August 2024 Training Course:

Artificial Intelligence Applications in Structural Engineering

Dr. Ahmed A. Torky – Civil Engineering Department

Dr. Shady Salem – Civil Engineering Department

Course Details

Instructors

- ***Dr. Shady Salem*** *(Specialized in Theory of Structures)*
- ***Dr. Ahmed A. Torky*** *(Specialized in AI implementation in Structural Engineering)*

Brief Weekly Content

- *Week 1: Introduction to Python and SAP2000 (maybe OpenSEES)*
- *Week 2: Integrating Python with SAP2000*
- *Week 3: AI algorithms and Implementation*
- *Week 4: Structural Engineering Project powered by AI*

Typical Week

- *Sunday, Thursday (Monday, Tuesday, Wednesday Self-Study)*
- *Prior Session 10am - 12 pm (**Lecture**)*
- *Post Session 1pm - 3pm (**Hands-on Training**)*

Purpose of this training course

Why is this important

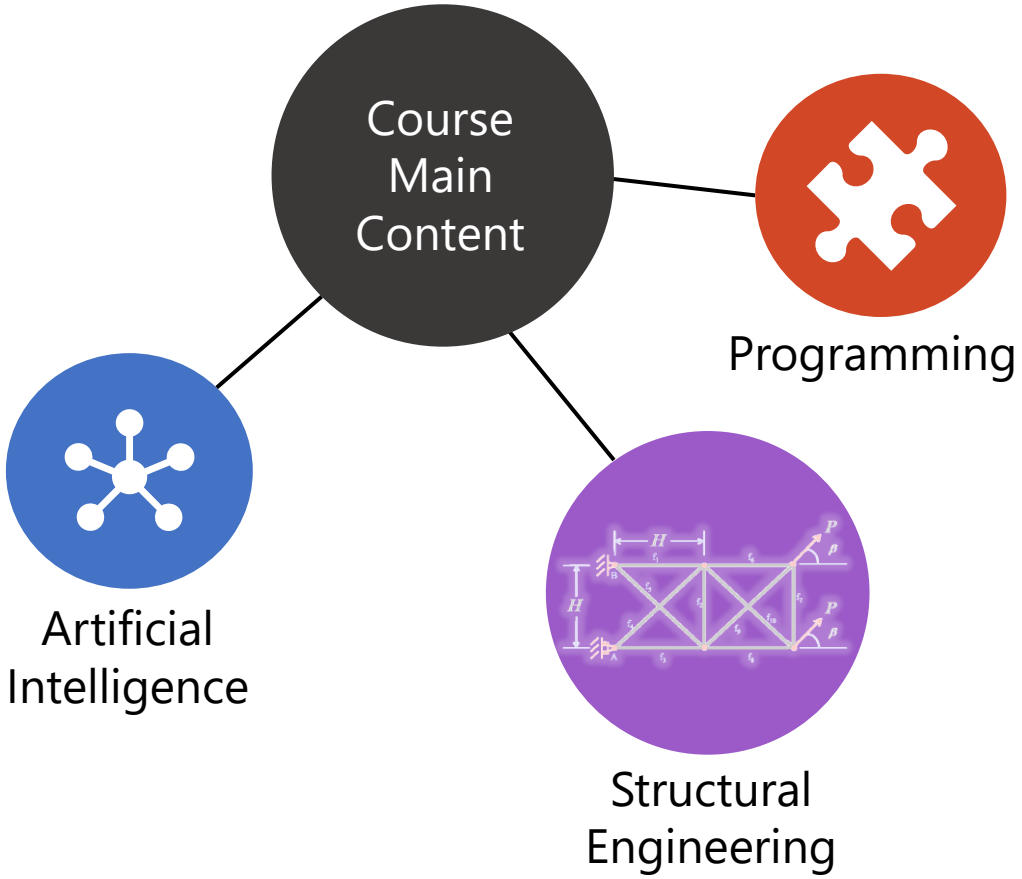
- *You will learn about the modern artificial intelligence algorithms.*
- *Programming provides engineers with a lot of automation support.*
- *AI is here to stay, better learn how to make use of it.*

