Py

AGASTHYA COMPUTERS
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COURSE SYLLABUS · 2025–26

Advanced Python Programming

A rigorous 3-month program designed to take learners from intermediate to professional-grade Python development — covering data engineering, backend systems, automation, and real-world project delivery.

📅 Duration: **3 Months (12 Weeks)**

⏱️ Hours: **120 Hrs Total**

🎯 Level: **Intermediate → Expert**

🏆 Certificate: **On Completion**

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MONTH 01

Core Mastery & Advanced Language Features

WEEK 01

Python Internals & Memory Model

- Python data model & object system
- Mutable vs immutable types in depth
- Memory management & garbage collection
- Reference counting & `sys.getrefcount()`
- Python bytecode & dis module
- CPython vs PyPy overview

WEEK 02

Advanced OOP & Design Patterns

- Dunder/magic methods deep dive
- Metaclasses & class creation
- Abstract base classes (ABC)

- Mixins & multiple inheritance (MRO)
- Descriptors & property protocol
- Design patterns: Singleton, Factory, Observer

WEEK 03

Functional Programming & Decorators

- Higher-order functions & closures
- Decorators: stacking, parameterized, class-based
- functools: lru_cache, wraps, partial, reduce
- Itertools & generators in depth
- Context managers with `contextlib`
- Lambda, map, filter, zip advanced usage

WEEK 04

Concurrency & Parallelism

- GIL: implications & workarounds
- Threading module & thread safety
- Multiprocessing & process pools
- asyncio: event loop, coroutines, tasks
- async/await patterns & best practices
- concurrent.futures: ThreadPoolExecutor

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MONTH 02

Data Engineering, APIs & Backend Development

WEEK 05

Data Handling & Scientific Python

- NumPy: arrays, broadcasting, vectorization
- Pandas: advanced indexing, groupby, merge
- Data cleaning & transformation pipelines
- Time-series analysis with Pandas
- Matplotlib & Seaborn visualizations
- Reading/writing CSV, JSON, Excel, Parquet

WEEK 06

Databases & ORM

- SQLite3 & PostgreSQL with psycopg2
- SQLAlchemy Core & ORM
- Migrations with Alembic
- MongoDB with PyMongo
- Redis caching with redis-py
- Connection pooling & transactions

WEEK 07

REST APIs with FastAPI & Flask

- FastAPI: routing, path/query parameters
- Pydantic models & data validation
- Authentication: JWT, OAuth2
- Middleware, CORS, rate limiting
- API versioning & documentation (Swagger)
- Flask vs FastAPI comparison project

WEEK 08

Web Scraping & Automation

- Requests + BeautifulSoup scraping
- Selenium & Playwright for dynamic pages
- Scrapy framework for large-scale crawling
- Task automation with schedule & Celery
- Email automation with smtplib & sendgrid
- File & OS automation with pathlib, shutil

MONTH 03

Testing, DevOps, ML & Capstone Projects

WEEK 09

Testing, Debugging & Code Quality

- pytest: fixtures, parametrize, markers
- unittest.mock & patching
- Test coverage with Coverage.py
- TDD (Test-Driven Development) approach
- Logging, profiling & cProfile
- Code quality: Black, Pylint, mypy, flake8

WEEK 10

Packaging, DevOps & Cloud Deployment

- Package structure: pyproject.toml, setup.py
- Publishing to PyPI with Twine
- Docker: Dockerfile, containers, compose
- CI/CD with GitHub Actions
- Deploying FastAPI on AWS / Render / Railway
- Environment management: dotenv, secrets

WEEK 11

Machine Learning with Python

- Scikit-learn: preprocessing, pipelines
- Supervised & unsupervised algorithms
- Model evaluation, cross-validation, tuning
- Intro to TensorFlow / Keras for deep learning
- NLP basics: NLTK, spaCy, transformers
- Saving & serving ML models (pickle, joblib)

WEEK 12

Capstone Projects & Career Prep

- Project 1: Full-stack REST API with FastAPI + DB
- Project 2: Data pipeline & analysis dashboard
- Project 3: ML model deployment as an API
- Code review & portfolio documentation
- Interview preparation: DSA in Python
- Certificate examination & presentation

TECH STACK

Tools & Technologies Covered

Python 3.12+ · NumPy · Pandas · FastAPI · Flask · SQLAlchemy · PostgreSQL · MongoDB · Redis · Celery · Selenium · Scrapy · pytest · Docker · GitHub Actions · scikit-learn · TensorFlow · spaCy · Matplotlib · Pydantic · asyncio · VS Code · Jupyter Lab · Git & GitHub

WHAT YOU'LL ACHIEVE

Learning Outcomes

⚙️ **Python Mastery**
Deep understanding of Python internals, OOP, and advanced language features

🌐 **Backend Development**
Build and deploy production-ready REST APIs with FastAPI and Flask

📊 **Data Engineering**
Process, analyze, and visualize real-world datasets at scale

🤖 **Machine Learning**
Train, evaluate, and deploy machine learning models as APIs

🐳 **DevOps Ready**
Containerize and deploy Python apps using Docker and CI/CD pipelines

🏆 **Portfolio Projects**
3 complete, deployable projects ready to showcase to employers