Information Booklet cum Syllabus

Of

Programming and Problem Solving Through Python Language.
(O-Level -M3-R5.1 Module)

July 2025

National Institute of Electronics and Information Technology

An Autonomous Scientific Society under
Ministry of Electronics and Information Technology, Government of India

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1. ## About Course

   Python is easy to use, powerful and versatile programming language, making it a great choice for developers. Python is used widely in different areas likes building Raspberry Pi applications, writing script program for desktop applications, configuring servers, developing machine learning& data analytics applications and developing web applications.

2. ## NIELIT

   National Institute of Electronics and Information Technology, NIELIT, (Erstwhile DOEACC Society) is an autonomous scientific society of the Ministry of Electronics & Information Technology, Government of India. The Society is registered under the Societies Registration Act, 1860. NIELIT was set up to carry out Human Resource Development and related activities in the area of Information, Electronics & Communications Technology (IECT). NIELIT is engaged both in Formal & Non-Formal Education in the areas of IECT besides development of industry-oriented quality education and training program in the state-of-the-art areas. NIELIT has endeavored to establish standards to be the country's premier institution for Examination and Certification in the field of IECT. It is also one of the National Examination Body, which accredits institutes/organizations for conducting courses in IT and Electronics in the non-formal sector.

3. ## Objective of Course

   The objectives of this module are to make the learners understand the programming language concepts like Data Types, Loops, Functions; Python Lists, Strings, Tuples, Dictionaries, Elementary Data Handling using Pandas, NumPy etc. After completion of this course, the learner is expected to analyze the real life problem and write a program in Python to solve the problem. The main emphasis of the module will be on writing algorithm to solve problems and implement in Python. After completion of the module, the learner will be able to after completing the module, the learner will be able to:

   ➢ Draw flow charts for solving different problems.
   ➢ Develop efficient algorithms for solving a problem.
   ➢ Use the various constructs of Python viz. conditional, iteration.
   ➢ Write programs making judicious use of Lists, Strings, Tuples, and Dictionaries wherever required.
   ➢ Manage data using NumPy.
   ➢ Handle files and create Modules in Python.
   ➢ Data Handling and Visualization Using Pandas & Matplotlib.
   ➢ Data Connectivity with SQL Lite.
   ➢ Introduction to GUI Programming.

   This course covers the " Programming and Problem Solving through Python" paper (Module Code: M3-R5.1/ A3:R5.1) of the NIELIT 'O'/'A' Level course.

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4. **Job Roles of Course**

After successful completion of the qualification the candidates shall be employed in the industries for following occupations:

- Assistant Programmer
- Training/Faculty
- And also make Career in Machine Learning/AI

If already working this course is very useful to in-hence your knowledge and Skills and after completed course you can go ahead for advanced courses like AI/ML Data Science etc.

5. **Eligibility**

12th Pass.

6. **Total duration of the Course**

60 Hours (Theory: 20 Hrs, Practical: 40 Hrs)

7. **Course Details**

7.1. Course Outline and Objective of Each Unit

S. No./Unit	Topic	Duration (Theory) in Hours	Duration (Practical) in Hours	Total Learning Hrs.	Learning Objectives
Unit-1	Introduction to Programming, Algorithm and Flowcharts to solve problems, Python Installation, Python virtual machine, Operator, Data Types, & Input/output	1	3	4	After completion of this unit of module, Learner will be able to • Understand the concept of programming. • Understand evolution of programming. • Understand features of Python that make it one the most popular languages in the industry. • Understand structure of Python problem. • Understand the areas where Python is used. • Python version and Installation

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					• Use the different Types of Operator, variables, data types, Keywords and expressions available in Python in developing program. • Making Program in Python • Input/output Function in Python • Take input from console. • Understanding Comments/multiline comments
Unit-2	Concept of indentation and if,elif-else Statement, Loop	2	4	6	After completing this unit, Learner will be able to understand. • Understand and use various Python statements like conditional constructs, looping constructs in writing Python program. • Concept of Indent Spacing. • Conditional Statement, Nested Statement by using if-elif-else • Use of Loop (for, while) • Nested Loop.
Unit-3	Sequence data types	2	4	6	After completing this unit, Learner will be able to understand • Work with various built-in Sequence data types and their use. • Understand the concept of mutable and immutable objects.
Unit-4	Introduction to User Defined Function(UDF), Anonymous Function	2	6	8	After completing this unit, Learner will be able to understand.

