PD-160-S.E.-CV-19
M.Sc. PHYSICS (1st Semester)
Examination, Dec.-2020
Paper-
NUMERICAL METHODS & PROGRAMMING

Time : Three Hours]

[Maximum Marks : 80

[Minimum Pass Marks : 29

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. Fill in the blanks with appropriate words:-　　　　1x10=10
   - (a) What is run time error in C-language?
   - (b) Which header file contains the file manipulations functions in C?
   - (c) Write the format specifier used to print the values of double type variable.
   - (d) Which type of value does a function return by default?
   - (e) What is string constant?
   - (f) Write the name of two exact methods for solving a system of linear non-homogeneous equations.
   - (g) State the formulae for the first approximation of the root of the equation obtained by the method of false position.
   - (h) Define shift operator E.
   - (i) Write the error of approximation in evaluating the definite integral $\int_a^b f(x)dx$, where f(x) is the interpolating polynomial.
   - (j) What is the disadvantage of Euler's method for solving ordinary differential equations of first order?

2. Answer the following short answer type questions:-　　　　2x5=10
   - (a) Comment on 'C' is a middle level language.
   - (b) Write the syntax of if, if-else and nested if-else statements.
   - (c) What is meant by associativity of operators?
   - (d) Derive the Newton-Raphson iteration formulae for finding the square root of 'a' where a > 0.
   - (e) Compute the dominant eigen value of the following matrix $A = \begin{bmatrix} 2 & -12 \\ 1 & -5 \end{bmatrix}$ using power method.

Section-B　　　　15x4=60

Answer all questions.

3. (a) Describe the bitwise operators in C-language.
   (b) Explain the various symbols used in making a flow chart giving a suitable example.

   OR

   (a) Describe the various data types used in C. List the user defined data types.
   (b) What is meant by hierarchy of operators? Explain conditional operator.

4. (a) Differentiate between the entry-controlled and exit controlled loops giving examples.
   (b) Write a program to sort the elements of an array in ascending order.

   OR

   (a) Explain the different ways of passing parameter to the functions.
   (b) Write a program to search an item in a list of elements. (linear search)

5. (a) Upper triangularise the following system of equations and obtain solution using Gaussian elimination method.
   $$x + 3y + 2z = 5$$
   $$2x - y + z = -1$$
   $$x + 2y + 3z = 2$$

(b) Using method of False position, find a root of $x^3 + 2x - 2 = 0$, correct up to three significant figures.

OR

(a) Find the eigen values and eigen vectors of the following symmetric matrix using Jacobi method.

$$A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$$

(b) Derive the normal equations for fitting a straight line $f(x) = ax + b$ using least square approach.

6. (a) Given the following table:

x	1	2	3	4	5	6	7	8
f(x)	1	8	27	64	125	216	343	512

Construct the difference table and find f(1.5) using suitable Interpolation formulae.

(b) Evaluate $\int_0^1 (4x - 3x^2)dx$, taking 10 intervals by Trapezoidal rule. Compute the exact value and find the absolute and relative errors in your result.

OR

(a) Given $\dfrac{dy}{dx} = \dfrac{y-x}{y+x}$ with initial condition y=1 at x=0, find y for x=0.1, by Euler's method, taking step length h=0.2.

(b) Compute y(0.4) from the equation $\dfrac{dy}{dx} = x - y$, $y(0) = 1$, taking h=0.1 by the fourth order Runge-Kutta Method, correct to five decimal places.