Remote Sensing - CPS (RMS)

RMS 5105. Fundamentals of Remote Sensing. 3 Hours.
Covers remote sensing principles and associated Earth observation applications. Covers four general categories: physical processes/theories involved in remote sensing, e.g., the nature and properties of electromagnetic radiation and how it is affected by interactions with the atmosphere and earth's surface; different sensor types and platforms, including optical, thermal, and microwave systems, from UAVs through environmental satellites; different applications of remote sensing such as land-use, land-change, vegetation, natural environmental, natural hazards, planetary environments, and military; and methods of remote sensing as applied to analyzing images and extracting desired information. Software: Mapbox, Raster Foundry, Google Earth, XMind, E-Portfolio.

RMS 6110. Digital Image Processing. 3 Hours.
Provides an overview of the basic techniques of digital image processing, including more specialized techniques such as synthetic aperture radar (SAR) data applications for land use and land cover and 3-D topographic mapping. Offers students an opportunity to learn modern approaches to image acquisition, image enhancement, and image analysis. Uses the algorithms involved in processing remotely sensed images, including spectral and spatial enhancement, image classification and clustering, spatial analysis, and linear transformations. Utilizes a variety of data types from high to low spatial and spectral information, SAR, and elevation data. Students perform independent lab exercises in order to apply some of the techniques they learn to their own area of expertise.

RMS 6210. Technology, Operations, and Requirements for Drones, Helicopters, and Airplanes. 3 Hours.
Covers the concept of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) via drones, helicopters, or airplanes that are manned, unmanned, optionally manned, or surrogate to requirements. Offers students an opportunity to obtain an in-depth understanding of the components of a C4ISR network, the functional aspects of operations ranging from planned to immediate response, and potential future demands. Focuses on skills needed to recognize, evaluate, and develop systems and overall networks for a range of functions in the military, security, scientific, and commercial applications in government and market ventures.

RMS 6215. Unmanned Aerial Systems for Geospatial Analysts. 3 Hours.
Covers the concept of unmanned aerial systems (UAS), CubeSats, and LiDAR for collision avoidance. Offers students an overview of the components of a command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) network. Focuses on new technologies (UAS and CubeSats) and their applications in remote sensing, including the skills needed to recognize, evaluate, and develop systems and overall networks for a range of functions in the military, security, scientific, and commercial applications in government and market ventures. Software utilized includes PixElement (Platform as a Service); DroneMapper (free version); DroneDeploy (for flight planning); Photogrammetry (TBC).

RMS 6225. Value of Information and Geospatial Analytics. 3 Hours.
Focuses on Value of Information (VOI) theory as applied to solving geospatial intelligence problems. Introduces students to VOI theory by working with a series of case studies where various types of data are introduced at different times in the problem-solving process. Offers students an opportunity to develop an understanding of the value of numerous data types (satellite, airborne, terrestrial; LiDAR; existing maps and GIS data; open source data including social media), the incremental value of each piece of data, and how to quantify the incremental value. Analyzes VOI theory as it relates to geospatial intelligence and demonstrates how to set up an analytic problem to calculate the value of data within that analytic problem construct. Software: GIS and remote sensing analytic software; VOI analytic framework (e.g., SAS).

RMS 6230. Remote Sensing and Global Change. 3 Hours.
Analyzes various components of the Earth systems and how those components are changing. Offers students an opportunity to make extensive use of observations and measurements from space. Focuses on global environmental change and climate change, that is, on the human impact on the planet and the modification of environments by human activity. Among the topics covered are ozone, SST, glacier distribution, and terrain impacts of human activity. Requires a research paper that includes elements of remote sensing data analysis.

RMS 6240. Introduction to Radar and LiDAR Remote Sensing. 3 Hours.
Introduces the techniques and methods of active imaging used in radar and Light Detection and Ranging (LiDAR). Covers the underlying principles of the measurement techniques and the interaction of microwaves and LiDAR signals with natural surfaces and the atmosphere. Regarding radar, the course focuses on the role of synthetic aperture radar (SAR) systems and their application to monitoring aspects of the Earth's surface, including 3-D. Regarding LiDAR, the course introduces the different airborne and satellite systems and applications in terrestrial surfaces, principally for urban applications. Students complete a weekly lab project related to the processing and analysis of these data. Software: ArcGIS; ENVI; LIDAR Analyst; ESA SNAP Toolbox; ASF MapReady; ASF SAR Training Processor; USDA FS FUSION; FugroViewer. .