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	Module & Package.				• Apply the in-built functions available in Python in solving different problems. • Work with modular approach using user defined functions. • Import Module • Create Package
Unit-5	File Handling	1	3	4	After completing this unit, Learner will be able to understand. • Open File in read/write mode. • Read/Write input/output data in text file. • Store input/output data in text file.
Unit-6	OOPS Concept, Exception Handling Regular Expression	4	6	10	After completing this unit, Learner will be able to understand. • Object Oriented Programming Concepts • Classes and Objects, Encapsulation Constructor, Destructor and Inheritance • Data Hiding, Method Overriding, Polymorphism • Handling Exceptions: try…except, try…finally. • Regular Expression Use.
Unit-7	Numpy	2	2	4	After completing this unit, Learner will be able to understand. • Installation of Numpy. • Use ndarray Array. • Provides a lot of supporting functions that make

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					working with ndarray very easy.
Unit-8	Pandas & Matplotlib	2	4	6	After completing this unit, Learner will be able to understand. • Store data in frame? • Data Analyzing in pandas. • Data Visualization. • Use Different types of Graph
Unit-9	Introduction to SQL Lite & Connectivity	2	4	6	After completing this unit, Learner will be able to understand. • Connect Python to SQL Database • Manipulation of Data
Unit-10	GUI Programming	2	4	6	After completing this unit, Learner will be able to understand. • Able to make GUI Program. • Connect with Database.

7.2.Detailed Syllabus

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S.NO./UNIT	Unit Name	Contents	Hrs.
Unit-1	Introduction to Programming, Algorithm & Flowchart, Python Installation, Python virtual machine, Operator, Data Types, & Input/output	• The basic Model of computation, algorithms, flowcharts, • Programming Languages, compilation, testing & debugging and documentation. • PVM (Python Virtual Machine), How PVM Works, Basics of Python Program Execution, Variables & Data Types, Python Keywords & Operators, Input/Output Operations, Comments & Documentation in Python, Flowchart.	4
Unit- 2	Concept of indentation and if,elif-else Statement, Loop	• Conditional Statements in Python, IF Statements in Python, IF-ELSE Statements in Python, ELIF Statements in Python, Why Loop?, Python For Loop, Python range() Function, Syntax of range() Function, Example of range() Function, For Loop Flow Chart, The Break Statement, The Continue Statement, For-Else Loop, The While Loop, While-Else Loop.	4
Unit- 3	Sequence data types	• Array, Basic Operations, Accessing Array Elements, Insertion Operation, Deletion Operation, Search Operation, Update Operation • Python Collections (Arrays), Python List, Accessing list, Accessing List using for loop, List Slicing, Concatenation and Repetition Operation in	

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		List, List Modification, List Method, List Copy • Introduction to Tuple, Key features of Tuple, Creating a Tuple, Accessing Tuple, Slicing a Tuple, Modifying a Tuple, Deleting a Python Tuple, Tuple Functions, Linear Search on Tuple, List vs Tuple. • Python String, Objectives of Python String, Creating String in Python, Strings Indexing, Slice Operator [ ] in String, String Operators, Example on String Operator, String Functions, count(), find(), rfind(), capitalize(), title(), lower(), upper(), islower(), isupper(), istitle(), strip(), lstrip(), rstrip(), split(), partition(), join(), isspace(), Escape Characters in Python String, List of Escape Characters, String Formatting Operator, Assignment.	
Unit- 4	Introduction to User Defined Function(UDF), Anonymous Function Module & Package.	• Why Function?, Advantages of Using Function, Functions and its types, Function Definition, Function calling, Non-Parameterized Function, Parameterized Function, Returning a value, Types of parameters: 1. Required arguments, 2. Keyword arguments, 3. Default Arguments, 4. Variable length Arguments, Scope of Variable, Local Variable, Global variable, Rules of	

