Training Day 10 Report:

Date: 8 *July,2025(Tuesday)*

Location:*PG Block HPC Lab*

Guided by:*Training Instructors (Classroom-Based)*

Main Objective:

To learn the concepts and practical applications of K-Means clustering, online learning, and semi-supervised learning, including a real-world case study on Smart City Ludhiana.

Summary of the Day's Work

Today's session focused on unsupervised learning with K-Means, visualizing clustering, seeing how centroids update, and understanding how clustering applies to urban planning. Discussed continuous and semi-supervised learning concepts and their practical roles.

Topics/Areas Covered:

- K-Means Clustering Algorithm (Unsupervised Learning)
- Smart City Case Study – Ludhiana
- Online Learning in ML
- Semi-Supervised Learning

Concepts Learned:

- K-Means groups similar data without labels.
- Centroids are updated until convergence is reached.
- K-Means used in customer segmentation, zone classification, etc.

- Online Learning is for continuous data (used in fraud detection, recommender systems).
- Semi-Supervised Learning uses both labeled and unlabeled data.
- ML can be applied to real-world smart city problems.

Tools / Platforms Used

- Google Colab / Python
- Libraries: sklearn, matplotlib, seaborn, pandas

Tasks Performed:

- Implemented K-Means Clustering on sample unlabeled dataset.
- Visualized how data points were grouped into clusters.
- Observed how centroids change with each iteration.
- Discussed how ML could help Ludhiana with traffic, pollution, waste, etc.

Case Study: Smart City – Ludhiana

- **Issues found:** Traffic, pollution, semi-automated waste system.
- Discussed the use of K-Means to classify city zones for improvement.

Observations / Reflections

Learning clustering through K-Means was easy to follow and fun to visualize. The Ludhiana Smart City case helped me see how ML can be useful in urban planning and real problems.

Key Takeaways

- Built confidence in unsupervised ML and clustering.

- Saw practical, impactful ML applications for cities and society.

- Understood basic to advanced clustering workflow.