COURSE DESCRIPTIONS

All courses offered through the Center may be taken by both matriculated and non-matriculated students; however, the stated prerequisites must be satisfied by the first day of class unless prior written consent is provided by the Center director.

GIS 100. GEOSPATIAL PRIMER. A broad, elementary introduction to geospatial technology and its applications. Topics directed toward individuals who (at least initially) do not intend to specialize in substantial further coursework or hands-on activity in the field. 3

GIS 200. COMPUTERIZED MAPS AND CARTOGRAPHY. Presented as an introductory-level course, students will explore spatial technologies through cartography. Students will explore scale, projections, coordinate systems, layout styles, color ramps, font selection, generalization, symbol selection and similar concepts through review of existing map products and the opportunity to create their own maps. Students will learn about the history of maps and their impact as visualization tools to influence governance/decision making, public opinion (maps in the news), and online-based mapping technologies. Lecture 2 hours, laboratory 1 hour. 3

GIS 202. INTRODUCTION TO GEOSPATIAL SCIENCE AND TECH (GIS I). This course is an introduction to the theory and practice of spatial science and technology using the scientific method as a learning gateway. Fundamental concepts include geodesy, coordinate systems and projections, basic computer science, inductive/deductive reasoning skills, data structures, hypothesis development and testing, map reading, land navigation, and GIS software skills. Practical exercises using GIS software, GPS, and map reading skills will reinforce theoretical discussions. Satisfies the General Education Lab Science requirement for non-science majors. Lecture 2 hours, laboratory 1 hour. 3

GIS 211. ONLINE. DIGITAL IMAGE PROCESSING I. The art and science of digital image processing of satellite and aircraft-derived remotely-sensed data for resource management, including how to extract biophysical information from remote sensor data for almost all multidisciplinary land-based environmental projects, is presented. Includes the fundamental principles of digital image processing applied to remotely sensed data. Prerequisites: MAT 104 and 105 or equivalents. 3

GIS 221. ONLINE. AERIAL PHOTOGRAPHIC INTERPRETATION. Introduction to the principles and techniques utilized to interpret aerial photography. Emphasis is on interpreting analog photographs visually in a range of application areas; also includes an introduction to acquiring and analyzing aerial photographic data digitally. Prerequisites: MAT 104 and 105 or equivalents. 3

GIS 231. ONLINE. PHOTOGRAMMETRY I. Provides the fundamental principles of photogrammetry. Topics introduced include a review of photogrammetry developments and processes, methods for
obtaining aerial photographs including cameras and camera calibration, image coordinate measurement and refinement, correction of lens distortion, principal point offset, atmospheric refraction Earth curvature distortion scale and relief displacement in vertical and tilted photographs. **Prerequisites:** MAT 104 and 105 or equivalents. 3

**GIS 310. ADV GEOSPATIAL SCIENCE & TECH (GIS II).** Advanced geospatial science and technology theory and skills. Topics include GIS planning and management, workflow management, systems architecture, data conflation/deflation/ manipulation, 3-D surface generation and analysis, intermediate-level spatial analysis techniques, and network design and analysis. Software skills development will accompany each lecture topic. Lecture 2 hours, laboratory 1 hour. 3. Prerequisite: GIS 202.

**GIS 311. ONLINE. DIGITAL IMAGE PROCESSING II.** Advances in science and technology in aerial and satellite image processing and pattern recognition are presented. **Prerequisites:** GIS 211, GIS 221 or equivalents. 3

**GIS 316. INTRO REMOTE SENSING.** Students will learn the fundamentals of remote sensing, including the principles of electromagnetic radiation, wave theory, the concept of a blackbody, how energy interacts with the atmosphere and terrestrial objects, and the principles of feature/object identification based upon spectral properties. Students will use remote sensing software to develop basic skills such as ortho-rectification, color balancing, tiling imagery, and automated feature recognition (supervised and unsupervised classification). Students will be exposed to a wide range of remote sensing products and their application areas including aerial photography, hyper-spectral imagery, multi-spectral imagery, LiDAR, microwave, and RADAR. Lecture 2 hours, laboratory 1 hours. 3

**GIS 320. GIS AND COMMUNITY.** This course focuses on the utilization of Geographic Information Systems for resolving socio-economic issues, with a focus on public involvement and participation. **Prerequisites:** GIS 200 or 202 or equivalent. 3

**GIS 330. SPATIAL SOLUTIONS TO NATURAL RESOURCE ISSUES.** This course focuses on the use of GIS and remote sensing for understanding, modeling, and resolving issues in natural resource management using a spatially-based approach. Students are expected to gain an understanding about the use of geostatistics to model terrain/data and to resolve issues involving oil and gas, mining, pollution (land, water, and air), conservation planning, species/ecosystem diversity through case studies and practical exercises. Lecture 2 hours, laboratory 1 hour 3. Prerequisites: GIS 202 and REM 316.

