2020

PHYSICS — HONOURS

Paper : SEC-A-1

[Scientific Writing]

(Syllabus : 2019-2020)

Full Marks : 20

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer ***any ten*** questions. 2×10

1. Which LaTeX package is required to include a figure in the document?

   (a) figure   (b) graphicx

   (c) picture   (d) fig

2. Which style of a page includes page number?

   (a) plain   (b) empty

   (c) numbered   (d) marked.

3. What will be LaTex command to write : $y = 1+2+3+\cdots$

   (a) \$ y = 1 + 2 + 3 + \cdots \$ (b) \$ y = 1 + 2 + 3 + \cdot \$

   (c) \$ y = 1 + 2 + 3 + \ cdots \ cdots \ cdots \$ (d) None of these

4. To write the integral symbol like

   $$\int_0^1$$

   which of the following LaTeX instruction is required?

   (a) \integral^1_0   (b) \int_0^1

   (c) \intg_0^1   (d) \integration^1_0

5. The following mathematical expression in LaTeX
   $$\sin\theta \sim \theta$$

   can be written by

   (a) \sin\theta\sim\theta   (b) \sin\theta\approx\theta

   (c) \sine\theta\sim\theta   (d) \sin\theta\simm\theta

Please Turn Over

6. The mathematical expression

$$z \ngeq a + b$$

can be written by which of the following LaTeX instruction?

(a) z\neq a + b

(b) z\ngeq a + b

(c) z\eqn a + b

(d) z\nneq a + b

7. The LaTeX instruction for closed loop line integral

$$\oint$$

is given by

(a) \cint

(b) \oint

(c) \loopint

(d) \closedint

8. The LaTeX instruction given below

$$\text{\$\lim\_\{x \to 0\} \$}$$

provides which of the following mathematical expression?

(a) $\lim\limits_{x \to 0}$

(b) $\lim_{x \to 0}$

(c) $\text{Lim}_{x \to 0}$

(d) $\text{Lt}_{x \to 0}$

9. To write the summation

$$\sum_0^\infty$$

which of the following LaTeX instruction is required?

(a) \summation^0_{\inf}

(b) \summ_0^{\inf}

(c) \sum_0^{\infty}

(d) \Sum_0^{\infty}

10. The following mathematical expression in LaTeX

$$\frac{x}{y}$$

could be generated by

(a) \fraction x_y

(b) \frac{x}{y}

(c) \div{x}{y}

(d) \frac{x}_{y}

11. Which of the following code block is used to write more than one equations inside a LaTeX document?

    (a) \begin{equations}
        \end{equations}

    (b) \begin{eqnarray}
        \end{eqnarray}

    (c) \begin{eqns}
        \end{eqns}

    (d) \begin{eqs}
        \end{eqs}

12. The dedault numbering scheme of a list defined inside the block \begin {enumerate} \end{enumerate} is

    (a) alphabets in uppercase i.e., A, B, C...

    (b) arabic i.e., 1, 2, 3...

    (c) alphabets in lowercase i.e., a, b, c...

    (d) roman number in lowercase i.e., i, ii, iii

————————

[Basics Programming and Scientific Word Processing]

(Syllabus : 2018 - 2019)

Full Marks : 80

Answer *question nos.* **1** & **2**, and *any four* questions from the rest.

1. Answer *any ten* of the following questions : 2×10=20

   (a) 500 GB is equal to how many bytes?

   (b) Let i be an integer. Under what condition $(i / 2 * 2 - i)$ will be equal to zero?

   (c) Write the basic structure of the program to calculate $x = a\cos\theta$ and $y = a\sin\theta$, where $a = 10.0$ and $\theta = 30º$.

