

# Advanced Python Programming

## Course Syllabus & Table of Contents

### Module 1: Functional Programming in Python

- 1.1 Lambda Functions and Higher-Order Functions
- 1.2 Map, Filter, and Reduce
- 1.3 Closures and Decorators
- 1.4 Functools Module

### Module 2: Metaprogramming

- 2.1 Dynamic Code Execution (exec, eval)
- 2.2 Decorators with Arguments
- 2.3 Metaclasses and \_\_new\_\_ Method
- 2.4 Monkey Patching

### Module 3: Concurrency & Parallelism

- 3.1 Threading vs Multiprocessing
- 3.2 Global Interpreter Lock (GIL) Workarounds
- 3.3 Asyncio and Coroutines
- 3.4 Futures and Executors

### Module 4: Performance Optimization

- 4.1 Profiling Python Code (cProfile, timeit)
- 4.2 Memory Management (\_\_slots\_\_, gc)
- 4.3 Cython and Just-In-Time (JIT) Compilation
- 4.4 NumPy for Speed

### Module 5: Advanced OOP Patterns

- 5.1 Abstract Base Classes (ABCs)
- 5.2 Singleton and Factory Patterns
- 5.3 Dependency Injection
- 5.4 Context Managers (\_\_enter\_\_, \_\_exit\_\_)

### Module 6: Testing & Debugging

- 6.1 Mocking with unittest.mock
- 6.2 Property-Based Testing (Hypothesis)
- 6.3 Debugging Memory Leaks
- 6.4 Logging Best Practices

### Appendix

- **References:** PEP 8, Python Documentation
- **Tools Used:** PyCharm, Jupyter Notebook, Docker
- **Sample Code Repo:** [github.com/demo/python-advanced](https://github.com/demo/python-advanced) (fake link)

