Training Course PyQGIS: Scripting and Automation in QGIS

Professional Development Training Course Outline

Category	GIS	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Training Course PyQGIS: Scripting and Automation in QGIS delves into the powerful capabilities of **PyQGIS**, the Python API for QGIS, empowering GIS professionals and developers to master **geospatial scripting** and **workflow automation**. Leveraging open-source GIS technology, participants will gain hands-on expertise in manipulating spatial data, performing advanced geoprocessing, and developing custom QGIS plugins, transforming repetitive tasks into efficient, automated processes. From fundamental Python concepts tailored for GIS to complex **geospatial analysis** and **data visualization**, this course provides the essential skills for modern GIS development, enhancing productivity and unlocking new possibilities in spatial data management.

In today's data-driven world, the ability to automate GIS workflows is paramount for efficiency and accuracy. PyQGIS offers an unparalleled opportunity to extend QGIS functionalities, enabling users to tackle complex spatial problems programmatically. This course is designed to bridge the gap between traditional GIS operations and advanced **Python programming for GIS**, equipping participants with the knowledge to build robust, scalable solutions. Through practical exercises and real-world case studies, attendees will learn to optimize **GIS data processing**, create custom tools, and integrate QGIS with other **Python libraries**, ultimately fostering a deeper understanding of **open-source geospatial development** and maximizing the potential of their GIS projects.

Programme Curriculum

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Course Objectives

1. Master Python for GIS fundamentals and object-oriented programming concepts relevant to PyQGIS.
2. Gain proficiency in the PyQGIS API for interacting with QGIS desktop functionalities.
3. Automate repetitive GIS tasks and complex geoprocessing workflows using Python scripts.
4. Develop custom QGIS plugins to extend core application capabilities and user interfaces.
5. Perform advanced spatial analysis and data manipulation programmatically with PyQGIS.
6. Integrate QGIS with other powerful Python geospatial libraries like GeoPandas and Rasterio.
7. Implement efficient GIS data validation and cleaning routines using scripting.
8. Create stunning cartographic outputs and map layouts through automated processes.
9. Learn standalone PyQGIS scripting for running geospatial operations outside the QGIS GUI.
10. Explore database connectivity with PyQGIS for managing spatial data in PostGIS and other databases.
11. Apply version control for GIS scripts to manage code development effectively.
12. Understand web GIS integration concepts with PyQGIS for publishing geospatial data.
13. Troubleshoot and debug PyQGIS scripts for robust and error-free automation.

Organizational Benefits

- Automate tedious, repetitive GIS tasks, significantly reducing manual effort and processing time.
- Minimize human error in data processing and analysis through standardized, scripted workflows.
- Reduce reliance on commercial GIS software licenses by leveraging powerful open-source QGIS and PyQGIS.
- Empower GIS teams to accomplish more complex analyses and deliver results faster.
- Enable in-house creation of bespoke GIS tools tailored to specific organizational needs.
- Enforce data standards and quality checks through automated validation routines.
- Develop scripts capable of handling large datasets and batch processing operations efficiently.
- Foster a culture of technical innovation and problem-solving through scripting and automation.

Target Audience

1. GIS Analysts and Specialists
2. Geospatial Developers
3. Data Scientists.
4. Urban Planners and Environmental Scientists
5. Researchers and Academics
6. GIS Managers
7. Anyone with basic QGIS knowledge and Python fundamentals.

Course Outline

Module 1: Introduction to PyQGIS and Python Fundamentals for GIS

- Understanding the QGIS Python Console and basic scripting environment.
- Core Python concepts: variables, data types, control flow (loops, conditionals).
- Introduction to the PyQGIS architecture and key classes (qgis.core, qgis.gui).
- Setting up your development environment (IDE, virtual environments).
- Case Study: Automating a simple layer load and symbology change in QGIS upon project opening.

Module 2: Working with Vector Data in PyQGIS

- Loading, accessing, and iterating through vector layers and features.
- Manipulating geometries (points, lines, polygons) and attributes.
- Selecting features by attribute and location.
- Creating new vector layers and adding features programmatically.
- Case Study: Scripting the import of multiple CSV files with coordinates into QGIS as point layers, automating projection assignment.

Module 3: Geoprocessing with PyQGIS and the Processing Framework

- Leveraging the QGIS Processing Toolbox via PyQGIS (processing.run).
- Automating common geoprocessing tools (buffer, clip, intersect, dissolve).
- Batch processing multiple layers or files.
- Handling geoprocessing parameters and outputs.
- Case Study: Batch geocoding a list of addresses using a QGIS geocoding service and buffering the resulting points, saving output to a GeoPackage.

Module 4: Raster Data Handling and Analysis with PyQGIS

- Loading and accessing raster layers and their properties.
- Performing basic raster operations (reclassification, resampling).
- Extracting raster values at point locations.
- Using raster calculator functionalities programmatically.
- Case Study: Automating the calculation of land surface temperature from a series of satellite imagery and creating a time-series plot.

Module 5: Custom QGIS Plugin Development - Basics

- Understanding the QGIS plugin architecture and directory structure.
- Using Plugin Builder to scaffold a new plugin project.
- Designing basic user interfaces with PyQt/Qt Designer for plugins.
- Connecting GUI elements to PyQGIS functions.

