AS PER NEP 2020 SYLLABUS

BASICS IN PYTHON PROGRAMMING

For

First Year Mathematics (Semester - I)
VSC - 2 Credits
As per NEP 2020 Syllabus w.e.f. Academic Year 2024-25

Prof. Bhakti Velankar
M.Sc. Mathematics, M.Phil.
Assistant Professor
NES Ratnam College, Bhandup, Mumbai.

Price ₹ 40.00

NIRALI PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

N8056

BASICS IN PYTHON PROGRAMMING (MATHS VSC Sem - 1)

First Edition : August 2025 **ISBN 978-93-6993-293-1**

© : Authors

The text of this publication, or any part thereof, should not be reproduced or transmitted in any form or stored in any computer storage system or device for distribution including photocopy, recording, taping or information retrieval system or reproduced on any disc, tape, perforated media or other information storage device etc., without the written permission of Authors with whom the rights are reserved. Breach of this condition is liable for legal action.

Every effort has been made to avoid errors or omissions in this publication. In spite of this, errors may have crept in. Any mistake, error or discrepancy so noted and shall be brought to our notice shall be taken care of in the next edition. It is notified that neither the publisher nor the authors or seller shall be responsible for any damage or loss of action to any one, of any kind, in any manner, therefrom. The reader must cross check all the facts and contents with original Government notification or publications.

Published By :
NIRALI PRAKASHAN
Abhyudaya Pragati, 1312, Shivaji Nagar,
Off J.M. Road, Pune – 411005
Tel - (020) 25512336/37/39
Email : niralipune@pragationline.com

Polyplate

Printed By:
YOGIRAJ PRINTERS AND BINDERS
Survey No. 10/1A, Ghule Industrial Estate
Nanded Gaon Road
Nanded, Pune - 411041

DISTRIBUTION CENTRES

PUNE

Nirali Prakashan
(For orders outside Pune)
S. No. 28/27, Dhayari Narhe Road, Near Asian College Pune 411041, Maharashtra
Tel : (020) 24690204; Mobile : 9049672225
Email : bookorder@pragationline.com

Nirali Prakashan
(For orders within Pune)
119, Budhwar Peth, Jogeshwari Mandir Lane
Pune 411002, Maharashtra
Mobile : 9657703145, 9890997937
Email : niralilocal@pragationline.com

MUMBAI

Nirali Prakashan
385, S.V.P. Road, Rasadhara Co-op. Hsg. Society Ltd., 'D' Wing, Ground Floor, Prarthana Samaj, Mumbai 400004, Maharashtra Mobile : 7045821020, Tel : (022) 2386 9976
Email : mumbai@niralibooks.com

DISTRIBUTION BRANCHES

DELHI
Nirali Prakashan
Room No. 2 Ground Floor
4575/15 Omkar Tower,
Agarwal Road Darya Ganj,
New Delhi 110002
Mobile : 9555778814/
9818561840
Email : delhi@niralibooks.com

BENGALURU
Nirali Prakashan
Maitri Ground Floor, Jaya Apartments, No. 99, 6th Cross, 6th Main, Malleswaram, Bengaluru 560003 Karnataka;
Mob : 9686821074
Email :
bengaluru@niralibooks.com

NAGPUR
Nirali Prakashan
Above Maratha Mandir,
Shop No. 3, First Floor, Rani Jhanshi Square, Sitabuldi
Nagpur 440012 (MAH)
Tel : (0712) 254 7129
Email :
nagpur@niralibooks.com

KOLHAPUR
Nirali Prakashan
438/2, Bhosale Plaza, Ground Floor, Khasbag, Opp. Balgopal Talim,
Kolhapur 416 012,
Maharashtra
Mob : 9850046155
Email :
kolhapur@niralibooks.com

JALGAON
Nirali Prakashan
34, V. V. Golani Market, Navi Peth, Jalgaon 425001,
Maharashtra
Tel : (0257) 222 0395
Mob : 94234 91860
Email :
jalgaon@niralibooks.com

SOLAPUR
Nirali Prakashan
R-158/2, Avanti Nagar, Near Golden Gate, Pune Naka Chowk Solapur 413001,
Maharashtra
Mobile 9890918687
Email :
solapur@niralibooks.com

marketing@pragationline.com | www.niralibooks.com

Also find us on www.facebook.com/niralibooks

Preface ...

