(b) Create a NumPy array representing the average temperature (in °C) for 12 months:

temps = [15, 17, 21, 26, 30, 32, 31, 29, 27, 23, 19, 16]

months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

Plot a bar graph of temperature vs months using Matplotlib. Add markers, title, and x-axis labels as month names. (6+6+6)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5747 **K**

Unique Paper Code : 2512011101

Name of the Paper : Programming Fundamentals using Python

Name of the Course : **B.Sc. (H) Electronics (CORE)**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** questions in all, out of which you have to attempt any **five** questions.
3. **All** questions carry equal marks.
4. **First** Question is Compulsory.

1. (a) Evaluate the following expression:

```
15 // 4 + 15 % 4 * 4 – 6
```

(b) Examine the following code and identify any errors, if present. Provide a brief justification for your answer

```
total=0
N=5
for i in range(1,N+1):
    for j in range(1,N+1):
total+=j
print(total)
```

(c) Explain how .loc[] and .iloc[] differ when selecting data from a DataFrame.

(d)
```
x = 10
def show():
    x = 5
    print("Inside function, x =", x)
```


(i) Create Pandas DataFrame using the above data and display it.

(ii) Add a new column named Total_Sales, calculated as:

Total_Sales = Units_Sold x Price_per_Unit

(iii) Find the Total sales for each month

(b) Create a class Rectangle with attributes: length and width.

Member methods: Area() that returns the area of the rectangle.

Perimeter() that returns the perimeter of the rectangle.

Display() that prints the rectangle's length, width, area, and perimeter in a readable format.

Create an object of the class and display their details using the Display() method.

- A line plot of heights (y-axis) vs. time_points (x-axis).
- A title: "Projectile Trajectory Simulation".
- Labels for the axes: "Time (s)" and "Height (m)" (6+12)

7. (a) A store keeps track of its monthly sales for two products: Pen and Book. The data is as follows :

Month	Product	Units_Sold	Price_per_Unit
Jan	Pen	120	10
Jan	Book	80	50
Feb	Pen	150	10
Feb	Book	60	50
Mar	Pen	130	10
Mar	Book	100	50
Apr	Pen	170	10
Apr	Book	70	50

show()

print("Outside function, x =", x)

Trace the output of the above program and identify which x is local and which is global in the above code. Explain why the values of x inside and outside the function differ.

(e) Define a function mix(a, b=2) that returns a*b + b. Give outputs for: mix(3), mix(b=5), mix(4, b=3).

(f) Give the output of the following python snippet

```
set1 = {10, 20, 30, 40, 50, 60}
set2 = {50, 60, 70, 80, 90, 100}
print(set1|set2)
print(set1&set2)
```

(3×6=18)

2. (a) Write a Python program to demonstrate the use of identity operators and membership operators.

P.T.O.

(b) Write a Python program to display a pyramid pattern using nested loops.

1

1 2

1 2 3

1 2 3 4

(c) What will be the output of the following Python code :

a = 15

b = 3

(i) print (a & b)

(ii) print (a | b)

(iii) print (a ^ b)

(iv) print (~a)

(v) print (a << 2)

(vi) print (b >> 1) (6+6+6)

$$h(t) = v_0t - 0.5\ gt^2$$

where :

t = time in seconds

v_0 = initial vertical velocity (in m/s)

g = acceleration due to gravity (in m/s^2)

Assume v_0 = 50m/s and g = 9.8m/s

(i) Create a NumPy array named time_points that represents time from 0 to 10 seconds (both inclusive) with a step of 0.1 seconds.

(ii) Using this array, calculate the corresponding heights of the projectile.

(iii) Determine and print the maximum height reached by the projectile, and the time at which the maximum height occurs.

(iv) Generate a plot showing the trajectory of the projectile. The plot must include:

(ii) Add a new country and capital into the created dictionary.

(iii) Remove any one country and its capital from the created dictionary.

(c) Write Python statements to :

(i) Create an empty tuple using two different methods.

(ii) Create a tuple with a single element and explain why the statement t = (8) does not form a tuple.

(iii) Convert a tuple into a list and then convert the list back into a tuple. (6+6+6)

6. (a) What is inheritance in object-oriented programming? Explain single, multiple, and multilevel inheritance using a suitable example.

(b) The height (h) of a projectile at any time t, ignoring air resistance, is given by the formula :

3. (a) What will be the output of the following assignment statement:

string1 = 'HONESTY is the best POLICY'

(i) print(len(string1))

(ii) print (string1[7: -1])

(iii) print (string1.find('case'))

(iv) print (string1[-len(string1):len(string1)])

(v) print (string1.swapcase())

(vi) print (string1.isalpha())

(b) Write a Python program to :

(i) Take 5 inputs from the user and store them in a list

(ii) Print the list in reverse order

(iii) Sort the list in ascending and descending order

P.T.O.

(c) Write a Python program to demonstrate set methods like add(), remove(), discard(), pop(), clear(). (6+6+6)

4. (a) Write a simple python program that checks the presence of '@' and '.' in an email id taken as input from the user and also give their position of occurrence in the email id.

(b) Give the output of the following python script

str1 = "I love Python"

str2 = "I learn Python"

(i) print(str1[6])

(ii) print(str2*2)

(iii) print(str2[:9])

(iv) print(str1[-9])

(v) print(str1[-2:])

(vi) print(str2+" & Java")

(c) How does a recursive function differ from an iterative function? Explain the working of a recursive factorial function using a step-by-step function call trace. (6+6+6)

5. (a) Consider a list nums = [10, 12, 15, 18, 20, 21, 24, 27, 30].

Write a python program to :

(i) Display all elements of nums that are divisible by 5.

(ii) Display the list in reverse order using slicing notation.

(iii) Delete all the elements that are factors of 3.

(b) Create a dictionary of five countries and their capitals and perform the following operations :

(i) Allow the user to input a country name and display its capital.