Roll No. ..... Total Printed Pages - 11

# F - 514

## M.Sc. (Second Semester)
## EXAMINATION, MAY-JUNE, 2022
### PHYSICS
### Paper Fourth
### (Computational Physics and Computer Programming)

*Time : Three Hours]* *[Maximum Marks:80*

**Note : All sections are to be attempted. Non Programmable calculator may be allowed inside the examination hall.**

**Section-A**

**(Objective/Multiple Choice Questions)**

**Note : Attempt all questions. Chose correct answer.**

1. The Newton-Raphson's method fails when-

   (A) $f'(x)$ is negative

   (B) $f'(x)$ is too large

   (C) $f'(x)$ is zero

   (D) Never fails





2. As soon as, a new value of a variable is found by iteration, it is used immediately in the following method of showing equations.

   (A) Gauss Jordan method

   (B) Gauss Seidal method

   (C) Gauss Elimination method

   (D) Jacobi's method

3. The inversion of a square matrix can be obtained by method of_____.

   (A) Gauss-Jordan

   (B) Gauss-Seidal

   (C) Gauss Elimination

   (D) Jacobi

4. The order of convergence of Newton-Raphson method is-

   (A) 3

   (B) 4

   (C) 1

   (D) 2

5. The (n+1)th order difference of nth degree polynomial is-

   (A) 0

   (B) 1

   (C) 2

   (D) 3

6. If $\Delta$ and $\nabla$ respectively are forward and backward operators, then $\Delta \nabla$ =?.

   (A) $\nabla \Delta$

   (B) $\nabla + \Delta$

   (C) $\Delta - \nabla$

   (D) None of the above

7. For the data:

| $x$ | 2 | 4 | 6 | 8 |
|---|---|---|---|---|
| $f(x)$ | 5 | 7 | 8 | 9 |

   $\int_2^8 f(x)\,dx$ when calculated by trapezoidal rule is

   (A) 29

   (B) 43

   (C) 44

   (D) 58

8. $\Delta^n f(a)$ will be equal to:

   (A) $\Delta^{n-1} f(a+h) - \Delta^n f(a)$

   (B) $\Delta^{n-1} f(a+h) - \Delta^{n-1} f(a)$

   (C) $\Delta^{n-1} f(a) - \Delta^{n-1} f(a+h)$

   (D) $\Delta^{n-1} f(a) - \Delta^{n-1} f(a1-h)$







9. With the help of least squares we can fit the curve of a :

   (A) Straight line

   (B) Polynomial

   (C) None of (A) and (B)

   (D) Both of (A) and (B)

10. Fourth order Runge Kutta formula for solving differential equation is:

   (A) $y = y_0 + 1/6\ (k_1 + 2k_2 + 2k_3 + k_4)$

   (B) $y = y_0 + 1/4\ (k_1 + 2k_2 + 2k_3 + k_4)$

   (C) $y = y_0 + 1/2\ (k_1 + 2k_2 + 2k_3 + k_4)$

   (D) $y = y_0 + 1/8\ (k_1 + 2k_2 + 2k_3 + k_4)$

$$k_1 = hf(x_0, y_0)$$
$$k_2 = hf\left(x_0 + \tfrac{1}{2}h, y_0 + \tfrac{1}{2}k_1\right)$$
where $k_3 = hf\left(x_0 + \tfrac{1}{2}h, y_0 + \tfrac{1}{2}k_2\right)$
$$k_4 = hf\left(x_0 + h, y_0 + k_3\right)$$

11. Which one is not the function of a complier:

   (A) Translation from High to machine language

   (B) Detection of syntax error

   (C) Taking action in accordance with non-executable statements

   (D) Execution of a program

12. Which one is not an operating system?

(A) LINUX

(B) EXCEL

(C) UNIX

(D) WINDOWS

13. Floating Point Arithmetics are applicable to:

(A) Integer numbers

(B) Real numbers

(C) Logical expressions

(D) Characters

14. Logical errors in a program are detected at the time of:

(A) Compilation

(B) Coding

(C) Execution

(D) Testing and debugging

15. Indicate the false statement about DO loop:

(A) Nesting of DO is permitted

(B) Jumping out of DO loop is allowed

(C) DO loop is used for iteration

(D) Jumping inside the DO loop from outside is permitted





16. Which statement about DIMENSION statement is false:

(A) It can be converted into executable statement at the time of program execution

(B) It is a non-executable statement

(C) A program may contain several DIMENSION statements

(D) It can be declared for arrays of Integers and Real types

17. Which of the following IF statement is correct?

(A) IF (X. GT.Y)

(B) IF (X > Y) GO TO 20

(C) IF (X.EQ.Y) .....Y=X

(D) IF (X-Y) 10, 20, 30, 40

18. Which statement about FUNCTION and SUBROUTINES is true.

(A) Both must contain STOP statement

(B) Both can CALL itself

(C) Constants can appear in the arguments of CALL statement.

