GEOMATICS AND GIS COURSES: 2014/15

Introduction to GIS (CVEN 5381)

The Introduction to GIS course provides an overview exposure to and experience with various aspects of GIS technology and its uses for natural resource and infrastructure planning, design and management. The course involves a survey of GIS software and hardware, a review of cartographic mapping principles, and hands-on applications to prototype situations, such as environmental impact assessment, municipal facilities management, transportation, water resources and demographics. GIS project management factors are addressed. Prerequisites include: graduate or upper division standing and training in the use of personal computers; or instructor approval.

GIS Data Development (CVEN 5382)

Geographic information systems require development of supporting spatial and attribute data on which to apply the required analyses. This GIS course builds on the introductory course and addresses principles and technologies for development and conversion of spatial data; including photogrammetry, surveying and geodesy, coordinate systems and transformations, and remote sensing. The course objectives are to: 1) introduce design concepts for GIS data collection and processing, 2) review principles of geodesy and coordinate reference systems, and 3) address methods for map data collections and conversions, including tablet digitizing, scanning, remote sensing, plane surveying, photogrammetry and global positioning systems (GPS).

GIS Analyses (CVEN 5383)

GIS Analyses focuses on a spectrum of topics relevant to understanding the conceptual foundations of spatial analyses, and for processing data to obtain analysis products. Review GIS software functions, including: data entry (input, editing), manipulation (projection, merge, window, aggregate), analysis (map algebra, overlay, Boolean, interpolation, network, measurements, distance, terrain modeling, statistical analysis), query (spatial, attribute), and display/reporting. Integration of various domain-specific systems analysis models with GIS databases is also addressed. Laboratory activities involve programming applications using available GIS.

GIS Management (CVEN 5384)

GIS Management and Policies addresses aspects of system planning and development. These include topics of benefit-cost and financial analysis, scheduling, internal and external marketing, and project management. Also addressed are issues of GIS institutional acceptance, the role of computerized spatial data systems in decision-making, application of planning techniques for accomplishing resource goals, administrative structures that enhance efficiency of use, and legal considerations involved with development and use of such databases.

GIS Relational Databases (CVEN 5385)

GIS Relational Databases introduces relational database management system concepts with emphasis on GIS. Includes examination of relational database systems from conceptual design through relational schema design and physical implementation. Topics include SQL, database design and implementation for large database systems, transaction management, concurrency control, distributed database management systems and the interaction and progressive integration of GIS technologies and RBDMS technologies.

GIS Laboratory (CVEN 5386)

Geomatics for GIS (CVEN 5391)
This course is designed to present Geomatics as a concept along with its data and tools, and their connection. The class includes topics from geodesy, surveying, spatial data collection methods, assessment and processing. The course also includes projections, coordinate conversion and transformation principals and solutions, and data transfer across different spatial software platforms

GNSS and GPS basics (CVEN 5392)
Description of GPS signal structure and derivation of observables; characteristics of instrumentation; analysis of atmospheric, orbital, random and non-random effects; derivation of mathematical models used for absolute and differential static and kinematic positioning; pre-analysis methods and applications; software considerations; introduction to GPS. GNSS structure and participants

Practical High Definition Surveying (CVEN 5800)
HDS instrumentation. HDS project reconnaissance and planning. Field data collection principles and methods. Coordinate systems and survey control for HDS data collection. Data analysis, cleaning and processing. Data extraction and deliverables. 2D and 3D models. Data attribution and data sharing.

Unmanned Airspace Systems (UAS) (CVEN 5800)
Provide information and practical skills for managing a project using unmanned aerial systems. The focus is on mission planning, operations, and data processing and the benefits of using unmanned aircraft as a tool in Geospatial, Engineering and other industries.

Mathematical Cartography (CVEN 5800)
Reference surface, deformation laws, map projections, common cartographic projections. Numerical methods in mathematical cartography. Optimization and rules for proper choice of projection. Common projection description and calculations.

Adjustment of Observations and Data Analysis (CVEN 5800)
Random error theory. Accuracy and precision. Statistical testing. Error propagation in Geomatic measurements. Principles of lease square methods. Weight matrix. Adjustment of level nets. Adjustment of horizontal surveys. Adjustment of GNSS networks. Coordinate transformation. Error ellipse an constraint equations.

Geodesy (CVEN 5800)
Shape of the Earth. Ellipsoid and Geoid. Geodetic models and datum. Vertical Datum and heights. Horizontal datum. Geodetic position, Geoid undulations and deflection of the vertical. International Terrestrial Reference System and Conventional Terrestrial Pole. USA reference frames and Datums. National Spatial Reference Systems. Geodetic, geographic and astronomic coordinate systems. Local coordinate systems. Geodetic positional computations. Coordinate transformations. Spherical coordinate systems and three dimensional coordinate position computations. Earth magnetic field. Gravimetry and gravimetrical models.

NEW for spring 2015

Photogrammetry (CVEN 5800)
Airborne, space and terrestrial acquisition systems. Metric and non-metric cameras. Linear Sensors and non-conventional imagery. Fundamental coordinate systems and mathematical relationship between image, model and object space. Direct and inverse problems of projective and similarity coordinate transformations. Correction of photogrammetric measurements. Colinearity and complanarity equations. Analytical space resection and space intersection. Interior and exterior orientation.

LIDAR systems and data processing (CVEN 5800)
Concept and principals of the laser distance measurement technology. Airborne data collectors. Signal decoding. Data cleaning and data extraction procedures. Model development and data analyses.

Legal aspects in surveying, PLSS, Boundary and Cadastral surveying (CVEN 5800)
Legal, economic and social concepts of land tenure; land ownership and land registration; fiscal, judicial and multipurpose cadastral systems; the proprietary land unit; use, valuation and management of land resources; the role of the cadastral surveyor, liability of surveyors; the Public Land Survey System, history, detailed description and calculations; land registration systems; Introduction to other Legal Survey Systems; descriptions of land.

Topographical mapping and DTM (CVEN 5800)
Topographic data collection methods. Topographic maps and their unique format. Contours and breaklines. Methods of planimetric data extraction and representation. Digital Terrain Modeling (DTM, DEM, DHM, DSM) concepts and their implementation and applications in Geomatics engineering and other disciplines. Structures of DTM (Contours, Grid, and TIN). Types of DEM (eg. CDED, DTED). Processing, storage, and manipulation of DTM. Raster and vector surface representation from point data. Grid resampling methods and search algorithms used in gridding and interpolation. DTM derivatives (slope maps, aspect maps, viewsheds, and watershed). Applications of DTM in orthoimage generation, volume computation, data fusion, and 3D models and visualization. DEM error analysis and impact on DEM-based derived products.