Practical Sessions:

Section	Labs	Topics Covered
Data Science for IoT	**1-4**	Data handling, EDA, Time-Series, TinyML
IoT Fundamentals	**5-8**	Microcontrollers, Sensors, Cloud, Communication
IoT & AI Integration	**9-10**	Edge AI, Face/Object Recognition
Capstone Project	**Final**	Real-world IoT-Data Science system

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This structure provides **a balanced mix of IoT, ML, and cloud-based practicals**, ensuring students **get industry-ready skills**.

📌 Practical Syllabus for M.Sc. Data Science & IoT

💡 *Objective: Hands-on experience in Data Science, IoT, and their integration.*

🔹 Section 1: Data Science for IoT (Labs 1-4)

💡 *Goal: Understand data processing, time-series analysis, and TinyML for IoT datasets.*

🧪 Lab 1: Exploring & Analyzing IoT Data with Python

- Work with **NumPy, Pandas, Matplotlib**
- Handle **text, table, and time-series data** (e.g., stock prices, weather data)
- Perform **Exploratory Data Analysis (EDA)**
- Compute **mean, median, standard deviation**
- Handle **missing values & outliers**

🧪 Lab 2: Time-Series Analysis for IoT Data

- Load and visualize **IoT sensor data over time**
- Apply **moving averages & trend detection**
- Implement **basic forecasting models (ARIMA, Exponential Smoothing, LSTMs)**

🧪 Lab 3: Deep Dive into TinyML

- Introduction to **TinyML & Edge AI**
- Train & deploy **lightweight ML models**
- Work with frameworks like **TensorFlow Lite & Edge Impulse**

🧪 Lab 4: Working with Real IoT Datasets

- Select a **real-world IoT dataset** (e.g., air quality, smart home data)
- Perform **EDA & preprocessing**
- Train a simple **ML model** for IoT predictions

🔹 Section 2: IoT Fundamentals (Labs 5-8)

💡 *Goal: Gain hands-on experience with microcontrollers, sensors, cloud communication, and IoT networking.*

🧪 Lab 5: Getting Started with Microcontrollers & Sensors

- Work with **Arduino & ESP32**
- Read data from **sensors** (temperature, humidity, soil moisture, PIR, infrared, LDR, etc.)
- Display sensor values on **serial monitor & OLED screens**

🧪 Lab 6: Sending IoT Data to the Cloud

- Connect ESP32 to the **internet (WiFi/Bluetooth)**
- Send sensor data to **ThingSpeak, Firebase, or Arduino IoT Cloud**
- Visualize real-time data dashboards

🧪 Lab 7: Communication Between Microcontrollers

- Implement **device-to-device communication**
- Use **MQTT / HTTP / LoRa** for message exchange
- Example: **ESP32 sending data to another ESP32/Arduino**

🧪 Lab 8: Multi-Sensor Network & Simulation

- Simulate a **multi-sensor IoT system**
- Collect & combine data from multiple sensors
- Implement **data fusion techniques** for decision-making

🔹 Section 3: IoT & Data Science Integration (Labs 9-10)

💡 *Goal: Combine ML & IoT for real-world applications.*

🧪 Lab 9: Deploying Edge AI Models on IoT Devices

- Deploy a **TinyML model on ESP32/Raspberry Pi**
- Perform **real-time IoT data classification**
- Optimize model for **low power & efficiency**

🧪 Lab 10: Object/Face Recognition for IoT

- Implement **Face/Object Recognition** using OpenCV & TensorFlow Lite
- Run the model on **Raspberry Pi / ESP32-CAM**
- Use IoT integration for **access control / smart surveillance**

🔹 Capstone Project: Real-World IoT-Data Science System

💡 *Objective: Apply all learned concepts in a full-fledged project.*

🔹 **Example Projects:**
✅ **Smart Home Automation** (AI-powered sensor-based control)
✅ **Predictive Maintenance for Industry 4.0** (Anomaly detection on sensor data)
✅ **Smart Agriculture System** (Soil moisture monitoring & AI-based irrigation)
✅ **AI-Powered Security System** (Face recognition for door access)