PYTHON PROGRAMMING
(CSEN 2103)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   Which one of the following is a mutable data type?
          (a) String   (b) Integer   (c) Tuple   (d) Dictionary.

    (ii) An interpreter
          (a) scans the entire program and translates it as a whole into machine code
          (b) generates intermediate object code which further requires linking, hence requires more memory
          (c) makes debugging more difficult
          (d) translates a program one statement at a time.

    (iii) What will be displayed, when the following code is executed?
          lst = [3, 5, 7, 9]
          lst[1:2] = [6, 12,15]
          print(lst)
          (a) [3, 6, 12, 15, 9]   (b) [3, 5, 7, 9, 6, 12, 15]   (c) [3, 6, 12, 15]   (d) [3, 6, 12, 15, 7, 9]

    (iv) _____ is the model in which instructions have the effect of making changes to memory
          (a) Imperative programming paradigm   (b) Object-oriented programming paradigm
          (c) Functional programming paradigm   (d) None of the above

    (v)   print('ABABABABA'.replace('ABA','C')) statement, when executed, will display
          (a) CCBC   (b) CBCBA   (c) CBCC   (d) CCCBA.

    (vi) If a is given list, print([x*x for x in a if x > 2 and x < 5]) is an example of
          (a) Reduction   (b) List comprehension   (c) Concatenation   (d) Inheritance.

    (vii) What will be the shape of y, after application of Broadcasting Rule # 1, in the following code?
          import numpy as np
          x = np.ones((2,3))
          y = np.arange(3)
          z = x + y
          (a) (1, 3)   (b) (3, 1)   (c) (2, 3)   (d) (3, 2).

    (viii) A technique to describe indexing using integer arrays in NumPy is known as
          (a) Integral indexing   (b) Fast indexing
          (c) Fancy indexing   (d) None of the above.

    (ix) What will be displayed when the following piece of code is executed?
          import numpy as np
          import pandas as pd
          df = pd.DataFrame([[5.1], [np.nan]], index = ['Row1','Row2'],
          columns = ['Col1'])
          print(df.sum())
          (a) Col1 5.1   (b) Col1 NaN   (c) Row1 5.1   (d) Row1 NaN.

    (x)   To create an empty set, we use the notation
          (a) s = {}   (b) s = []   (c) s = ()   (d) s = " "

Group- B

2. (a) What will be the output of the following code if "break" is removed?
```
def find_char(char):
    my_string = "Computing"
    for character in my_string:
        print(character)
        if character == char:
            print("Found " + char + " :)")
            break
    return None
```
                                                            [(CO2) (Evaluate/HOCQ)]

    (b) What will be the output of the following code?   [(CO2) (Evaluate/HOCQ)]
```
def my_func(n):
    if n > 1:
        my_func(n//2)
    print(n % 2,end = '')
my_func(1)
my_func(2)
my_func(8)
my_func(15)
```

    (c) In Python, what is a lambda function? Explain with examples.   [(CO2)(Remember/LOCQ)]

    (d) In Python, how are exceptions handled? Explain with examples.   [(CO2)(Understand/LOCQ)]

                                                                   4 + 4 + 2 + 2 = 12

3. (a) In Python, what is the __init__ method used for?   [(CO3)(Understand/LOCQ)]

    (b) Does Python allow a child class to inherit from multiple parent classes? If yes, give an example where such inheritance may be useful.   [(CO3)(Remember/LOCQ)]

    (c) In Python, which method is used to return the string representation of an object? Illustrate with examples.   [(CO3)(Understand/LOCQ)]

    (d) What is the name of the temporary storage lying between the memory and disk that the file handle gives access to?   [(CO2)(Understand/LOCQ)]

    (e) If fh is a file handle, what is the difference between fh.readline() and fh.readlines()?

                                                               [(CO2)(Remember/LOCQ)]

                                                           2 + 3 + 3 + 1 + 3 = 12

Group - C

4. (i) How do you create an empty set in Python?

    (ii) What is the main advantage of using set, as opposed to a list, in Python?

    (iii) Is it possible to create a set of sets? Justify your answer.

    (iv) How do you create an empty dictionary in Python?

    (v) Let there be a dictionary d = {'Name': 'Deepak Gupta', 'Physics': 82, 'Mathematics': 95}
        What will be displayed when d.items() is executed?

    (vi) How do you create an empty tuple in Python?

    (vii) A tuple is defined as date = (15,8,1947). Display the date as 15/8/1947

    (viii) Which of the following pair is recommended for a string s (from CPU usage point of view)?
        s[5:] versus s[5:len(s)]

    (ix) What is the statement in Python to push a value v in stack s?