Learning outcomes

- *Python programming skills.*
- *Problem solving with AI algorithms.*
- *Optimize parameters using structural analysis tools via Python.*

Prospects

- *Project supervised by the instructors.*
- *Publication of Journal/Conference paper.*
- *Not just structural engineering … other applications are viable.*



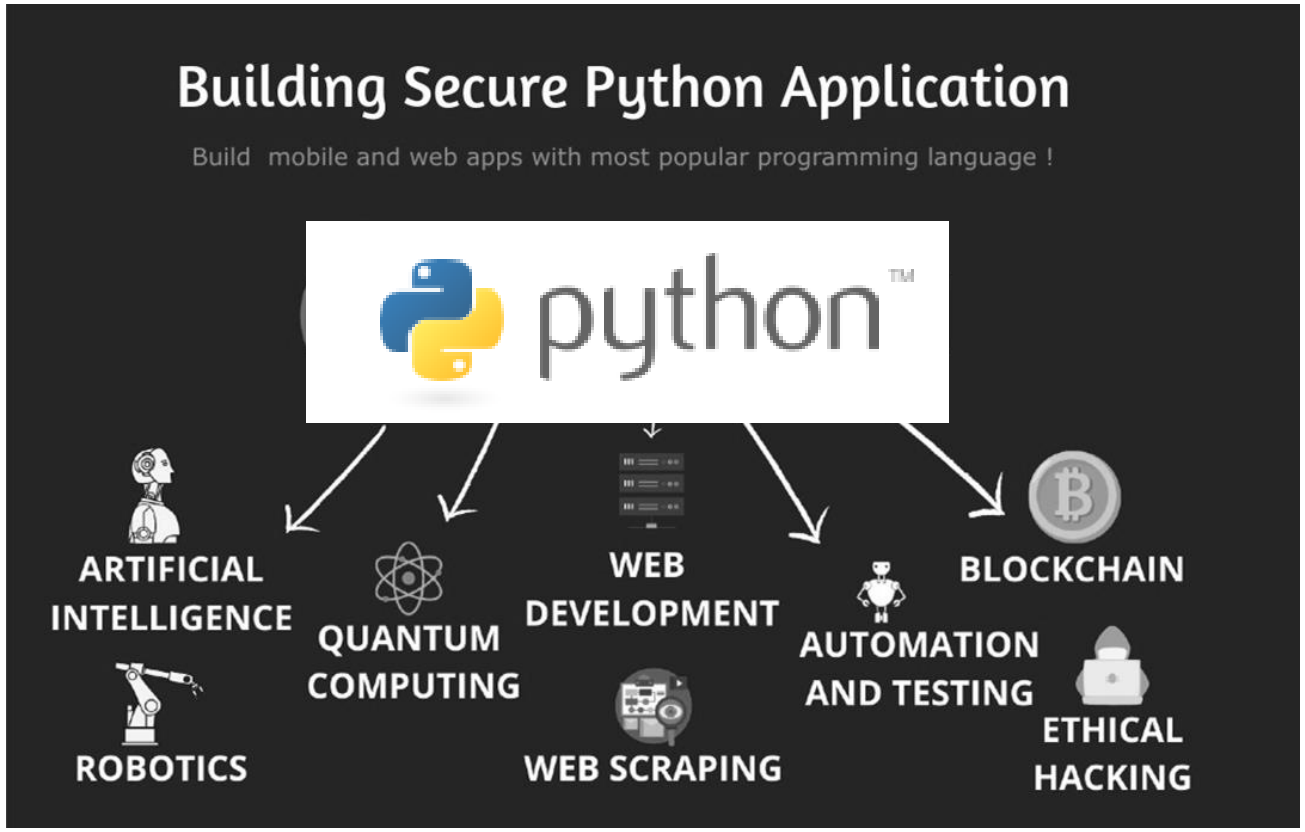
Programming – Python

Python is an easy to learn, **powerful programming** language. It has efficient **high-level** data structures and a simple but effective approach to object-oriented programming.

Python's ***elegant syntax and dynamic typing***, together with its interpreted nature, make it an ideal language for scripting and rapid application development.

The Python **interpreter** and the extensive standard library are freely available in source or binary form for all major platforms from the Python web site, https://www.python.org/, and may be freely distributed.

