GIS – 838 Spatial Hydrology (3+0=3)

1. **Course Objectives:**
   a. Spatial hydrology is an emergent field that links hydrological processes with spatially explicit landscape-scale modeling using remote sensing and Geographic Information System (GIS). This course presents the application of GIS in Water Resources. Concepts of ArcHydro tools, components and typical applications will be discussed. The course provides introduction and hands-on experience with creating hydro networks of rivers and streams, defining drainage areas, catchments, watersheds, and basins using Digital Elevation Model (DEMs), and connecting geospatial features to time series measurements recorded at gauging sites. Knowledge will be imparted about various hydrological models like HEC-RAS, HEC-GeoRAS, ArcSWAT, DRASTIC etc.

2. **Course Outcomes:**
   a. At the end of this course the student will be able to understand surface/sub-surface hydrological processes with respect to GIS and Remote Sensing.

3. **Course Code:**
   a. GIS – 838

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

5. **Detailed Contents:**
   a. The Hydrologic Cycle (system and process)
   b. Climatology (climate variables estimation, analysis, processes and multiple sources of datasets including gridded and remotely sensed data), climate change data sources (CMIP3, CMIP5 and CMIP6, CORDEX program), published articles reading
   c. Watershed delineation, ArcHydro Tool
   d. Energy flux estimations using models (CLM model)
   e. Evaporation and Transpiration (ET), SEBAL, SEBS, Metrix methods etc
   f. AI for the Optimization of Crop water requirements using image processing
   g. Basic Groundwater Hydrology and Systems
   h. Spatial Runoff Analysis
   i. Surface Runoff and Stream Flow
   j. Application of GIS in Hydrological modeling system, Multiple models for runoff analysis
   (1) HEC-HMS
   (2) HEC-RAS
   (3) HEC-GeoRAS, HEC-GeoHMS
   k. Land use land cover impact on runoff, Incorporation of LANDSAT data in Models
   l. AI in climate projections and streamflow predictions (rainfed and hydrologically complex catchments)
   m. Surface Water Resource Systems, Rivers, Lakes, and Reservoirs
   n. Assessing and modeling droughts, Floods using GIS, RS, and modeling approach
   o. Snow and Glacier Hydrology (mountainous hydrology)
   p. GIS Case Studies in Hydrology and Water Resources
   q. Term Project

6. **Textbooks/Reference Books:**

a. Robinson, M., & Ward, R. C. (2017). Hydrology: principles and processes. Iwa Publishing.
b. Brutsaert, W. (2005). Hydrology: an introduction. Cambridge University Press.
c. Dingman, S. L. (2015). Physical hydrology. Waveland press.