(D) A sub program cannot CALL other subprogram

19. Which is not a valid operation with a file:

(A) OPEN

(B) CLOSE

(C) READ/WRITE

(D) None of (A), (B) and (C)

20. Indicate which of following is a valid assigment statement?

(A) Y+Z = X

(B) DIST : = Y-X

(C) NUM = NUM +1

(D) P $\leftarrow$ Q.R

## Section-B

### (Very Short Answer Type Questions)

**(2 marks each)**

1. Evaluate the following FORTRAN expression and Assign

   J=3.1-2*4.6 + (3.1/2)**2

2. Invert Matrix $\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$

3. Show that $(1+\Delta)(1-\nabla) \equiv 1$ where 1, $\Delta$ & $\nabla$

   are finite difference operators.

4. A second degree polynomial, $f(x)$ has values

   for $x$ = 0, 1, 2

   $f(x)$ = 1, 4, 15 respectively

   estimate I = $\int_0^2 f(x)\,dx$ by applying

   Trapezoidal Rule taking h = 1

5. Differentiate the errors due to truncation and Rounding - off by taking an example.





6. Write Assignment statements to interchange the values of veriables A and B having 20.0 and 10.0 respectively.

7. Find the value of the logical expression

   .NOT.A. AND.B.OR.A.AND.NOT.B

   When A = B = .FALSE.

8. Consider the statement

   GO TO (25, 5, 2, 1) KOUNT

   Give the various possibilities for branching with respect to values of KOUNT

## Section-C

### (Short Answer Type Questions)

**(3 marks each)**

**Note:- Attempt all questions.**

1. For data :

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $f(x)$ | 1 | 4 | 15 | 34 |

   $\int_0^3 f(x)\,dx$ by simpson's 1/3 Rule

2. Give the equation $x^2 - 5 = 0$, one of its roots lie between [2, 3]. Find the root correct to three significant digits. Apply Newton-Raphson Method.

3. If P is the Pull to lift the weight W by means of a pulley block. Take Linear law

P= $a_0$ + a,w using the following data

| W (kg) | 50 | 70 | 100 | 120 |
|---|---|---|---|---|
| P (kg) | 12 | 15 | 21 | 25 |

Compute P when W = 150 kg by linear Regression

4. Using Newtons forward formula, find the value of $f(1.6)$, if

| $x$ : | 1 | 1.4 | 1.8 | 2.2 |
|---|---|---|---|---|
| $f(x)$ : | 3.49 | 4.82 | 5.96 | 6.5 |

5. IF (K-J) 10, 20, 10

   10 J = K

   20 J = J + 1

   What will be the final value of J after executing the above program segment? If K and J contains 10 and 5 repsecively before execution.

6. Find the final value of K after the execution of the following program segment

```
K     = 2
DO 20 I = 3, 8, 2
IF (I.EQ.5) GO TO 20
K = K + I
20 CONTINUE
K = 2*K
```





7. Distinguish between the FUNCTION and SUBROUTINE subprograms of FORTRAN.

8. Draw a flowchart to find the largest of N numbers.

## Section-D

### (Long Answer Type Questions)

**(5 marks each)**

**Note:- Attempt all questions.**

1. Solve the following system of simultaneous

   Linear equations

$$2x_1 + 3x_2 + 4x_3 = 20$$
$$4x_1 + 2x_2 + 3x_3 = 17$$
$$x_1 + 4x_2 + 2x_3 = 15$$

   Using Gauss elimination or Gauss - Jordan

   method with pivoting.

2. Solve the following differential equation $\frac{dy}{dx} = xy$ Euler's method given y(1) = 5 Find the solution correct upto three decimal position for x = 1.4 with step size h = 0.1

**OR**

Apply Runge Kutta fourth order method to find the approximate value of y(0.2) given equation $\frac{dy}{dx} = x + y$ and y=1 when x = 0.0

3. Find $f(22)$ by Gauss Forward method for Data

| $x$ : | 20 | 25 | 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|---|
| $f(x)$ : | 354 | 332 | 291 | 260 | 231 | 204 |

**OR**

Draw a flowchart and write the corresponding program to find real root (ie lies between (.0, + 1) of equation : $x^3 + x^2 - 1 = 0$ by Newton-Raphson's Method

4. Draw a flowchart and write program to multiply two Matrices

**OR**

For given N points $\left((x_i, y_i)\, z = 1, N\right)$. Fit the straight line by Linear Regression with the help of FORTRAN program after drawing flowchart.