GIS – 842 Natural Hazards and Disaster Management (3+0=3)

1. **Course Objectives:**
   a. To enable students to develop advanced understanding and analysis of various natural and manmade disasters using geospatial techniques

2. **Course Outcomes:**
   a. Participants by the end of their course will be able to understand and analyze various hazards/disasters and suggest possible mitigations measures

3. **Course Code:**
   a. GIS – 842

4. **Credit Hours:**
   a. Theory = 03
   b. Practical = 00
   c. Total = 03

5. **Detailed Contents:**
   a. Introduction to natural hazards
   (1) Living with Nature
   (2) Nature and environmental hazards
   (3) Defining natural hazards and predicting catastrophe
   b. Mass movement
   (1) Landslides
   (2) Rockfall
   (3) Soil Creep
   (4) Avalanches (snow and glacier)
   (5) GIS model and analysis techniques for the above disasters
   (6) Vulnerability and risk analysis
   (7) Mitigation measures
   c. Flood processes
   (1) Streamflow and modeling for disaster mapping
   (2) Channel patterns, groundwater, precipitation, and streamflow
   (3) Flash floods
   (4) Riverine floods
   (5) Flood vulnerability and risk assessment using GIS
   d. Geophysical and environmental dynamics
   (1) Earthquakes and plate tectonics
   (2) Mapping earthquake vulnerability
   e. Tsunami and coastal cyclones
   (1) Dynamics of the Indian Ocean and the Arabian Sea
   (2) The population at risk (mapping areas bearing high-risk potential)
   (a) Effects of Tsunamis and cyclones on the coastal landscape
   (3) The run-up of tsunamis/coastal cyclones
   (4) Period/duration of tsunami/coastal cyclones
   (b) Mitigating coastal risk
   (c) The Indonesian and Japanese Tsunami
   (d) The case of the Arabian Sea cyclones
   f. Hazards related to extreme weather
   (1) Drought, desertification, dust-storms, snow, and blizzards
   (2) Torrential rainfall and storms
   g. Climate change

(1) Myth or reality, a survey of supportive arguments
(2) Global warming and the greenhouse effects
(3) Precipitation changes
(4) Snow, ice and blizzards
h. Multi-hazard risk assessment
(1) Exposure/vulnerability combination of multi-hazard risk
(2) GIS mapping for multi-hazard risk assessment (models and techniques
i. Mitigating natural disasters
j. Hazard alert automation
k. Flood and AIoT (align decision makers with necessary actions required for disaster mitigation)
l. Landslide/mass movement detection and alert

6. **Detail of Lab work, workshop practice, if applicable:**

a. Mapping exercises (Course specific/there are other exercises included with the Provided virtual machine)
b. Mapping mass movement
(1) AHP and MCDA for Landslide Mapping
(2) Mapping snow avalanches
c. Rainfall mapping and flood modeling.
d. Tsunami modeling and mapping
e. Drought mapping and modeling using MODIS and TRMM data

7. **Textbooks/Reference Books:**

a. Hyndman, D., & Hyndman, D. (2016). Natural hazards and disasters. 5th Edition. Cengage Learning.
b. Cross, J. A. (2009). Teaching hazards by geographers: A decade of change. Environmental Hazards, 8(1), 71-85.
c. Mileti, D. S. (1999). Disasters by design: A reassessment of natural hazards in the United States. National Academy Press.
d. Sørensen, J., Vedeld, T., & Haug, M. (2006). Natural hazards and disasters.
e. Alcántara-Ayala, I. (2002). Geomorphology, natural hazards, vulnerability and prevention of natural disasters in developing countries. Geomorphology, 47(2), 107-124.
f. Tomaszewski, B. (2014). Geographic information systems (GIS) for disaster management. Routledge.
g. Related Journal Papers (Class handouts)