2021

PHYSICS — HONOURS

Paper : SEC-A-1

[Syllabus : 2019-2020]

(Scientific Writing)

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. What will be the LaTeX command to write : e^{x^2} in math mode?

(A) e^x^2 (B) e^{x^2}

(C) $e**{x**2}$ (D) $**x**2$

2. To write the following integral in math mode

$$\int_0^{\pi} \sin\theta \, d\theta$$

which of the following LaTeX command is required?

(A) $\displaystyle\int_0^\pi sin \theta\, d\theta$

(B) $\displaystyle{\int\limits_0^\pi \sin \theta\, d\theta}$

(C) $\displaystyle\int_0^\pi \sin \theta\, d\theta$

(D) $\displaystyle{\int_0^\pi\ sin \theta\, d\theta}$

3. The quantity $\cos^{-1}(\theta)$ is written in LaTex as

(A) $\arccos(\theta)$ (B) $\cos^{–1}(\theta)$

(C) $\arccos{\theta}$ (D) $\cos inv{\theta}$

4. What will be the LaTex command to write :

$$\frac{\partial^2 f}{\partial x \partial y}$$

(A) $\frac{\del^2f}{\del x*\del y}$ (B) $\frac{\partial^2f}{\partial x\partial y}$

(C) $\frac{\delta^2f}{\delta x\delta y}$ (D) $\frac{\D^2}{\D x\D y}$

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5. The up arrow (↑) symbol is written in LaTeX as

(A) $\uparrow$ (B) $\Uparrow$

(C) $\UpArrow$ (D) $Uparrow$

6. Which of the following code block includes a picture inside a LaTeX document?

(A) \begin{picture}
\end{picture}

(B) \begin{figure}
\end{figure}

(C) \begin{fig}
\end{fig}

(D) \begin[figure]
\end[figure]

7. The LaTeX statement to create a vertical line is

(A) \vline (B) \Vline

(C) \vrline (D) \Vrline

8. To type $\vec{\mathbf{E}}$ symbol in math mode which of the following LaTeX instruction is used?

(A) $\overarrow{E}$ (B) $\overrightarrow{E}$

(C) $\overrightarrow{\textbf{E}}$ (D) $\vec{E}$

9. Which of the following code block prints more than one equations without any equation number inside a LaTeX document?

(A) \begin{eqnarry*}
\end{eqnarray*}

(B) \begin{eqs*}
\end{eqs*}

(C) \begin{eqnarray}
\end{eqnarry}

(D) \begin{equations*}
\end{equations*}

10. To create table in a LaTeX document which statement in the following is correct?

(A) \begin[table]
\begin[tabular]
\end[tabular]
\end[table]

(B) \begin{table}
\begin{tabular}
\end{tabular}
\end{table}

(C) \begin[tabular]
\begin[table]
\end[table]
\end[tabular]

(D) \begin{tabular}
\begin{table}
\end{table}
\end{tabular}

11. The LaTeX instruction for typing $\left.\frac{dy}{dx}\right|_{x=0}$ is given by :

(A) $\frac{dy}_(dx)\vert_x = 0$ (B) $\frac{dy}_(dx)\vert_{x = 0}$

(C) $\frac{dy}{dx}\vert_x = 0$ (D) $\frac{dy}{dx}\vert_{x = 0}$

12. The matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is written in LaTeX as :

(A)
```
\begin{pmatrix}
a & b \\
c & d
\end{pmatrix}
```

(B)
```
\begin{matrix}
a & b \\
c & d
\end {matrix}
```

(C)
```
\begin{vmatrix}
a & b \\
c & d
\end {vmatrix}
```

(D)
```
\begin{bmatrix}
a & b \\
c & d
\end {bmatrix}
```

[Syllabus : 2018-2019]

(Basics of Programming and Scientific Word Processing)

Full Marks : 80

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

1. Answer ***any ten*** questions : 2×10

(a) Write the FORTRAN/C expressions for the following : $\dfrac{3x}{4y^2 + x^{b/c}}$.

(b) Let j be an integer equal to 13. Find the value of $(j / 2*2 - j)$.

(c) Find the output of the following program written in C :

```
int main ()
 {
      int  i = 5,  j = 3;
      i = 10*i*(i-1)/j;
      printf("i=%4d\n",i);
      return  0;
 }
```

Or,

Find the output of the following program written in FORTRAN :

```
i = 5
j = 3
i = 10*i*(i-1)/j
write(*,10)i
```

```
10  format(i5)
    stop
    end
```

(d) Write the following statement in FORTRAN/C :

if $p > q$ then print "$p - q$ is +ve", otherwise print "$p - q$ *is* –ve".

