School of Computer Science Engineering and Technology

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| Course- B. Tech | Type- Specialization Elective |
| Course Code- CSET369 | Course Name- Time Series Analysis |
| Year- 3rd Year | Semester- V |
| Date- Week 5 |  |

**Lab Assignment -5**

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| Experiment | CO1 | CO2 | CO3 |
| Identify Noise and Apply Filtering Techniques |  |  |  |

**Objective:** Identify noise in a given time series, apply filtering techniques (SMA, EWMA, low-pass), and compare original vs. filtered series for effectiveness.

Download the following time series dataset and read them as a python dataframe and print the heads.

* **Dataset:** **Electric Production dataset** (monthly U.S. electricity production)

**Perform all the following tasks on the above dataset.**

**Tasks**

Task 1 — Data Loading & Visualization

1. Load the dataset and set the datetime column as index.
2. Plot the raw time series.

Task 2 — Noise Identification

1. Plot the **ACF** and **PACF** of the raw data to detect random fluctuations.
2. Add **rolling statistics** (mean & variance with a window of 7 or 12 depending on data frequency) to visualize volatility/noise.
3. Discuss whether the noise seems **white noise** or **correlated noise**.

Task 3 — Filtering Techniques

1. Apply a **Simple Moving Average (SMA)** with appropriate window size.
2. Apply **Exponential Weighted Moving Average (EWMA)** to smooth short-term fluctuations.
3. Apply a **Butterworth Low and High-Pass Filter** (scipy.signal).
4. Plot and compare original vs. filtered series.
5. Re-compute the **ACF** of filtered data and compare with original.