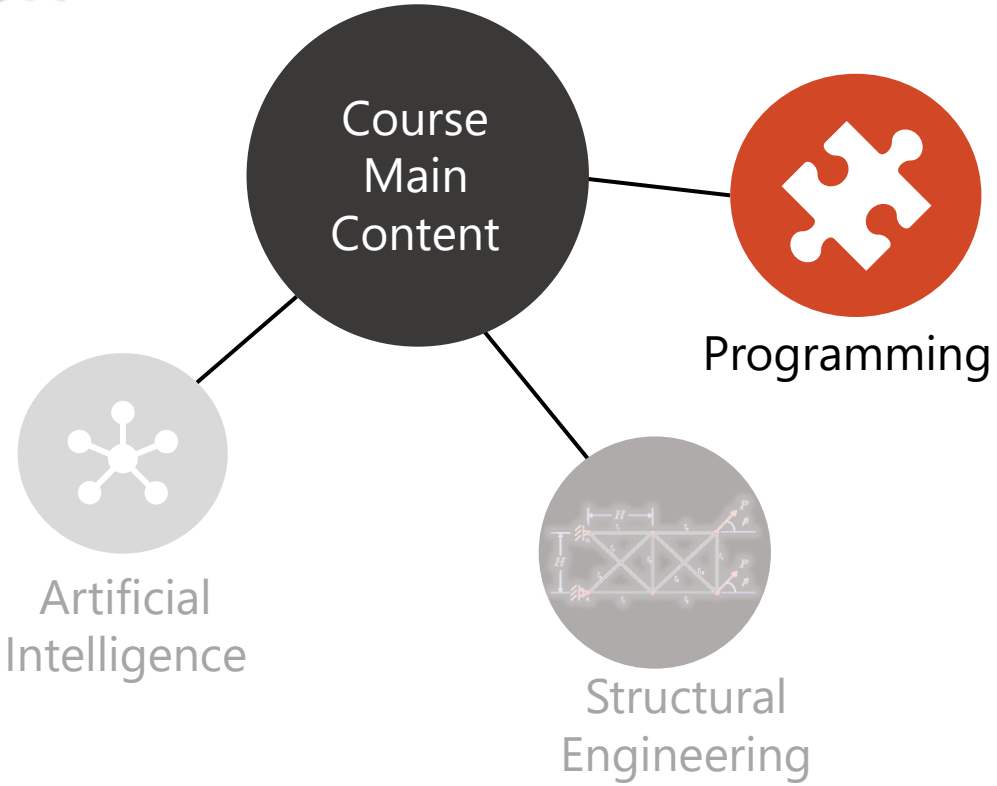
Python is used in many application domains.



Week 1 – Day 1 and Day 2

Programming with Python:

1. Python installation instructions
2. Language Basics: Data Types, Loops, If-statements
3. Simple Operations and Matrix Operations
4. Plotting
5. Functions/Classes
6. Modules and Online Libraries
7. Best Practices – Type-hinting and Doc-strings



Python – Create an Environment

Python ----------> **Anaconda** (Spyder & Jupyter)

Download Link: https://www.anaconda.com/download

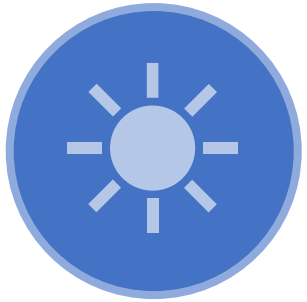
- **Jupyter**, is excellent for learning the language. It is a **web application** that allows you to create interactive documents that combine live code, visualizations, and narrative text.
- **Spyder** is a more traditional **IDE** that is easy to use and offers a range of features that are specifically designed for scientific computing and data analysis. It is excellent for making Python **scripts/packages**.

Try it out – Install Anaconda!

1. Install **Anaconda** executable.
2. Make sure you add it to **Path**.
3. Open **Anaconda Prompt**
4. Open **Spyder/Jupyter**.
5. Start **coding**!

Road to **Data Science**
and **Machine Learning**

Questions?



- Coding questions?
- Concept questions?
- What to do next?