(e) What is the command to plot the functions $y = 5x^2$ and $y = x$ in the same graph using GNUPLOT with dashed and solid lines respectively?

(f) Write the command to plot a circle of radius 2 unit using polar plot in GNUPLOT.

(g) Suppose $a = 2.0$ and $b = 3.0$. Write the code in FORTRAN/C to swap the values of the variables.

(h) Which code block is used to write more than one equation in LaTeX? Give one example.

(i) Write the GNUPLOT script to plot the following mathematical function

$f(x) = x,\ x \le 0$

$= -x,\ x > 0$

within the range $-2 \le x \le 2$.

(j) Write the code in LATEX to write the following :

$$\int_0^{2\pi} e^{-i\theta} d\theta$$

(k) Write the code in LATEX to write the world **UNIVERSITY** in bold font.

(l) Write the command in LATEX to write

$$\lim_{x \to \infty} \exp(-x)$$

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

(a) Write a program in C/FORTRAN to read the three components of any two vectors (x_1, x_2, x_3) and (y_1, y_2, y_3) and to check whether $(x_1y_1 + x_2y_2 + x_3y_3) = 0$ or not. Also write the Algorithm/Flowchart for the program.

(b) Write an algorithm / flowchart to read a 2×2 matrix, $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and to compute A^2.

(c) Write an algorithm / Flowchart of a program to read any number x, and to check whether it is a prime number or not.

(d) The ith Fibonacci number, F_i, is obtained from the relation

$$F_i = F_{i-1} + F_{i-2}$$

The first two Fibonacci numbers are, by definition, 1, that is, $F_1 = F_2 = 1$. Write a program in C/FORTRAN to determine the 7th Fibonacci number.

(e) Write the Latex code to type the following equations

(i) $C_P - C_V = \frac{VT\beta^2}{KT}$

(ii) $\frac{dP}{dT} = \frac{L}{T\left(V_f - V_i\right)}$

(f) Define the function $f(x) = x^2 + 3$ and write command to plot it for $x = -3$ to $+3$ using GNUPLOT. Show the X-axis and Y-axis on the graph. Lebel the X-axis as 'x' and Y-axis as '$f(x)$'.

3. (a) Write a code in FORTRAN/C to arrange the following numbers in ascending order

2, –3, 3, 9, 4, 8

(b) Write a program to compute the sum of the following series :

$S = a + ar + ar^2 + ar^3 + ar^4 + ... + ar^n$

where $a = 5$, $r = 0.5$ and $n = 10$. 5+5

4. Write a code in FORTRAN/C to calculate the sum of every third integer, staring from $i = 1$, that is $(1 + 4 + 7 + ...)$ for all values of i that are less than 100. Also write the Algorithm/Flowchart of the program. 5+5

5. (a) Give the output of the following code :

```
int main ()
{
   int i=1, j=0;
   while(1 <= 5)
    {
     j = j + 2*1;
     ++i;
    }
   printf("%d\n",j);
   return 0;
}
```

***Or*,**

Write the output of the following code :

```
i = 1
j = 0
do while(i.le.5)
j = j + 2*i
i = i + 1
enddo
```

```
write(*,*)j
stop
end
```

(b) Write a code in FORTRAN/C to calculate the sum

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots \text{upto 10 terms}$$

for any x. 5+5

6. Write the LaTex source code to create the following table : 10

	Amount (kg)	Rate @ kg	Delivery Date
Item I	2500	370	10.01.2016
Item II	750	251	03.02.2016
Item III	350	75	13.12.2015

7. Write the LATEX source code to type the following equations / statements : 2×5

(a) $x = \left(\frac{a\, lnb}{c^2} \right)^4$

(b) $m = \frac{m_0}{\sqrt{1 - v^2 / c^2}}$

(c) $I = \oint d\vec{r}$

(d) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

(e) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$

8. (a) Write code in LATEX to type the following equation :

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} \cos\theta_1 & \sin\theta_1 \\ -\sin\theta_1 & \cos\theta_1 \end{pmatrix} \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$$

(b) Write a LaTeX statement to insert an image in a document with centering. 7+3

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