This book 'Basics in Python Programming- I' is written according to the syllabus of Vocational Skill Course (VSC) offered by Board of Mathematics, University of Mumbai for F.Y.B.Sc Semester-I course under NEP-2020. The course is Practical type offering two credits. Algorithms is an important branch of study with deep roots in Discrete Mathematics, Calculus and Analysis. Algorithms and Basic Python Programming are foundational components of Computer Science. Algorithms are essential for creating optimized solutions to computational problems. Python is a highly developed computer language which is easy to use without much jargons and difficult syntaxes. No wonder it has become the most popular computer programming language. This book is strictly based as per the needs of the syllabus designed by University of Mumbai.

The book covers the two modules – Algorithms and Elementary Python Programming as per the requirements in the syllabus. Module 1 covers- Definition of Algorithms, Basic Algorithms, Conditional Looping with known/unknown iterations. Mathematical applications of Algorithms are separately dealt with. Module 2 introduces Python language with it's basic functionalities. The Book is meant for Practical based Vocational skill course; hence the emphasis is laid on Practical based- Algorithms and Programs.

I take this opportunity to thank Head, Department of Mathematics for her constant support and guidance in this endeavor. Thanks to the N.E.S. Ratnam College of Arts, Science and Commerce for providing the library and Computer Laboratory facility for this work.

I am thankful to **Shri. Pradeep Furia**, **Shri. Jignesh Furia** and **Shri. Dhairya Furia** M/s. **Nirali Prakashan**, for the confidence reposed in me by giving me this opportunity.

We are also thankful to Ms. Anagha (Co-ordinator) Mr. Ilyas Shaikh for excellent type setting, Mr. Jayant Dedhiya (marketing Executive, Mumbai) for the promotion of the book.

I request my colleagues, teaching the subject to offer their suggestions for further improvement of the book. Any suggestions towards the improvement of this book and sincere comments are most welcome on mumbai@niralibooks.com.

✍ ✍ ✍

Syllabus ...

MODULE 1: ALGORITHM (30 HOURS)

1. Definition of an algorithm, characteristics of an algorithm.
   Elementary algorithmic vocabulary (input or read, output or print), elementary mathematical operators (+, −, *, /, **, mod, div mod or %), logical operators (or, and, not).
   - Practical based on assigning value to a variable and performing basic mathematical operations on the same and printing the final result.
2. Exchange of values of variables.
   - Practical based on exchange of values of two variables, using dummy variable.
   - Practical based on exchange of values of two variables, without using dummy variable.
   - Practical based on circular exchange of values of several variables.
3. Conditional Structure (if-then-else)
   - Practical based on accepting and assigning value/s to variable/s and checking whether the variable is even/odd, multiple of 3/4/5 etc.
   - Practical based on accepting marks from the user and providing appropriate grade to the user.
4. Loop Structure with pre-known number of iterations (for loop)
   - Practical based on accepting a positive integer from the user and writing all of its divisors (Application to divisibility).
   - Practical based on accepting a positive integer n from the user, obtaining the sum of $1 + 2 + \ldots + n$, $1^2 + 2^2 + \ldots + n^2$, $1^3 + 2^3 + \ldots + n^3$, and finally verifying that these sums equal $\frac{n(n+1)}{2}$, $\frac{n(n+1)(2n+1)}{6}$, $\frac{n^2(n+1)^2}{4}$.
5. Loop Structure with pre-unknown number of iterations (while loop)
   - Practical based on accepting two positive integers from the user and getting the GCD and LCM of the two numbers.
   - Practical based on accepting a positive integer from the user and checking whether it is prime or composite or neither.

6.
   - Practical based on checking whether the given (finite) sequence is monotone or not. (Application to understanding monotone sequence).
   - Practical based on accepting a positive real number from the user, say epsilon, and getting value of n, such that $\frac{1}{n}$ or $\frac{1}{n^2}$ will be within epsilon distance from zero. (This suggests that the sequences like $\frac{1}{n}$ or $\frac{1}{n^2}$ could be convergent sequences).
7. Searching and Sorting:
   - Practical based on finding maximum and/or minimum element in a finite sequence of integers.
   - Practical based on the linear search and binary search algorithms of an integer x in a finite sequence of distinct integers.
   - Practical based on sorting of a finite sequence of integers in ascending order, selection sort.
8. Recursion:
   - Practical based on Tower of Hanoi.
   - Practical based on Fibonacci sequence.

