Problem Statement: Urban Flood Risk Prediction and Response Planning Using AI

Context:
Urban flooding poses a severe challenge to Indian cities, leading to significant disruptions and damages. With rapid urbanization and climate change, there is a growing need to develop predictive models and real-time response strategies that can mitigate flood impacts and enhance urban resilience.

Objective:
Develop a data-driven solution leveraging AI and physics-guided modeling to predict urban flood risk in real-time and propose adaptive strategies for flood management. Participants are expected to analyze provided datasets, derive key insights, and build predictive models that can inform actionable decision-making.

Data to be Used:

1. **Historical Rainfall Data:** Time-series data covering multiple years for cities like Surat, Ahmedabad, and Mumbai.
2. **Topographical Maps and Elevation Data:** Detailed GIS maps showing elevation gradients, drainage paths, and water flow patterns.
3. **Urban Infrastructure Data:** Information on road networks, drainage systems, and critical infrastructure (hospitals, schools, etc.).
4. **Socio-economic Data:** Population density, household income levels, and vulnerability indicators.
5. **Past Flood Incidents and Impacts:** Records of previous flood events, affected areas, and damage assessments.
6. **Remote Sensing Data:** Satellite imagery for land use/land cover, vegetation indices (NDVI), and surface water extent during flood events. Participants can use these data to improve accuracy and enhance the spatial resolution of flood predictions.

What Participants Need to Do:

1. **Flood Risk Prediction:** Use the provided datasets to develop a real-time flood risk prediction model. The model should take into account meteorological data, topography, drainage systems, and urban infrastructure to forecast flood-prone areas.
2. **Impact Assessment:** Assess potential impacts on critical infrastructure and vulnerable communities. The solution should prioritize regions based on risk levels, guiding emergency responses.
3. **Adaptive Strategies:** Propose response plans that include evacuation routes, resource allocation for relief operations, and infrastructure reinforcement strategies. Solutions should integrate AI-driven insights with physics-based modeling approaches.
4. **What-if Scenarios:** Develop what-if scenarios to simulate different rainfall intensities, urban growth patterns, and infrastructure failures. These scenarios should help decision-

makers understand how varying factors can influence flood risks and response strategies.

5. **Validation and Scalability:** Validate the model using historical flood data and explore how the approach can be scaled to other cities with varying climates and urban structures.

Expected Deliverables:

1. **Flood Risk Prediction Dashboard:** A visualization tool displaying real-time flood risk maps, impact projections, and suggested actions.
2. **What-if Scenario Simulations:** An interactive module allowing stakeholders to test and visualize the outcomes of different scenarios, such as extreme rainfall events, infrastructure breakdowns, and changes in urban planning.
3. **Technical Report:** Detailed documentation explaining the methodology, data processing steps, model architecture, validation results, and proposed strategies.
4. **Remote Sensing Analysis Report:** Integration of satellite data into the flood risk model, detailing how remote sensing improved predictions and scenario accuracy.
5. **Presentation:** A concise summary of the solution, highlighting key innovations, practical implications, and scalability potential.