**GIS 361. ONLINE. GEOSPATIAL DATA SYNTHESIS AND MODELING.** Detailed conceptual and analytical methods, and the knowledge to support synthesis and modeling of Geospatial data in the solution of scientific and policy problems. **Prerequisites:** GIS 200 or 202, MAT 300 or equivalents. 3

**GIS 371. ONLINE. DECISION SUPPORT SYSTEMS.** The course contains information about Decision Support Systems (DSS) from a general data processing point of view. The major components of the
course are divided into three major sections: elements of decision analysis, evaluation of multiple criteria, alternative, and decision rules, and evaluation of outcomes and alternatives. **Prerequisites:** GIS 200 or 202, REM 316 or equivalents. 3

**GIS 381. COMMUNITY GROWTH.** The use of remote sensing and GIS technologies to facilitate urban planning and infrastructure development for community growth. Students are expected to gain an understanding about the use of GIS and allied technologies with respect to understanding census/demographic data, municipal needs (roadways/tax mapping/sewer/water/electric/police/fire/EMS/Emergency Management), the interdependencies of infrastructure elements, and basic principles for urban/municipal planning. Lecture 2 hours, laboratory 1 hour. 3. Prerequisite: GIS 202.

**GIS 391. TOPOGRAPHIC MAPPING.** Students will learn to read, interpret, create, and publish topographic map products in accordance with current USGS standards. This includes the production of detailed marginalia, Geo-PDF formats, and the use of production editing and mapping tools to achieve a standardized map products at multiple scales and print sizes. Lecture 2 hours, laboratory 1 hour. 3. Prerequisites: GIS 202 and REM 316.

**GIS 431. ONLINE. PHOTOGRAMMETRY II.** Advanced photogrammetric systems for production of highly accurate digital map products and three-dimensional representations for use and modeling. **Prerequisites:** MT 442 or 3D Vector and Matrix Algebra, Statistics, GIS 231 or equivalents. 3

**GIS 441. ONLINE. ARTIFICIAL INTELLIGENCE AND GEOPROCESSING.** The artificial intelligence theory, principles and applications specific to geospatial processing and analysis in the files of both remote sensing and geographic information systems. **Prerequisites:** GIS 200 or 202, GIS 211, MAT 104 or equivalents. 3

**GIS 451. ONLINE. BUSINESS GEOGRAPHICS.** Key concepts in the field of business geographics, including motivation for using geospatial technology in business applications, the different geographic data sets available for use by business analysts, and modeling of spatial data for business applications. **Prerequisites:** GIS 221, GIS 361 or equivalents. 3

**GIS 461. ONLINE. GEOSPATIAL MATHEMATICS, ALGORITHMS, AND STATISTICS.** This is a geostatistics and geomathematics course, presenting the underlying principles and theory of GIS operations (raster, vector, or other data models), such as surface analysis, interpolation, network analysis, path optimization, topology, etc. **Prerequisites:** GIS 200 or 202, GIS 361, MAT 441, REM 316 or equivalents. 3

**GIS 470. PROGRAMMING GIS.** This course is intended as an in-depth look at computer programming within Geographic Information Systems. The focus will be on GIS programming and methodology, utilizing practical GIS software skills and basic scientific computing skills. Software skills development will accompany each lecture topic. Lecture 2 hours, laboratory 1 hour. 3. Prerequisite: GIS 202.
GIS. 480. INTERNET GIS AND SPAT DATABASES. The purpose of this course is to provide students with an understanding of how Internet GIS and spatial databases work and to help them develop the skills requisite for success in this field. Software skills development will accompany each lecture topic. Lecture 2 hours, laboratory 1 hour. 3. Prerequisite: GIS 202.

