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321404

May-2026

B.Sc. (Physics) - IV Semester

Programming with Python

(PHU-214-V)

Time : 3 Hours] [Maximum Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Differentiate between compiler and interpreter computer languages. (1.5)

(b) Illustrate systematic and random errors. (1.5)

(c) Define interactive and script mode in Python. (1.5)

(d) Predict the output of the program :

num1, num2 = 2, 3

num3, num2 = num1, num3 + 1

print (num1, num2, num3). (1.5)

(e) What is 'concatenation'? Explain with an example. (1.5)

(f) Distinguish between inbuilt and user-defined functions along with examples. (1.5)

(g) Write a Python program to check whether a number is prime or not. (1.5)

(h) What is NumPy? How is it different from List? (1.5)

(i) How a row can be added or removed in NumPy? Explain with an example. (1.5)

(j) Discuss the plotting of histograms in Matplotlib? (1.5)

PART–B

2. (a) Evaluate the propagation of error in $z = \left(\frac{u}{x}\right) + y^3$, wherein, $u = (2.42 \pm 0.02)$ cm, $x = (4.0 \pm 0.1)$ cm and $y = (5.0 \pm 0.3)$ cm. (5)

(b) Describe various Python basic Operators along with examples of each. (10)

3. (a) Write a Python program to calculate the amount payable if Rs. 10,000/- has been lent on simple interest at a rate of 14% for 3 years. (5)

(b) Write a general program for temperature conversion. (5)

(c) The formula $E = mc^2$ states that the equivalent energy (E) can be calculated as the mass (m) multiplied by the speed of light (c = about 3×10^8 m/s) squared.

Write a program that accepts the mass of an object and determines its energy. (5)

4. (a) Create a user-defined function to perform simple operation like finding largest of three numbers. (5)

(b) What is recursion in a function? Explain using the example of factorial of a number. (5)

(c) What is indentation? Discuss the role of indentation in control statements using an examaple. (5)

5. Write Python program for each :

(a) Generate a 2-D array with 3 rows, each row containing 5 random integers from 0 to 100.

(b) Print first 20 integers using while loop. How the program change if one exit the loop after 12th integer number?

(c) Check whether the roots of a quadratic equation are real, complex or equal?

(d) Identify a number is prime or not?

(e) Reversing the digits of a 4 digit number. (3×5=15)

6. (a) Predict the output in each case :

(i)
```
import numpy as np
arr = np.array([1, 2, 3, 4, 5, 6, 7, 8])
newarr = arr.reshape(3, 3)
```

(ii)
```
import numpy as np
arr = np.array([1, 2, 3, 4, 5, 6, 7])
print(arr[:4])
```

(iii)
```
import numpy as np
arr = np.array([[3, 2, 4], [5, 0, 1]])
print(np.sort(arr))
```

(iv)
```
import numpy as np
arr1 = np.array([[1, 2], [3, 4]])
arr2 = np.array([[5, 6], [7, 8]])
arr = np.concatenate((arr1, arr2), axis=1)
print(arr)
```

(v)
```
import numpy as np
arr = np.array([[[1, 2, 3], [4, 5, 6]], [[1, 2, 3],
[4, 5, 6]]])
print(arr)
```
(5×2=10)

(b) How mean, standard deviation and variance of an array can be computed using NumPy? Explain with an example. (5)

7. Elaborate plotting of $\cos(x) + \sin(x)$ using Matplotlib between $-\pi$ to $+\pi$. Also discuss the commands for the following :

(a) Mark each point with a circle.

(b) Plot using a dashed line.

(c) Add a plot title and labels for the x- and y-axis.

(d) Display only grid lines for the x-axis.

(e) A simple scatter plot. (15)