MODULE 2: ELEMENTARY PYTHON PROGRAMMING

(30 HOURS)

1. Introduction, Installing Python. Running Code in the Interactive Shell, IDLE. Input, Processing, and Output. Editing, Saving, and Running a Script.
   - Practical based on directly assigning values to variables and printing their values. (The values will be numbers as well as strings) - The purpose of this practical is to make the learner comfortable with the python environment.
2. Data types and expressions: Variables and the Assignment Statement, Program Comments and Docstrings. Mathematical operators +, − ∗, ∗∗, %. PEMDAS. Arithmetic expressions, Mixed-Mode Arithmetic and type

   Conversion, `type()`, `Input( )`, `print( )`, `id()`, `int( )`, `str( )`, `float( )`
   - Practical based on assigning values to variables, by accepting the values from the user, and then performing basic operations on them.
   - Practical based on obtaining the values of complicated math expressions.

3. Boolean expressions and Conditional Structure (if-then-else-elif)
    - Practical based on accepting income from the user and finding the income tax to be paid by the user.
    - Practical based on accepting a number and checking whether the number is positive, zero or negative (Application to Law of Trichotomy).
    - Practical based on accepting two positive integers and checking whether they are co-prime or not. (Application to coprime numbers).
4. Math Directory and the built-in functions and values (like, pi, e etc.)
    - Practical based on verification of $|a + b| \leq |a| + |b|$ and other properties of absolute value function. (Application to absolute value function).
    - Practical based on accepting three positive numbers from the user and checking whether a triangle is possible with these three numbers as its sides, and if such a triangle is possible then stating its type (Equilateral, Isosceles, Scalene).
    - Practical based on accepting sides of a triangle and finding its internal angles and area.
    - Practical based on accepting three positive numbers from the user and checking whether a triangle is possible with these three numbers as its sides, and if such a triangle is possible then stating its type. (Acute-angled, Right-angled, Obtuse-angled).
5. Loop Structure with pre-known number of iterations (for loop)
    - Practical based on accepting a non-negative integer from the user and finding its factorial.
    - Practical based on accepting a positive integer n from the user and writing first n terms of Fibonacci Sequence.
6. - Practical based on getting positive integral roots of Brahmagupta's equation (usually called Pelle's equation) $Nx^2 + 1 = y^2$, within some intervals for x, y and n.
    - Practical based on accepting an even positive integer (greater than 2) from the user and expressing it as sum of two primes, thereby verifying Goldbach conjecture.

7. Loop Structure with pre-unknown number of iterations (while loop)
   - Practical based on accepting a positive real number x from the user and finding smallest positive integer n such that $1 + \frac{1}{2} + \ldots + \frac{1}{n}$ exceeds x. (This gives an idea that the sequence 1, $1 + \frac{1}{2}$, $1 + \frac{1}{2} + \frac{1}{3}$, … could be unbounded and hence divergent).
8. - Practical based on finding all the integral roots (lying in some fixed interval, to be decided by the user) of a given polynomial.
   - Practical based on accepting a positive integer from the user and getting square root of the same to the desired level of accuracy.
   - Practical based on accepting a positive real number from the user, say epsilon, and getting value of E, which will be within the epsilon distance from the actual value of the Euler's number e.

     (The actual value of e may be assumed to be the built-in value of e).



Format of Question Paper

The performance of the learners shall be evaluated into two parts.

- Internal Continuous Assessment of 20 marks.
- Semester End Examination of 30 marks.
- Separate head of passing is required for internal, and semester end practical examination.

Semester End Practical Examination (30 marks):

Semester end practical examination of 30 marks on entire syllabus will be conducted of three hours duration as per the following pattern.

Sr. No.	Title	Marks
1.	Problems/Programs (Attempt any 5 out of 8)	25 Marks
2.	Journal	05 Marks

The students are required to perform 75% of the Practical for the journal to be duly certified. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

Contents ...

1.	Basics of Algorithms, Exchange of Variables	1.1 – 1.4
2.	Conditional Structures, Loop Structure with Pre-Known Number of Iterations	2.1 – 2.6
3.	The WHILE LOOP (Unknown Number of Iterations)	3.1 – 3.3
4.	Searching and Sorting of Algorithms	4.1 – 4.4
5.	Recursion Algorithm	5.1 – 5.3
6.	Introduction to Python, Running Code in IDLE in Script	6.1 – 6.3
7.	Data Type and Expressions, PEDMAS Rule	7.1 – 7.6
8.	Boolean Expression and Conditional Structures	8.1 – 8.5
9.	Math Directory and the Built in Functions	9.1 – 9.4
10.	Loop Structure - Programs Based on Loops	10.1 – 10.2
11.	Mathematical Applications of Python	11.1 – 11.5