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		global keyword, Use of global keyword, Python Docstrings. • Python Modules, Loading the module in our python code, The import statement, Access Modes, The from-import statement, Renaming a module, Using dir() function, The reload() function, Python packages, Python datetime, datetime.date Class, The calendar module. • Python Anonymous/Lambda Function, Syntax of Lambda Function in python, Example of Lambda Function in python, Use of Lambda Function in python, Example use with filter(), Example use with map(), Recursion Function, Python Recursive Function, Advantages of Recursion, Disadvantages of Recursion.	
Unit- 5	File Handling	• Introduction to File Handling, File Types, File Operations, File Handling Method, Access Modes, The close() method, Reading the file, Reading from a file, readlines(), Redirecting the output, Writing output to a file, Writing output to a file with more result, Writing to	

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		a file, Writelines(), Write() and WriteLine() method, Seek(), Tell(), Python os module, Renaming the file, Removing the file, Creating the new directory, Changing the current working directory, The getcwd() method.	
Unit- 6	OOPS Concept, Exception Handling Regular Expression	• OOPs: OOPs Concept Definitions, Objects, Object, Class, Method, Abstraction, Encapsulation, Basic Difference Between Abstraction and Encapsulation, Inheritance, Polymorphism, Advantage of OOPs, Sample program, Object-oriented vs. Procedure-oriented Programming languages. • Python Constructor, Creating the Constructor in Python, Counting the Number of Objects of Class, Python Non-Parameterized Constructor, Python Parameterized Constructor, Python Default Constructor, Python Inheritance, Python Multi-Level Inheritance, Python Multiple Inheritance, issubclass(sub, sup) Method, Consider the Following Example, The isinstance(obj, class) Method, Method Resolution Order (MRO), More than	

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		One Constructor in Single Class, Destructors in Python, Python Built-in Class Functions, Built-in Class Attributes. • Introduction to Polymorphism, Polymorphism in Class Methods, Polymorphism with Inheritance, Method Overloading, Method Overriding, Exception Handling in Python, Common Python Exceptions, The try and except Block, Raising and Handling Custom Exceptions. • What is Regular Expression, Python RegEx, Meta Characters, RegEx Functions, Special Sequence, Sets, The findall() Function, The search() Function, The split() Function, The sub() Function, Match Object.	
Unit- 7	Numpy	• NumPy Introduction, The need for NumPy, Importance and features of NumPy, Advantages of NumPy, NumPy Environment Setup, Using NumPy, Ndarray in NumPy, Creating a ndarray,	

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		Accessing Elements, Slicing, Indexing, Basic Array Operation, NumPy Array Axis, Understanding Array Dimensions, Higher-Dimensional Arrays, Important Attributes of an ndarray, Reshaping the array objects, Array Concatenation and Stacking, Splitting Arrays, Flattening Arrays with flatten(), NumPy Datatypes. • Array from Existing Data, Creation using NumPy, Creating Identical and Diagonal Matrices, Finding Square Root and Standard Deviation, Linear Algebra Operations, Dot Products, Matrix Multiplication, Trigonometric and Statistical Functions, Introduction to Broadcasting, NumPy Array Iteration, NumPy Bitwise Operators, NumPy Sorting and Searching.	
Unit- 8	Pandas & Matplotlib	• Python Pandas, Installing Pandas, Data Structures, Pandas Series, Syntax of Series, Create an empty Series, Create Series from ndarray, Create a Series from dict, Create a Series from Scalar, Accessing Data from Series with Position, Retrieve Data Using Label (Index), DataFrame, Type	

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| | | of data used for DataFrame creation, Create empty DataFrame, Create DataFrame from lists, Create DataFrame from dict, Create DataFrame from list of dicts, Create DataFrame from dict of Series, DataFrame — Operation on Column, DataFrame — Operation on Rows, Python Pandas - Sorting, Boolean Indexing in Pandas.
• Handling Missing Values, Sources of Missing Values, Types of Missing Values, Working with Missing Data, Filling missing values using fillna(), Filling null values using replace() method, Dropping missing values using dropna(), Iterating over rows and columns, Iteration over rows using iteritems(), Iteration over rows using itertuples(), Working With Text Data, Lowercasing and Uppercasing a Data, Splitting and Replacing a Data, Concatenation of Data, Removing Whitespaces of Data, Extracting a Data, Pandas str methods, Working with Date and Time, Date Time Methods, Assignment.
• Matplotlib, Features of Matplotlib, Matplotlib Installation, Matplotlib | |

