COURSE SYLLABUS
CIVE 577
GIS in Civil and Environmental Engineering

Credits: 3

Prerequisite: CIVE 322/ENVR 322: Basic Hydrology, or equivalent

Catalog Description: GIS technology for spatial design/analysis; applications in facilities management, urban infrastructure, water resources, environmental engineering.

Instructor: John W. Labadie, Engr. B-211, Phone: 491-6898

Required Textbook: Law, M. and A. Collins (2013) *Getting to Know ArcGIS Desktop: Updated for ArcGIS 10.1*, 3rd Edition, ESRI Press, Redlands, CA, ISBN: 978-1-58948-308-8.

Software: All students (on-campus and distance) will be provided access to ArcGIS 10.1 software (ArcInfo license) and associated Extensions

Course Objectives: Provide comprehensive instruction in the underlying concepts and principles of geographic information system (GIS) technology and its application to the design and analysis of civil and environmental engineering systems. The focus is a fundamental understanding of spatial data acquisition, geoprocessing, geostatistical methods; visualization, and querying of spatial data; network modeling, terrain mapping, and spatial analysis. Students are trained to become proficient in usage of ESRI ArcGIS 10.1 software through extensive computer lab sessions, including applications in urban hydrologic modeling, urban stormwater management, nonpoint source pollution control, ecological assessment, utility and infrastructure management; water, sewer and transportation network analysis, and river basin management.

Course Topics/Weekly Schedule:

Week	Topic

1. Introduction to GIS; engineering applications: utility system maintenance, urban hydrologic modeling, urban flood control, water supply, water distribution system design, stormwater quality monitoring/control, sold waste management and hazardous waste management.
2. Introduction to ArcGIS Desktop GIS; exploring the ArcMap interface and ArcCatalog for spatial data management.
3. GIS spatial data sources on the Internet; creating new data sets from xy events; heads-up digitizing; GPS for GIS data capture.
4. Spatial data structures in GIS; map projections and coordinate systems; map scale; raster and vector spatial data models; topology and relational query; selecting and editing features; displaying and editing tables; joining and linking tables.
5. GIS analysis functions and operations; feature proximity, containment, intersection; spatial joins; overlays; buffers; geoprocessing; creating/editing spatial data; map display.
6. ArcGIS Spatial Analyst Extension; identifying, displaying, querying and managing grids; converting grids; resampling and generalizing grid data; spatial analysis.
7. Urban hydrologic modeling in GIS; digital elevation model analysis; time-area watershed mapping; spatially derived unit hydrographs; least-cost routing; Dijkstra's algorithm.

8. Urban stormwater runoff modeling in GIS; spatial data requirements for EPA SWMM model; GIS in urban stormwater management; base map layers; derived maps; zone-risk analysis.

9. Image processing; supervised and unsupervised classification; image rectification and resampling; ArcScan Extension for vectorizing raster lines.

10. Utility Network Analyst in ArcGIS; building water networks in ArcCatalog; performing network analyses; developing network connectivity rules; network validation and editing.

11. ArcGIS Network Analyst Extension; network modeling and analysis; defining cost surfaces; finding best routes; closest facility; service areas.

12. ArcHydro Tools Extension; watershed and stream network delineation; building an Arc Hydro geometric network; flow tracing and analysis of hydrologic networks.

13. Application of HEC-GeoRAS for ArcGIS to hydraulic modeling of floodplains (FEMA), real-time operations, and emergency management.

14. GIS for estimating stormwater pollutant mass loadings; regulatory issues in nonpoint source pollution; estimation of event mean concentrations; land use impacts on pollutant loadings; evaluation of BMPs; application of GIS.

15. ArcGIS Geostatistical Analyst Extension; geostatistical analysis and interpolation; trend surface analysis; data smoothing; inverse distance weighted interpolation; kriging; Case Study: visualizing impacts of river operations on endangered species habitat.

Instructional Methodology: Two hours of class lectures and two hours of laboratory per week.

Methods of Evaluation: Term grades for this course will use the +/- grading system as described in the CSU catalog. The course grade will be based on approximately the following distribution; however, the instructor may adjust these weights as needed:

Homework	30%
Lab Exercises	10%
Midterm Examination	30%
Final Class Project	30%