RMS 6250. Spatial Analytics for Vegetation and Precision Agriculture. 3 Hours.
Explores a range of Earth observation and geospatial statistical routines required for vegetation analysis ranging from forests to precision Ag. Synoptic perspectives allow spatial patterns of surface phenomena to be studied, vegetative features extracted, and base maps created. Students perform exercises to create derived products, such as normalized difference vegetation indices and soil maps used to track the length of growing seasons or as operational and business data for day-to-day farm operations. Includes high to low spatial and spectral data from CubeSats, UAVs, and airborne and terrestrial LiDAR. Software: Desktop Analyst software (Arc or Q), GeoMesa, rapidlasso, and GeoDa.

RMS 6260. Remote Sensing for Archaeology. 3 Hours.
Provides an overview of the theory, tools, and techniques used in applying the discipline of remote sensing for the purposes of archaeological research and archaeological heritage management. Covers geomatic disciplines used in archaeology, practitioners of remote sensing in archaeology, spatial fundamentals underpinning archaeological theory, types of imagery, data portals, geomatics hardware and software, imagery transformations and analysis, contextual and spatial analysis via GIS, visualization and presentation of analysis, integration of remote sensing with survey planning and documentation, and application of remote sensing for archaeological heritage management.

RMS 6270. Remote Sensing for Disaster Management. 3 Hours.
Offers students an opportunity to understand the use of spatial information in disaster management and to acquire a comprehensive overview and hands-on skills in the application of remote sensing. The course is in five modules: (1) remote sensing theory, sensor/platform combinations, spectral imaging theories, atmospheric and radiometric correction, as well as sources for data download and analysis; (2) the use of remote sensing and GIS tools for use in wildfire management; (3) the use of remote sensing for flood mapping and analysis; (4) man-made disasters, such as oil spills, and consequence management of terrorist attacks or preevent planning to mitigate effects of a terrorist attack; and (5) a final project in which students analyze a set of data and produce a final report.

RMS 6280. Automated Feature Extraction for the Geospatial Professional. 3 Hours.
Introduces machine learning and automated feature extraction software and how it is utilized for image interpretation. Explores a variety of techniques and work flows associated with collecting features of interest from multiple data sources, e.g., aerial and satellite imagery, LiDAR, and elevation data. Students use AFE software to solve real-world problems in exercises corresponding to concepts introduced in weekly lessons. Offers students an opportunity to learn how to use feature extraction to create industry-standard analytical products and develop processing models for automation. Discusses the fundamentals of machine learning, supervised and unsupervised classification, hierarchical learning, postprocessing, cleanup, automation, modeling, and publication. Software: Esri ArcGIS 10.5; Feature Analyst for ArcGIS; LIDAR Analyst; ENVI; ENVI LiDAR.

RMS 6290. Spectroscopic Image Analysis. 3 Hours.
Explores the various techniques and work flows associated with nonliteral imagery analysis using hyperspectral data from numerous airborne and space-borne hyperspectral imaging (HSI) sensors. The course is divided into four modules: (1) basic theoretical concepts that underpin HSI analysis; (2) data preparation and other ancillary concepts such as spectral libraries and atmospheric correction that are critical to nonliteral analysis but are preprocessing steps; (3) nonliteral exploitation techniques, covered in sufficient depth to give the students an opportunity to understand the different methods and procedures used; (4) a final project where students are expected to conduct nonliteral analysis of a hyperspectral image from pre- through postprocessing. The ENVI software system is used extensively each week.

RMS 6292. Photogrammetry and GPS. 3 Hours.
Examines the theory, tools, and techniques used within the fields of photogrammetry and GPS. Emphasizes aerial photogrammetry and its utilization of GPS as well as discusses close-range photogrammetry. Studies cameras and imaging devices, image measurements, vertical photographs, stereoscopy, image rectification, ground control and aerotriangulation, digital elevation models, topographic mapping, and more. Discussions include an introduction to the fundamentals of geodesy and the concepts and calculations common to the mapping sciences, including datums, projections, coordinate systems, and scale.

RMS 6962. Elective. 1-4 Hours.
Offers elective credit for courses taken at other academic institutions. May be repeated without limit.