ADVANCED PROGRAMMING CONCEPTS WITH PYTHON
(MCA1102)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) What will be the output from the following Python code snippet?

```
x, y = 5, 5.5
print(type(x), type(y))
```

(a) <class 'int'> <class 'decimal'> (b) <class 'int'> <class 'float'>
(c) <class 'int'> <class 'real'> (d) <class 'number'> <class 'float'>

(ii) What will be the output from the following Python code snippet?

```
a = [1, 2, 3]
b = a * 2
print(b)
```

(a) [1, 2, 3, 3, 2, 1] (b) [2, 4, 6]
(c) [1, 4, 9] (d) [1, 2, 3, 1, 2, 3

(iii) How can you use range() to generate a sequence from 10 to 0 in steps of -2?
(a) range(10, 0, -2) (b) range(10, -1, 2)
(c) range(10, -1, -2) (d) range(10, 0, 2)

(iv) How can we check whether a key is present in a dictionary?
(a) Using the in keyword (b) Using the has_key() method
(c) Using the key_exists() method (d) Using the contains() method

(v) How can you retrieve all the keys from a dictionary 'my_dictionary'?
(a) my_dictionary.keys() (b) my_dictionary.get_keys()
(c) my_dictionary.all_keys() (d) my_dictionary.keys_list()

(vi) What will be the output from the following Python code snippet?

```
college = 'HIT'
city = 'KOLKATA'
print(college[:2] + city[-2:])
```

(a) TATA (b) HITTA (c) HIKOLKA (d) HITA

(vii) Which of the following statements is true about class methods in Python?
(a) They can only be called from instances of the class.
(b) They can modify the class state but not the instance state.
(c) They require the self parameter.
(d) They can be called without creating an instance of the class.

(viii) How can you achieve method overriding in Python?
(a) By using the @override decorator
(b) By using the super() function
(c) By defining methods with the same name in both the parent and child classes
(d) By defining a method inside another method

(ix) The default mode for opening a file with open() is
(a) rt (b) rb (c) wt (d) wb

(x) What is the primary data structure in pandas used for 1-dimensional labelled data?
(a) Array (b) Panel (c) Series (d) Dataframe

Fill in the blanks with the correct word

(xi) The data type that represents true or false values is called _____.

(xii) The _____ method removes all items from a list.

(xiii) To get the number of elements in a set, we can use the _____ function.

(xiv) _____ inheritance allows a class to be derived from more than one base class.

(xv) The NumPy array object has a property called _____ that returns the data type of the array.

Group - B

2. (a) Which of the following are legal Python variable names? If a name is not legal, state the reason.
Mca25, 25mca, student_name, student-name, pass, _pass *[(CO1)(Analyse/IOCQ)]*

(b) State the differences between '==' and 'is' with suitable examples.
[(CO1)(Understand/LOCQ)]

(c) Write a Python script to evaluate the series:
$x - x^3/3! + x^5/5! - x^7/7! + \ldots$ up to n terms *[(CO3)(Apply/IOCQ)]*

3 + 4 + 5 = 12

3. (a) Discuss the importance of indentation in Python. Provide examples showing correct and incorrect indentation. How does the incorrect indentation in your example affect the execution of Python code? *[(CO1)(Understand/LOCQ)]*

(b) Workout the output from the following code snippet with explanation

```
for num in range (0, 20, 2):
  if not num % 3:
    print(num * 2)
```

[(CO3) (Analyse/IOCQ)]

(c) Write a Python script that accepts a positive integer from a user, and checks whether that number is an Automorphic number or not. [An automorphic number is a natural number whose square ends in the same digits as the number itself] *[(CO3)(Apply/IOCQ)]]*

(2 + 1 + 1) + 3 + 5 = 12

Group - C

4. (a) Workout the output from the following code snippet with explanation

```
a = [1, [2, 3], (4, 5)]
b = list(a)
a.append(6)
a[1].remove(3)
print('a:', a, 'b: ', b)
b[1] += [7]
b[2] += (8,)
print('a:', a, 'b:', b)
```

[(CO2)(Analyse/IOCQ)]

(b) Explain how the 'split' and 'join' methods work with Python strings. *[(CO2)(Understand/LOCQ)]*

(c) Write a Python function 'invertDict' that takes a dictionary and returns a new dictionary with keys and values swapped. If there are duplicate values in the original dictionary, the function should group them in a list. *[(CO2)(Apply/IOCQ)]*

4 + 4 + 4 = 12

5. (a) What is deep copy of a list? How is it different from shallow copy? What happens when a list having a nested list undergoes shallow copy? *[(CO2)(Understand/LOCQ)]*

(b) Analyse the statement "Tuples are immutable". *[(CO2)(Analyse/IOCQ)]*

(c) Write a Python script that, given a string, outputs the longest substring of consecutive consonants. If more than one such substring has the same length, the first should appear in the output. *[(CO2)(Apply/IOCQ)]*

4 + 3 + 5 = 12

Group - D

6. (a) Differentiate among local, non-local, global and built-in scopes in Python. *[(CO3)(Understand/LOCQ)]*

(b) What is a namespace? How are most namespaces implemented in Python? *[(CO4)(Understand/LOCQ)]*

(c) Explain with a relevant example how multiple inheritance works in Python. *[(CO4)(Understand/LOCQ)]*

4 + 2 + 6 = 12

7. (a) How can you handle multiple exceptions using a single 'except' block? Provide an example. *[(CO4)(Understand/LOCQ)]*

(b) Differentiate between class method and instance method with suitable example. *[(CO4)(Understand/LOCQ)]*

(c) Define a class 'Shape' with a method 'area', and a derived class 'Rectangle' that overrides this method. Describe how overriding allows the derived class to provide a specific implementation for the 'area' method. *[(CO4)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) Suppose, a NumPy array is created with the following statement:

```
import numpy as np
a = np.arange(2,25,2).reshape(3, 4)
```

(i) What will be the output from the following?

```
print(a)
print(a.ndim, a.shape, a.size, a.strides)
print(a[1:,-3::2])
```

(ii) Extract all the numbers divisible by 3 from the array 'a' using a Boolean mask. *[(CO6)(Apply/IOCQ)]*

(b) Describe the purpose of the 'with' statement in Python when working with files. How does it differ from manually opening and closing files using open() and close()? *[(CO5)(Understand/LOCQ)]*

8 + 4 = 12

9. (a) You have a dataset named 'student_scores.csv' that contains information about students and their scores in different subjects. The columns are: Student_ID, Name, Math, Science, and English. Write a Python script using the Pandas library to perform the following tasks:

(i) Load the CSV file into a DataFrame.

(ii) Calculate the total score for each student by summing up their scores in Math, Science, and English.

(iii) Add a new column named Total_Score to the DataFrame that stores these calculated values.

(iv) Identify the top 5 students with the highest Total_Score.

(v) Save the DataFrame containing only these top 5 students and their scores to a new CSV file named 'top_students.csv'. *[(CO6)(Apply/IOCQ)]*

(b) Develop a Python script that reads a file and removes all blank lines from it. The modified content should be written back to the same file. *[(CO5)(Apply/IOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.67	58.33	0