Course Title:

"Data Science & Sensors: IoT to Insights"

(Grades 11-12 | 4 Weeks | Prerequisites: Algebra, Basic Programming)

Course Outcomes

By the end, students will:

1. **Design IoT systems** to collect sensor data (temperature, motion, etc.).
2. **Analyze datasets** using statistical methods (regression, correlation).
3. **Build interactive dashboards** and apps with MIT App Inventor.
4. **Solve real-world problems** (e.g., smart agriculture, urban monitoring).

Weekly Breakdown

Week 1: Foundations of IoT & Data Collection

Objective: Set up sensor networks and understand data flow.

- **Session 1**: "Introduction to IoT"
  - *Activity*: Assemble Raspberry Pi/Pico + sensors (DHT11, accelerometer).
  - *Project*: Live temperature logger with MIT App Inventor (CloudDB).
- **Session 2**: "Data Ethics & Cleaning"
  - *Skills*: Handle missing data, noise reduction (Google Sheets/Python).
  - *Project*: Clean and visualize sensor data.
- **Session 3**: "APIs & Automation"
  - *Skills*: Fetch data from public APIs (e.g., Weather.gov).
  - *Project*: Hybrid dataset (sensor + API) in App Inventor.

Assessment: Data quality report for collected sensor data.

Week 2: Advanced Analytics & Visualization

Objective: Apply statistical models to sensor data.

- **Session 4**: "Trend Analysis"
    - *Skills*: Linear regression, correlation (Google Sheets/Colab).
    - *Project*: Predict temperature trends with R^2 evaluation.
- **Session 5**: "Anomaly Detection"
    - *Skills*: Z-scores, thresholds.
    - *Project*: Build an app alerting for abnormal sensor readings.
- **Session 6**: "Geospatial Data"
    - *Skills*: GPS + sensor fusion (App Inventor LocationSensor).
    - *Project*: Noise pollution map of school.

Assessment: Statistical validity of trend predictions.

Week 3: App Development for Data Solutions

Objective: Create interactive data apps.

- **Session 7**: "Real-Time Dashboards"
    - *Skills*: Chart components, dynamic UI (App Inventor).
    - *Project*: Live sensor dashboard with alerts.
- **Session 8**: "Predictive Apps"
    - *Skills*: Integrate ML models (e.g., TensorFlow Lite).
    - *Project*: Crop health predictor using soil sensor data.
- **Session 9**: "Data Storytelling"
    - *Skills*: Narrative visualization.
    - *Project*: Interactive report on campus energy usage.

Assessment: Usability testing of apps with peers.

Week 4: Capstone & Ethics

Objective: Solve a community problem with IoT + data science.

- **Session 10**: "Ethics of Sensor Data"
    - *Debate*: Privacy vs. utility in smart cities.
- **Session 11-12**: "Final Project"
    - *Deliverable*: End-to-end solution (e.g., air quality monitor with public alerts).
    - *Presentation*: Demo + defense of technical/ethical choices.

Assessment: Rubric for innovation, technical depth, and ethical consideration.

Tools & Resources

- **Hardware**: Raspberry Pi Pico (4),DHT11,accelerometer(budget: 4),$DHT11$,$accelerometer$.
- **Software**: MIT App Inventor (Data Science Unit), Google Sheets, Colab.
- **APIs**: Weather.gov, OpenAQ (air quality).

Differentiation

- **Advanced**: Use Python for edge computing (MicroPython on Pico).
- **Inclusive**: Pre-built datasets for students without hardware access.

Sample Project Flow (Week 3, Session 7)

Goal: Build a real-time temperature dashboard.

1. **Hook (10 mins)**: Show NYC's heatmap dashboard.
2. **Direct Instruction (15 mins)**: App Inventor's WebViewer + Chart components.
3. **Guided Practice (20 mins)**: Fetch CloudDB data → update chart every 10 sec.
4. **Independent Practice (10 mins)**: Add anomaly alerts (e.g., red if >30°C).
5. **Wrap-up (5 mins)**: Discuss scalability challenges.