- Case Study: Developing a simple "Quick Statistics" plugin that displays count, min, max, and average for a selected numeric field of an active layer.

Module 6: Advanced Plugin Development and Best Practices

- Implementing more complex plugin logic and interactions.
- Error handling and robust plugin design.
- Packaging and deploying QGIS plugins.
- Debugging plugins effectively.
- Case Study: Building a plugin for automated map series generation with dynamic labels and north arrow based on predefined extents.

Module 7: QGIS Project Management and Map Layouts

- Opening, saving, and managing QGIS projects programmatically.
- Accessing and manipulating map canvas, layers, and symbology.
- Automating map layout creation (print layouts).
- Adding map elements (title, legend, scale bar, north arrow) via script.
- Case Study: Scripting the creation of a series of regional maps, each with specific symbology, extent, and custom text labels based on a data attribute.

Module 8: Working with QGIS Attributes and Expressions

- Advanced attribute table manipulation and data editing.
- Using QGIS expressions in PyQGIS for dynamic operations.
- Creating and updating virtual fields.
- Conditional formatting and rule-based symbology through scripting.
- Case Study: Automatically updating a "status" field in a parcel layer based on intersection with a "development zone" layer and property size using expressions.

Module 9: Standalone PyQGIS Scripting

- Setting up a standalone Python environment for PyQGIS.
- Running PyQGIS scripts without the QGIS GUI.
- Accessing QGIS processing algorithms from standalone scripts.
- Batch processing large datasets from the command line.
- Case Study: Developing a standalone Python script to reproject and dissolve a large national dataset of administrative boundaries, saving the result as a new shapefile.

Module 10: Integrating PyQGIS with Other Python Libraries

- Introduction to GeoPandas for spatial data manipulation outside QGIS.
- Working with Rasterio and GDAL for advanced raster processing.
- Data visualization with Matplotlib and Seaborn for geospatial data.
- Interfacing with NumPy for numerical operations on spatial data.
- Case Study: Combining a PyQGIS script to export vector data, processing it with GeoPandas for complex spatial joins, and then re-importing results to QGIS.

Module 11: Database Connectivity with PyQGIS (PostGIS Focus)

- Connecting to spatial databases (e.g., PostGIS) from PyQGIS.
- Querying, inserting, updating, and deleting spatial data in databases.
- Executing SQL queries against spatial tables.
- Managing database connections and transactions.

- Case Study: Building a script to synchronize QGIS layer attributes with an external PostGIS table, updating records based on a unique ID.

Module 12: Advanced Geospatial Analysis with Custom Algorithms

- Implementing custom spatial algorithms from scratch in Python.
- Integrating external Python libraries for specialized analysis.
- Creating custom processing algorithms for the QGIS Processing Toolbox.
- Performance considerations for complex scripts.
- Case Study: Developing a custom PyQGIS processing algorithm to calculate a "sightline analysis" or "viewshed" for a given point based on a DEM.

Module 13: Error Handling, Debugging, and Version Control

- Implementing robust error handling in PyQGIS scripts (try-except).
- Debugging techniques for PyQGIS scripts and plugins.
- Introduction to Git and GitHub for version control of GIS projects and scripts.
- Collaborative development of PyQGIS code.
- Case Study: Refactoring an existing PyQGIS script to include comprehensive error checks and logging, then committing changes to a Git repository.

Module 14: Web GIS Integration and Data Sharing

- Exporting QGIS data for web mapping platforms.
- Generating KML, GeoJSON, and other web-friendly formats using PyQGIS.
- Introduction to simple web services with Python (e.g., Flask for serving data).
- Creating interactive maps with Folium from PyQGIS processed data.
- Case Study: Scripting the export of selected QGIS layers to GeoJSON, then automatically generating a basic interactive web map using Folium.

Module 15: Real-World Applications and Project

- Review of advanced PyQGIS techniques and their practical applications.
- Discussion of common industry challenges and solutions with PyQGIS.
- Participants work on a capstone project applying learned skills to a real-world GIS problem.
- Project presentation and peer feedback.
- Case Study: Participants choose a personal or work-related GIS challenge and develop a PyQGIS-based solution, such as automating a municipal asset management update or a land-use change detection process.

Training Methodology

This training course employs a highly **interactive and hands-on methodology**, blending theoretical concepts with practical application.

- **Instructor-Led Sessions:** Expert-led explanations of PyQGIS concepts and functionalities.
- **Live Coding Demonstrations:** Step-by-step demonstrations of scripting techniques.
- **Practical Exercises:** Extensive hands-on exercises after each module to reinforce learning.
- **Real-World Case Studies:** Application of PyQGIS to solve industry-relevant problems.
- **Code-Along Sessions:** Participants actively write code alongside the instructor.
- **Troubleshooting and Debugging Workshops:** Dedicated sessions to address common coding issues.
- **Project-Based Learning:** A culminating project to integrate and apply all learned skills.

- **Q&A and Discussion Forums:** Encouraging active participation and knowledge sharing.
- **Comprehensive Course Materials:** Access to well-documented code examples, datasets, and reference guides.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	02 Oct 2026	Online	$2,000
21 Sep 2026	02 Oct 2026	Physical	$3,000
21 Sep 2026	02 Oct 2026	Physical	$0

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21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0
21 Sep 2026	02 Oct 2026	Physical	$0

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