UNIVERSITY OF CALCUTTA · Previous Year Question Paper

2024

MATHEMATICS — HONOURS

Paper: SEC-2.1

(Python Programming and Introduction to LaTeX)

Full Marks: 75

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The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group - A
(Python Programming)
(Marks : 50)

1. Answer *any five* questions :

(a) Suppose in Python `a = False, b = True, c = True`, then evaluate the value of the following expressions :

(i) `a or b`

(ii) `(a and b) or c`

(iii) `a and (b or c).` **3**

(b) What is a list in Python? How can you check if 3 is an element of the list `[1, 7, 5, 3, 4]`? **1+2**

(c) Write down the syntax of an if-else statement in Python. Write a Python program using if-else statements to check whether a number is even or odd. **1+2**

(d) Given a list : `primes = [2, 3, 5, 7, 11, 13, 17, 19, 23, 29]`. How do you obtain the first four primes? **3**

(e) Define dictionary with example in Python. **3**

(f) Use SymPy to compute the expression $x^3 + xe^y$ for $x = 1.5, y = 0.75$. **3**

(g) Write a Python program to find the surface area $(4\pi r^2)$ of a sphere, where radius of spherer is given. **3**

2. Answer *any seven* questions :

(a) Write the output of the following codes in Python :

(i) `x = 'Hello'; print(x+x)`

(ii) `print(len(["Math", 2, 4, 6]))`

(iii) `print(4%2+5**2**2+5/2).` **2+1+2**

(b) Explain the importance of "break" and "continue" statements with examples in Python. **5**

(c) (i) Write a Python program to calculate the sum of three given numbers. If the values are equal, print "The numbers are all equal".

(ii) Write the values of y in following code :

```
y = [x for x in range(10) if x%2 == 0]
print(y).
```

3+2

(d) Write a Python function to compute $S = \sum_{n=1}^{30} \frac{1}{u_n^2+1}$, where $u_1 = 1$, $u_2 = 1$ and $u_{n+1} = u_n + u_{n-1}$, $n \geq 2$. **5**

(e) Write a Python program to generate a list of all primes number between two positive integers 20 and 50. **5**

(f) (i) Find the value of python code `2**6 - 35//6%7`.

(ii) Use SymPy to find the roots of the equation $x^4 - x^2 + 1 = 0$.

(iii) Use SymPy to simplify the expression $(x^3 + y^3)(x^3y + 2y^2)$. **1+2+2**

(g) Write short notes on the list operations :

(i) `sort()`

(ii) `append()`

(iii) `pop()`. **5**

(h) Write a Python program to check whether a year is a leap year or not. **5**

(i) Plot the functions $f(x) = x^2$ and $g(x) = x^3$ on the same graph over the interval $[-2, 2]$ using a dashed line for $f(x)$ and a dotted line for $g(x)$. Also add labels to the axes and a title to the graph. **2+2+1**

(j) Plot the following two functions in one graph using SymPy :

(i) $f(x) = x^2$ in $(-2, 2)$ in color black.

(ii) $g(x) = x^3 - 2$ in $(-2, 2)$ in color blue. **5**

Group - B

(Introduction to LaTeX)

(Marks : 25)

3. Answer *any five* questions : 2×5

(a) What is the output of the LaTeX command :

```
$$\frac{d}{dx}\left(\int_{0}^{x}f(t),dt\right)=f(x).$$
```

(b) What is the wrong with the following input in LaTeX command? What is the right way to do it?

```
If $theta = pi$ then $sin theta = 0$.
```

(c) Write down codes in LaTeX to produce the following output : $\left|\frac{1}{1+x}\right|$.

(d) Write three LaTeX commands for font size and style of a tex.

(e) Write the command in LaTeX to generate the expression $\forall x \in \mathbb{R}$.

(f) Write LaTeX command for the following output : $\alpha^2 + \beta^2 = \gamma^2$.

(g) What is the command for an underlined text in LaTeX? Give one example.

Answer *any three* questions : 5×3

4. (a) Write the following statement in LaTeX :
"The well-known Pythagorean theorem $x^2 + y^2 = z^2$ was proved to be invalid for other exponents. Meaning the next equation has no integer solutions :

$$x^n + y^n = z^n, \quad x, y, z \in \mathbb{N}."$$

(b) Write a block of LaTeX code to display the mathematical expressions :

$$\begin{pmatrix} \alpha & \lambda & \sqrt{\tan\theta} \\ \beta & \beta^2 & \beta^3 \\ \frac{1}{3} & -10 & \sqrt{3} \end{pmatrix}.$$

(c) Write a block of LaTeX source code to create the following table :

	Amount (kg)	**Rate/kg**	**Delivery place**
Item I	2500	370	Kolkata
Item II	750	251	Chennai
Item III	350	75	Mumbai

(d) Write a block of LaTeX code to print the following system of equations in its present form :

$$\begin{aligned} 20x + 7y + 45z + 11u &= 1 \\ 15z + 9u &= 7 \\ 5x + 17y + 5z + 9u &= 1 \\ 13y + 6z + 3u &= 2. \end{aligned}$$

(e) Write code in LaTeX for typesetting the following :

$$f(x) = \begin{cases} -1 & x < 0 \\ 0 & x = 0 \\ +1 & x > 0. \end{cases}$$

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