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		Importing, Matplotlib Functions, Formatting the Style of Plot, Line Style, Plotting with Keyword String, Plotting with Categorical Variables, Controlling Line Properties, Types of Plots, Scatter Plot, Scatter Plot with Groups, Bar Chart, Multiple Bar Chart, Stack Bar Chart, Comparing Bar Chart, Pie Chart, Box Plot.	
Unit- 9	Introduction to SQL Lite & Connectivity	• SQLite, SQLite Features/Why to Use SQLite, SQLite Advantages, SQLite Commands, Data Definition Language, Data Manipulation Language, Data Query Language, SQLite Data Types, Types of SQLite Data Types, SQLite Affinity and Type Name, Date and Time Type, SQLite Operators, SQLite Arithmetic Operators, SQLite Comparison Operator, SQLite Logical Operator, SQLite Bitwise Operators, Some Important sqlite3 Module, Connect to Database, Create Table in Python Using SQLite 3, SQLite Insert Query, DELETE Operation.	
Unit- 10	GUI Programming	• Graphical User Interface, GUI Technologies, Tkinter: GUI for Python, First	

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Window Using Tkinter, GUI Widgets, Geometry Management, Pack, Grid(), Place(), Binding Function, Event Handling.

- GUI Programming (Tkinter), Tkinter Widgets or Components, Frame, Menu, Canvas, Listbox, Menubutton, Scale, Scrollbar, Text, Toplevel, Combobox, CRUD Application, Example Components of a Python CRUD App, Bind Method, Create CRUD Application, Create Window, Declare Variables for Entries, Create Frames for Placing Widgets, Create Labels, Create Entries, Create Buttons, Create Table to Show Data, Create Database and Table, Insert Record, Update Record, Delete Record, Reset Record, OnSelected() Method.
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8.   Reference Books/Study Material

- Python Programming- A modular Approach (with Graphics, database, Mobile and Web Applications by Sheetal Taneja and Naveen Kumar, Pearson.

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- Python Network Programming Cookbook by Pradeeban Kathiravelu, Dr. M. O. Faruque Sarkar, PACKT.
- Head First Python by Paul Berry, O'Reilly
- Dive into Python by Mark Pilgrim, APress
- Beginning Programming with Python Dummies by John Paul Meuller.

9. Practical Assignments Model:

Assignment 1.

Installation of Python IDLE Environment

- Write a program to print "Hello, This is My First Python Program".

- Python Program to read two numbers and print their quotient and remainder.

- Python Program to take the temperature in Celsius and convert it to Fahrenheit.

- Python Program to read height in centimeters and then convert the height to feet and inches

- Python program to add two numbers.

- Python Program to print odd numbers within a given range.

- Python Program for Program to find area of a circle.

- Python Program for Simple interest calculation.

- Python program to reverse three digits number without using loop.

- Python program to exchange the values of two numbers without using a temporary variable.

- Python program to calculate gross salary where gross salary=Basic+HRA+DA
    - In this HRA is 16% of Basic, DA is 12% of Basic

Assignment 2.
- Write a Python program to find maximum between two numbers using if else.

- Write a program to find maximum among three number

- Python Program to Take in the Marks of 5 Subjects and Display the Grade.

- Python Program to check Armstrong Number use three digit number.

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- Write a Python program to check whether a number is positive, negative or zero.

Assignment 3.
- Python program to calculate factorial of a given number
- Python Program to find the sum of digits in a number.
- Python Program to count the number of digits in a number.
- Python Program for n-th Fibonacci number.

Assignment 4.
- Create a function to calculate the area of Circle.
- Create a function to find out factorial of a number.
- Create a function to find the reverse of a number.
- Create a function to calculate the arithmetic operation.

Assignment 5.
- Program to Find Out Length of String.
- Python program to Check Palindrome of string.
- Program to count No. of vowels of string.
- By using String Function Count a substring in main string

Assignment 6.
- Create a lambda Function to calculate remainder.
- Find the Square of a number by using lambda function.
- Program to add number from 1 to 6 by using Function recursion.
- Program to Calculate Factorial Value By Using Recursion Function.