                                                         [(CO1)(Understand/LOCQ)]

                                            (1 + 1 + 2 + 1 + 2 + 1 + 2 + 1 + 1) = 12

5. (a) Write a Python code, using (i) List comprehension method and (ii) Functionalprogramming approach, to eliminate from a list, all the multiples of its firstelement.   [(CO3)(Analyse/IOCQ)]

    (b) Write a Python code, using (i) List comprehension method and (ii) Functional programming approach to find a list (y), containing the squares of the odd elements of another list x.   [(CO3)(Analyse/IOCQ)]

    (c) Initialize a list with all integer numbers from 1 to 8 (both inclusive). Write a Python code, using anonymous function,
        (i) to display the values of 3 times of each of the elements of the list

(ii) to display only the odd elements of the list
(iii) to display the sum of squares of all the elements of the list.   [(CO3)(Analyse/IOCQ)]
(2 + 2) + (2 + 2) + (1 + 1 + 2) = 12

Group - D

6. Using built-in functions wherever possible, write a code to:
(i) Create a NumPy array (name: nparr) of 9 equi-spaced numbers between 1 and 3 in linear scale.
(ii) Take the last six elements of 'nparr' in reverse order using negative integers for start index, stop index andstepsize and put it in an array 'revarr'.
(iii) Create another array (name: randarr) containing 6 random numbers (0 to 1).
(iv) Create a Boolean array (name: boolarr) such that its element is True if the corresponding element in the'randarr' multiplied by 10 is greater than or equal to 5; otherwise it is False
(v) Take from 'revarr' only those elements for which the corresponding element in the array 'boolarr' is True andkeep them in 'finarr'.
(vi) Display the minimum, maximum, mean, median, variance, standard deviation of the elements in 'finarr'.
[(CO4, CO6)(Understand/LOCQ)]
(6 × 2) = 12

7. (a) Where is the name "pandas" derived from?   [(CO4)(Remember/LOCQ)]
(b) The data structures and operations of pandas are mainly focussed towards what activities? Explain with examples.   [(CO4)(Understand/LOCQ)]
(c) What will the following code display?   [(CO4) (Analyze/IOCQ)]
```
import pandas as pd
obj = Series([2,7,-3,9])
print(obj)
```
(d) What is a pandas data frame? Explain with examples how it is used.   [(CO4)(Understand/LOCQ)]
2 + 3 + 3 + 4 = 12

Group - E

8. (a) Sketch the plot that will be generated by the following code:
```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(1, 5, 20)
y = 5 / x
plt.plot(x,y)
plt.show().
```
[(CO5) (Analyse/IOCQ)]
(b) What will be the output of the following code?
```
import numpy as np
from scipy import optimize
def f(x):
    return(x**2 -5*x +11)
x_min = optimize.brent(f)
print(x_min, f(x_min))
```
[(CO5) (Understand/LOCQ)]
(c) Sketch the plot that will be generated by the following code:
```
import matplotlib.pyplot as plt
import numpy as np
x = np.linspace(-4, 4, 20)
y = np.sqrt(16 - x*x)
plt.plot(x,y)
plt.show().
```
[(CO5)(Analyse/IOCQ)]
4 + 4 + 4 = 12

9. (a) In the context of SymPy, what is symbolic computation? Explain with examples.
[(CO5)(Remember/LOCQ)]

(b)   What will be the output of the following code?   [(CO5)(Analyze/IOCQ)]
import sympy
sympy.sqrt(8)

(c)   What will be the output of the following code?   [(CO5)(Analyze/IOCQ)]
from sympy import symbols
x, y = symbols('x y')
expr = x + 2*y
x*expr

(d)   What kind of inputs are expected by the plotting functions of Matplotlib?   [(CO5)(Understand/LOCQ)]

3 + 3 + 3 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	61.46	30.21	08.33

Course Outcome (CO):

After the completion of the course students will be able to

CSEN2103.1. Understand the basics of the Python Programming Language and its data structures viz. Lists, Tuples, Dictionaries and Sets

CSEN2103.2. Develop Python codes using iterations, recursion, function, input/output with files and using exception handling

CSEN2103.3. Learn how to manipulate strings, use regular expression, object-oriented features of Python and also how to write good and efficient codes in Python

CSEN2103.4. Apply NumPy library and develop codes using Pandas data structures (Series and Data Frames) and other features of Pandas

CSEN2103.5. Learn GUI programming using Tkinter, Symbolic computing using SymPy, plotting and visualization using Matplotlib and Equation Solving, Optimization, Interpolation, Integration and solving Ordinary Differential Equation using SciPy.

CSEN2103.6. Apply Python in building solutions to basic data analysis problems

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question