   (d) Give the output of the following code :

   ```
   void main()
   {
     int i=5, j=2;
     float x;
     x=i/j+j/i;
     printf ("x=%5.3f\n",x);
   }
   ```

   Or,

   Write the output of the following code :

   ```
     i = 5
     j = 2
     i = i/j + j/i
     x = float(i)
     write (*,1)x
   1 format (E8.2)
     stop
     end
   ```

   (e) Explain the statement, where 'phy' means marks in physics and 'math' means marks in mathematics;

   If ((phy >= 80) || (math >= 90)

   printf ("Eligible for admission")

Or,

Write the output of the following program :

```
   i = 5
   i = i/2 * 2
   write (*,1)i
 1 format (I3)
   stop
   end
```

(f) Translate the following statement into FORTRAN / C :

if x is greater than 100.0 or is less than or equal to 0.0, print 'out of range'.

(g) Suppose $a = 5.0$ and $b = 7.0$. Write the code in FORTRAN / C to swap the values of these two variables.

(h) Write the command in GNUPLOT to draw a vertical line parallel to y-axis extending from $y = 0$ to 5 at $x = 3$.

(i) Write code in GNUPLOT to plot the polar equation $r = 2\theta$.

(j) Write the command in LaTeX to write the following decay :

$$_3^1 \mathrm{H} \rightarrow {}_3^2\mathrm{He} + e^- + \bar{v}_e$$
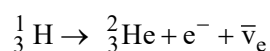
(k) Write the command in LaTeX to write the following matrix :

$$\begin{pmatrix} \cos\theta & -\sin\theta \\ \\ \sin\theta & \cos\theta \end{pmatrix}$$

(l) Write the command in LaTeX to write the following equation involving determinant :

$$M_{12} = \begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix}$$

2. Answer *any four* of the following questions :   5×4=20

(a) Write an algorithm / flowchart to check whether a given number is prime or not.

(b) Write an algorithm / flowchart to find the roots of a given quadratic equation.

(c) Write a code in FORTRAN/C to read a square matrix ($n{\times}n$) and to find the sum of its diagonal elements.

(d) Suppose $\vec{A}$ and $\vec{B}$ are two vectors in 3-dimensions with components (1, 2, 3) and (1, 0, 1) respectively. Write a code in FORTRAN/C that will calculate $\vec{A} + \vec{B}$ and $\vec{A} \cdot \vec{B}$.

(e) Suppose you are given two functions : $y_1 = 5 \sin x$ and $y_2 = 5 \cos x$. Write code in GUNPLOT to draw both functions in different colours on the same plot, where the range of x is $-\pi \le x \le \pi$.

Please Turn Over

(f) Write the LaTeX code to type the following expression :

$$I = \int_0^\infty \frac{\sin x}{x}\, dx = \frac{\pi}{2}$$

3. Write a code in FORTRAN/C to sort the following sequence of numbers in ascending order by any method :

15, 10, 13, 9, 12, 18

Also write the algorithm/flowchart of the program. 5+5

4. Write a code in FORTRAN/C to read two numbers x and y, and to determine the value of $a = x^y$ without using any library function like $pow(x, y)$ (or $**$ in FORTRAN), where y is an integer. Also write the flowchart / algorithm of the code. 5+5

5. Write a code in FORTRAN/C to read three real numbers a, b and c. Then check whether a, b and c form a triangle. If they do, find whether the triangle is right angled or not. 5+5

6. Write code in GNUPLOT to plot $f(x) = \sin(x)$ and $g(x) = \sin^2 x$ in the range $x = -4.0$ to $x = +4.0$. Show the x-axis and y-axis in the plot. 5+5

7. Write the LaTeX code to type the following equations : 5+5

(a) $\dfrac{\partial^2 \phi}{\partial x^2} = \dfrac{1}{c^2}\dfrac{\partial^2 \phi}{\partial t^2}$

(b) $\vec{\nabla} \times \vec{E} = 0$ and $\vec{\nabla} \cdot \vec{E} = \dfrac{\rho}{\epsilon_0}$

8. (a) Write code in GNUPLOT to plot the following functions in a single graph :

$$f(x) = 1$$
$$g(x) = x$$
$$h(x) = \frac{1}{2}(3x^2 - 1)$$

where $-1 \le x \le +1$.

(b) Write the LaTeX code to create following table : 5+5

Voltage (V)	Current (I)	Power
1·0	2·0	2·0
2·0	4·0	8·0
3·0	6·0	18·0

————