Assignment 7.
- Program to check the file is Exist or not.
- Program to Read text from File. (File Must be created before reading) at default location.
- Write a program to save the output of program in a file.
- Create a file By using w mode.
- Create a Program to Writing in file using writelines function.

Assignment 8.

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- Create a module to calculate Simple Interest and use this module in another Program by Using import method.
- Create a package and import this package in another Program.

Assignment 9.

- Create a Program to calculate sum of two numbers by Using OOPs Concept.
- Create a constructor to take input as a Function.
- Create a class that derived from base class by using derived class object access the base class method.
- Create a Program to Explain Overriding method.

Assignment 10.

- Create a Program to Handle Exception
- Create a program to make your own exception class.
- Create a Program to explain try, except and finally method.

Assignment11:

- Create a Python Program to an empty and a full NumPy array.
- Create a Python Program to Numpy array filled with all zeros.
- Create a Python Program to an array of integers from 30 to 70
- Create NumPy program to create a 3x3 identity matrix.
- Create a NumPy program to generate a random number between 0 and 1.
- Create a NumPy program to create a 3x4 matrix filled with values from 20 to 31.

Assignment12:

Sample Questions:

1. Python was created by _____.
   a. James Gosling   b. Bill Gates
   c. Steve Jobs   d. Guido van Rossum

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2. Which of the following is an invalid variable?
   a. my_string_1   b. 1st_string
   c. foo   d. _

3. The && and || operators
   a. Compare two numeric values   b. Combine two numeric values
   c. Compare two Boolean values   d. Combine two Boolean values

4. What will be the output of the following Python code?
   True = False
   while True:
       print(True)
       break
   a. True   b. False
   c. None   d. Yes

5. Suppose list1 is [2, 33, 222, 14, 25], What is list1[:-1]?
   a. [2,33,222,14]   b. Error
   c. 25   d. [25,14,222,33,2]

6. What is a variable defined inside a function referred to as?
   a. A static variable   b. A global variable
   c. A local variable   d. An automatic variable

7. random() function will give values between
   a. 1 to 10   b. 1 to -1
   c. 1 to 20   d. 0 to 1

8. Which function is used to close a file in python?
   a. close()   b. stop()
   c. end()   d. closefile()

9. _____ represents an entity in the real world with its identity and behaviour.
   a. A method   b. An object
   c. A class   d. An operator

10. To determine in which order Python should access namespace, you can use the:
    a. LEGB rule   b. LGBE rule
    c. LBGE rule   d. LGEB rule

11. NumPY stands for?

   a. Numbering python   c. Numerical python
   b. Number in python   d. None of the above

12. Numpy developed by?

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a. Guido van rossum   b. Travis oliphant
c. Wes mckinney   d. Jim hugunin

13. The most important object defined in numpy is an N- dimensional array type called?

a)Ndarray   b. Narray
c. Nd_array   d. Darray

14. What is the default data type of NumPy arrays?

a) int32   c) object
b) float64   d) None of the above

15. What is the output of the following code?

```
import numpy as np

a = np.array([[1, 2], [3, 4]])

print(a)ndim)
```

a) 0   c) 2

b) 1   d) 3

16-What is the primary data structure in Pandas used for 2-dimensional labeled data?

a) Series   c) Panel

b) DataFrame   d) List

17- Which function is used to read a CSV file in Pandas?

pd.read_csv()   c) pd.load_csv()

.read_excel()   d) pd.open_csv()

18-Which command is used to create a line plot in Matplotlib?

a) plt.line()   c) plt.graph()

b) plt.plot()   d) plt.show()

19-How do you display a plot in Matplotlib?

a) plt.show()   c) plt.open()

b) plt.plot()   d) plt.view()

20-Which function is used to set the title of a plot?

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a) plt.label()   c) plt.caption()

b) plt.title()   d) plt.name()

21-What symbol is used to denote the start of a string in regular expressions?

a)$ c) \

b)^   d) *

22-Which function returns all matches of a pattern in a string?

a)search()   c) match()

b)findall()   d) split()

23-What does the \d metacharacter match?

a)Any letter   c) Any digit

b)Any whitespace   d) Any special character

24-Which method is used to start the Tkinter main event loop?

a)mainloop()   c) execute()

b)run()   d) start()

25-What does Button() in Tkinter create?

a)A new window   c) A text field

b)A button widget   d) A label