector of the following matrix : **3**

   $$\begin{bmatrix} 1 & -2 & 4 \\ -2 & 5 & -2 \\ 4 & -2 & 1 \end{bmatrix}$$

(c) Using the Gauss Seidel method solve the following system of linear equations (two iterations) : 2

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

5. (a) Derive the Newton-Gregory forward difference interpolation formula. 2

(b) The distance s covered as a function of time by an athlete during his run in the 50 metre race is given in the following table :

Time(sec)	0	1	2	3	4	5	6
Distance s (mts)	0	2.5	8.5	15.5	24.5	36.5	50

Determine the speed and acceleration of the athlete at t = 5 seconds. 2

(c) Using the Simpson's $\frac{1}{3}$ rule deduce the integral

$$I = \int_{0}^{6} \frac{dx}{1 + x^2}$$

3

OR

(a) Derive the Simpson's $\frac{1}{3}$ rule to solve numerically the integral

$$I = \int_{a}^{b} f(x)dx$$

2

(b) The velocity v (km/min) of a car which starts from rest is given at fixed intervals of time t(mins)

t	2	4	6	8	10	12	14	16	18	20
v	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes. 2

(c) Use the second order Runge-Kutta method to solve the differential equation

$$\frac{dy}{dx} = x + y; \text{ given } y = 1 \text{ when } x = 0$$

within the interval [0.0, 1.0]. Take h = 0.2. 3