

Course Title: Python Learning with Turtle Graphics –

Level 2

Course Description: This course provides a comprehensive introduction to Python programming and Python Turtle graphics. It covers the basic concepts of programming and gradually progresses to more advanced topics, equipping students with the skills to develop Python applications by using Python Turtle.

Course Duration: 33 weeks (1 hours per session, 1 session per week)

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Class Time: Sunday 10am-11am

- Meeting ID: 842 3689 8216
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Prerequisites:

- No prior programming experience is required.
- Windows 10/11 laptop or desktop.

Course Syllabus:

Week 1: Introduction to Python

- Introduction to programming
- Why Python?
- What can Python do?
- Setting up the development environment (Python installation, text editor/IDE)
- Running Simple Python programs
- 3 Core Parts of Programming

Week 2: Python Basics 1 – Data Type and Variables

- Basic Python syntax
- Simple data type
- Collection data type
- Variables
- Operators
- Math operators
- Bitwise operators
- Assign vs equal
- Comments
- Input and Output

Week 3: Introduction to Turtle Graphics

- Introduction to Turtle Graphics and its features
- Two-dimensional Plane
- Directions and degrees on 2-D plane
- Basic Turtle commands: forward, backward, left, right, penup, pendown
- Drawing simple shapes (lines, squares, circles)

Week 4: Colors and Filling

- Using colors in Turtle Graphics
- Choose color by name
- Choose color by RGB value
- Drawing shapes with different colors
- Filling shapes with colors
- Creating gradients and patterns

Week 5: Control Flow 1 – Conditional Statements

- Conditional statements (if, elif, else)
- TRUE and FALSE cases
- Apply conditional statements in Python Turtle
- Turtle graphics workshop using if/else statements

Week 6: Control Flow 2 – For Loop and While Loop

- For Loop basics
- While Loop basics
- Range function
- Index and steps
- Compare for loop with while loop
- Apply loop in Python Turtle

- Turtle graphics workshop using loop

Week 7: Draw Various Shapes with Python Turtle

- Circle starting point and starting directions.
- How to draw various circles
- How to draw oval with circles
- Directions and angles on 2D plane
- Find positions with coordinates.
- Programming workshop for circle graphics

Week 8: 2D Plane Advanced Topics

- Circle and PI
- How to find point location on a circle
- Using multiple pens to find location
- Using Math Sin/Cos to calculate location
- How to calculate rebound angle for a ball
- Programming workshop for circle graphics

Week 9: Data Structures 1 – Simple Data Type vs Collection Data Type

- Strings and string manipulation
- Integer and Integer conversion to/from string
- Boolean and Boolean usage
- Turtle graphics workshop
- What is List
- What is Tuple
- List usage vs Tuple Usage
- Index in List
- Multiple dimensions of List
- Programming workshop using List and Tuple

Week 10 Data Structures 2 – Collection Data Type with Set/Dictionary

- What is Set
- What is Dictionary
- Set usage
- Dictionary Usage
- Compare Set with List and Tuple
- Programming workshop using Set and Dictionary

Week 11 RGB Color and HLS Color

- What is HLS color
- Compare RGB color with HLS color
- Convert RGB color from/to HLS color
- HLS color pros and cons
- Programming workshop using HLS color

Week 12 Animation Basics

- How to draw animation using Python Turtle
- Turtle Trace Function
- Turtle Update function
- Demo of animation graphics
- Programming workshop for animation graphics

Week 13 More Animation Graphics

- Animation graphics using multiple pens
- Illusions with animations
- Demo of illustration graphics
- Programming workshop for illusion graphics

Week 14 Function

- What is Function
- Function invocation, parameter and return value
- Fixed Function parameters vs Dynamic Function parameters
- Different ways of passing function parameters
- Different ways of invoking a function
- Variable scope with function
- Local and global variables usage in function
- Pack and unpack function return value
- Programming workshop using Function

Week 15 Object and Class

- What is Object
- Compare function with object
- Passing function as object
- What is Lambda Function
- Lambda syntax and usage
- Lambda function pros and cons
- What is Class
- How to create an object from a class
- Object Identifier and Memory address

- Programming workshop using Class and Lambda Function

Week 16 Recursive Function

- What is Recursive Function
- Recursive usage
- Recursive function pros and cons
- Programming workshop using recursive Function

Week 17 Recursive Function for Fractal Graphics

- What is fractal graphics
- How to draw fractal graphics using recursive function
- Programming workshop for fractal graphics

Week 18 More Fractal Graphics

- Demo of drawing fractal trees
- Demo of drawing fractal snowflake
- Fractal Programming workshop 2

Week 19 List Comprehension

- What is List Comprehension
- List comprehension usage
- List comprehension pros and cons
- Programming workshop using List Comprehension

Week 20: Image editing with PIL module

- What is PIL module
- How to read image file and load image
- How to modify image by pixel
- How to convert image to various mode
- Programming workshop for image editing

Week 21: Flood Algorithm for Image Editing

- What is Flood Algorithm
- How to apply flood algorithm to image editing
- Programming workshop with flood algorithm

Week 22: Projects Tic-Tac-Toe - 1

- Draw the board for Tic-Tac-Toe
- How to draw the cross and circle on the board
- Programming workshop for Tick-Tac-Toe

Week 23: Projects Tic-Tac-Toe - 2

- How to find out three pieces in a row on the board
- Find winner using 2 dimensional list
- Find winner using bitwise operators
- Programming workshop for Tick-Tac-Toe

Week 24: Projects Tic-Tac-Toe - 3

- Piece all together
- Expand tic-tac-toe to Gobang
- Basic AI algorithms for chess game
- Programming workshop for Tick-Tac-Toe

Week 25: Projects Gobang Game - 1

- Find straight line patterns in Gobang
- Find end points for straight line patterns
- Programming workshop for Gobang

Week 26: Projects Gobang Game - 2

- Find diamond pattern in Gobang
- Find center point for diamond pattern
- Programming workshop for Gobang

Week 27: Projects Gobang Game - 3

- AI play defense for Gobang
- How to use bitwise operators to find pattern.
- Programming workshop for Gobang

Week 28: Projects Gobang Game - 4

- AI play offense for Gobang
- Min-max prune algorithm
- Programming workshop for Gobang

Week 29: Projects Gobang Game - 5

- Evaluation function
- How to fine tune evaluation function
- How to debug your code
- Programming workshop for Gobang

Week 30: Projects Sudoku Game - 1

- Draw sudoku board
- How to convert 2D list to board
- Programming workshop for Sudoku Game

Week 31: Projects Sudoku Game - 2

- How to receive keyboard input
- How to update board based on user input
- How to validate user input
- Programming workshop for Sudoku Game

Week 32: Projects Sudoku Game - 3

- Backtrack algorithm.
- How to apply backtrack algorithm to Sudoku Game
- Programming workshop for Sudoku Game

Week 33: Projects Sudoku Game - 4

- Put it all together.
- Add difficulty level to the game.
- Programming workshop for Sudoku Game