

Course Name:

Remote Sensing (RS) and Geographic Information System (GIS) Application in Civil Engineering and Laboratory

Course Number:

20896

Credit:

3

Course Content (outline):

- Geographic Information System (GIS)
 - Introduction to Geographic Information System and Remote Sensing
 - Overview of ArcGIS package: ArcMap, ArcCatalog, ArcView, and ArcScene
 - Data types (spatial data, coordinate data, attribute data, vector data, raster data, and triangulated irregular network data) and file structures (shapefile and grid data structures)
 - Coordinate systems, projection, and transformation (ellipsoid, geoid, horizontal vs. vertical coordinate systems, datum transformation, classification of map projections, distortion in map projection)
 - Georeferencing
 - Editing and digitizing
 - Raster analysis and algebra
 - Vector analysis and operations (joining and selecting features based on location and attribute; buffer, clip, union, and dissolve operations)
 - Table operations (selections by attribute and location, field editing, field statistics, field calculator, join fields)
 - Terrain and watershed analysis (DEM preprocessing, delineation of slope, flow direction, flow accumulation, drainage area, and drainage network, geometry computations)
 - Map components and design, layout overview

- Remote Sensing (RS)
 - Key concepts of remote sensing
 - Remote sensing platforms, sensor types, satellite characteristics (orbits and swaths)
 - Resolution (spatial, temporal, radiometric, and spectral), pixel size, and scale concepts
 - Physical basis for remote sensing, energy-matter interactions
 - Electromagnetic radiation, electromagnetic spectrum, and radiation laws
 - Electromagnetic radiation interactions with atmosphere and surfaces
 - Spectral signatures for vegetation, water, snow, etc.
 - Remotely sensed data acquisition: analog vs. digital imagery, errors in digital imagery, and photogrammetry
 - Digital imagery and band combinations in optical and multispectral imagery
 - Image enhancement
 - Image classification
 - Classification accuracy assessment

References:

- “GIS Fundamentals: A First Text on Geographic Information Systems”, P. Bolstad, 4th Ed., Eider Press, 2012.
- “Introduction to remote sensing”, J.B. Campbell, and R.H. Wynne, Guilford Press, 2011.
- “Principles of Geographic Information Systems”, A. Rolf, R.A. de By, ITC Educational Textbook Series, 2000.
- “Principles of Remote Sensing”, L.L.F. Janssen, 2000, ITC Educational Textbook Series.
- “GIS Implementation for Water and Waste Water Treatment”, WEF, Water Environmental Federation Manual of Practice No. 26, McGraw Hill, 2005.
- “Remote Sensing in Hydrology and Water Management”, G.A. Schultz, & E.T. Engman, Springer, 2000.