

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

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

(a) figure	(b) graphicx
(c) picture	(d) fig
- Which style of a page includes page number?

(a) plain	(b) empty
(c) numbered	(d) marked.
- What will be LaTeX command to write : $y = 1+2+3+\dots$

(a) $\$ y = 1 + 2 + 3 + \cdots \$$	(b) $\$ y = 1 + 2 + 3 + \cdots \$$
(c) $\$ y = 1 + 2 + 3 + \cdots \cdots \cdots \$$	(d) None of these
- To write the integral symbol like

$$\int_0^1$$

which of the following LaTeX instruction is required?

- | | |
|-------------------------------|----------------------------------|
| (a) $\backslash integral^1_0$ | (b) $\backslash int_0^1$ |
| (c) $\backslash intg_0^1$ | (d) $\backslash integration^1_0$ |
- The following mathematical expression in LaTeX
 $\sin \theta \sim \theta$
 can be written by

(a) $\backslash sin\theta\sim\theta$	(b) $\backslash sin\theta\approx\theta$
(c) $\backslash sine\theta\sim\theta$	(d) $\backslash sin\theta\sim\theta$

Please Turn Over

6. The mathematical expression

$$z \not\geq a + b$$

can be written by which of the following LaTeX instruction?

- (a) $z \backslash neq a + b$ (b) $z \backslash ngeq a + b$
 (c) $z \backslash eqn a + b$ (d) $z \backslash nneq a + b$

7. The LaTeX instruction for closed loop line integral



is given by

- (a) $\backslash cint$ (b) $\backslash oint$
 (c) $\backslash loopint$ (d) $\backslash closedint$

8. The LaTeX instruction given below

$$\lim_{x \rightarrow 0} x$$

provides which of the following mathematical expression?

- (a) $\lim_{x \rightarrow 0}$ (b) $\lim_{x \rightarrow 0}$
 (c) $\text{Lim}_{x \rightarrow 0}$ (d) $\text{Lt}_{x \rightarrow 0}$

9. To write the summation

$$\sum_0^{\infty}$$

which of the following LaTeX instruction is required?

- (a) $\backslash summation^0_{\infty}$ (b) $\backslash summ_0^{\infty}$
 (c) $\backslash sum_0^{\infty}$ (d) $\backslash Sum_0^{\infty}$

10. The following mathematical expression in LaTeX

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

could be generated by

- (a) $\backslash fraction x_y$ (b) $\backslash frac\{x\}\{y\}$
 (c) $\backslash div\{x\}\{y\}$ (d) $\backslash frac\{x\}_\{y\}$

11. Which of the following code block is used to write more than one equations inside a LaTeX document?
- | | |
|--|--|
| (a) <code>\begin{equations}</code>
<code>\end{equations}</code> | (b) <code>\begin{eqnarray}</code>
<code>\end{eqnarray}</code> |
| (c) <code>\begin{eqns}</code>
<code>\end{eqns}</code> | (d) <code>\begin{eqs}</code>
<code>\end{eqs}</code> |
12. The default 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 $\theta = 30^\circ$.
- (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
```

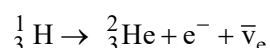
- (e) Explain the statement, where 'phy' means marks in physics and 'math' means marks in mathematics;
- ```
If((phy >= 80) || (math >= 90)
printf ("Eligible for admission")
```

**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 :



- (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  $-\pi \leq x \leq \pi$ .

**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) 
$$\frac{\partial^2 \phi}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 \phi}{\partial t^2}$$

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

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  $-1 \leq x \leq +1$ .

(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  |