BSE 4344 – Geographic Information Systems for Engineers

Credit / contact hours: 3 credits, 5 contact hours

Course instructor: V. Sridhar

Textbook / materials:
suggested textbook:
Harder, C., T. Ormsby, and T. Balstrom. 2013. Understanding GIS: An ArcGIS Project
Workbook, 2nd Edition. ESRI: Redlands, CA. Pp. 392.
Bolstad, P., 2016 GIS Fundamentals, 5th Edition ISBN 978-1-50669-587-7

Catalog description:
The objectives of this course are to develop necessary skills and knowledge related to the
applications of Geographic Information Systems (GIS) in pre- and post-processing of model
inputs and outputs, spatial analysis and interpretation; real-world water resource problems and
integration of external models

Co-requisites: NA

Pre-requisites: BSE 3324

Course type: elective in the program

Specific outcomes of instruction:
1. Identify types of products and applications of GIS
2. discuss the nature and characteristics of spatial data and objects
3. list and define GIS operations.
4. describe and evaluate methods of data capture and sources of data
5. describe the characteristics, advantages and disadvantages of different models
6. discuss factors affecting errors, accuracy, and data quality
7. categorize and describe spatial analysis functions
8. demonstrate spatial analysis operations using sample data sets and GIS software
9. describe and demonstrate applications of GIS
10. implement GIS models to solve engineering problems using available software

Student outcomes addressed by course:
Outcome 1: an ability to identify, formulate, and solve complex engineering problems by
applying principles of engineering, science, and mathematics

Outcome 6. an ability to develop and conduct appropriate experimentation, analyze and interpret
data, and use engineering judgment to draw conclusions

Outcome 7. an ability to acquire and apply new knowledge as needed, using appropriate learning
strategies

List of topics covered:

- Basics of GIS
    - Components of a GIS
    - Geospatial Data
    - GIS operations

- Coordinate Systems
    - Map projections
    - Projected and Predefined Coordinated systems
    - On-the-Fly Projections

- Vector Data Model
    - Representation of simple features
    - Topology
    - Representation of composite features
    - Geodatabase

- Raster Data Model
    - Elements of the Raster Data Model
    - Types of Raster Data
    - Data structure, data conversion and integration
    - Integration of raster and vector data

- Data Exploration
    - Remotely sensed data
    - Descriptive Statistics
    - Attribute and spatial data query

- Raster Data Analysis
    - Local and neighborhood operations
    - Zonal operations

- Vector Data Analysis
    - Buffering and overlay
    - Pattern Analysis

- Hydrological Modeling
    - ArcSWAT , HEC-GEOHMS and other suitable models