Python in Electrical Engineering
Project I

Objective:

In this project, students will analyze the "Smart Meters in London" dataset from Kaggle using Pandas to extract meaningful insights. The goal is to explore energy consumption patterns, identify trends, and derive useful information that could be valuable for energy providers, policymakers, or consumers.

Dataset location: https://www.kaggle.com/datasets/jeanmidev/smart-meters-in-london

Students must:

1. Describe the dataset (structure, variables, missing data, etc.).
2. Perform exploratory data analysis to uncover patterns.
3. Extract interesting findings (e.g., peak usage times, seasonal trends, anomalies).
4. Provide Python code (Jupyter Notebook or script) with visualizations.
5. Summarize results in a report.

Example Analysis & Tasks

1. Exploratory Data Analysis (EDA)
   - Time-based trends:
     - Hourly, daily, weekly, and seasonal energy consumption patterns.
     - Compare weekdays vs. weekends.
   - Household behavior:
     - Compare high vs. low consumers.
     - Impact of tariff type (e.g., Standard vs. Economy-7).
   - Weather impact:
     - Does temperature affect energy use? (e.g., heating in winter vs. cooling in summer)

2. Data Cleaning & Feature Engineering
   - Handle missing values.
   - Resample data (e.g., hourly → daily).
   - Create new features (e.g., peak/non-peak hours).

3. Interesting Findings
   - Peak consumption hours (e.g., 6 PM - 9 PM).
   - Seasonal variations (higher usage in winter).
   - Anomalies (unusually high/low consumption days).
   - Correlation between weather or users group and energy use.

4. Visualizations
   - Line plots (consumption over time).
   - Heatmaps (hourly/weekly patterns).
   - Box plots (consumption distribution by household type).

Deliverables

1. Report (PDF) with:
   - Dataset overview.
   - Methodology (cleaning, analysis steps).

    - Key findings with supporting visualizations.
    - Conclusion & potential applications.
2. Python Code (Jupyter Notebook or .py file) with:
    - Data loading & preprocessing.
    - Analysis & visualizations.
    - Reproducible results.

Evaluation Criteria

- Data Understanding (Did they explore the dataset well?)
- Analysis Depth (Did they find meaningful insights?)
- Code Quality (Clean, efficient, well-documented?)
- Visualizations (Clear, relevant, well-labeled?)
- Report Clarity (Logical flow, good explanations?)