GIS 490. SPATIAL TECH. INTERNSHIP. This is a variable hour course. A minimum of three (3) semester hours of this course are required for the BSIS-GIS concentrations, the undergraduate-level certificate program, and minor. Students will learn how to give a technical presentation, manage GIS projects, and perform deadline-sensitive work through a cooperative education or research program performed at their place of work, with a designated sponsor or through the Center. Students will be expected to meet/discuss progress and lessons learned with the instructor on a regular basis, maintain a journal of activities and hours worked, and prepare and deliver final project presentation and written report. Students may not successfully complete more than nine (9) semester hours of this course per academic degree or certificate program. Prerequisite: GIS 202.

Remote Sensing

REM 301. ONLINE. SENSORS AND PLATFORMS. Basic design attributes of imaging sensor systems and the platforms on which they operate. An introduction to cameras, scanners, and radiometers operating in the ultraviolet, visible, infrared, and microwave regions of the spectrum. Prerequisites: GIS 200 or 201; PHY 231 and 232 or equivalents. 3

REM 401. ONLINE. ORBITAL MECHANICS. Uses elementary principles of mathematics, physics, and mechanics to introduce traditional science required to place a spacecraft into orbit, keep it there, determine its position, and maneuver it. Course provides a basic understanding of orbital mechanics. Prerequisites: MAT 205 and 206, PHY 231 and 232 or equivalents. 3

REM 411. ONLINE. REMOTE SENSING OF THE ENVIRONMENT. Remote sensing and geographic information systems (GIS) are used as powerful tools in environmental research. Prerequisites: GIS 200 or 202, GIS 211, REM 301 or equivalents. 3

REM 421. ONLINE. INFORMATION EXTRACTION USING MICROWAVE DATA. Presents the basic concepts, theory, and applications of microwave remote sensing. Topics include unique aspects of microwave radiation, passive microwave, fundamental principles of microwave (active), synthetic aperture radar, backscatter principles and models, interferometry, phase relationships, processing radar data. Environmental influences on radar returns and applications of these principles are presented. Prerequisites: GIS 200 or 202, REM 301 or equivalents. 3

REM 431. ONLINE. INFORMATION EXTRACTION USING MULTI-, HYPER-, AND ULTRA-SPECTRAL DATA. This course addresses the two main components of a VNIR remote sensing study: preparation of the
imagery and information extraction techniques for both multi-spectral and hyper-spectral imagery. **Prerequisites:** PHY 231 and 232, GIS 211, REM 301 or equivalents. 3

**REM 441. ONLINE. ADVANCED SENSOR SYSTEMS AND DATA COLLECTION.** The newest active and passive sensors, including advanced synthetic aperture radar, lidar, radiometers, spectrometers, microwave sounders, advanced hyperspectral sensors, and the advanced platforms which carry these sensors are presented. **Prerequisites:** PHY 231 and 232, REM 301 or equivalents. 3

**REM 451. ONLINE. APPLICATIONS OF REMOTE SENSING TO ECOLOGICAL MODELING.** Techniques and applications of remote sensing to a broad spectrum of issues related to ecological modeling are presented. **Prerequisites:** PHY 202, or BIO 111 or 201 or 449, REM 316 or equivalents. 3

**REM 461. ONLINE. FORESTRY MONITORING AND MANAGEMENT.** Fundamental principles of photographic and non-photographic remote sensing and the application of these principles specifically to detect, map, measure, and monitor forest tree, stand, and canopy attributes. **Prerequisites:** REM 316, BIO 449 or Forest Management, or equivalents. 3

**REM 471. ONLINE. AGRICULTURAL APPLICATIONS IN REMOTE SENSING.** The applications of remote sensing, global positioning system technologies, and geographic information systems (GIS) for the management and conservation of soil, vegetation, and water resources that are important to agricultural production; the use of these technologies for inventoring and monitoring agricultural conditions for improving the information base on a local, regional and global basis; and for decision-making in the management of agricultural conditions at different spatial, spectral, and temporal resolutions. **Prerequisites:** MAT 104 and 105, CHE 100 or 101, PHY 231 and 232 or equivalents. 3

**REM 481. ONLINE. LAND USE AND LAND COVER APPLICATIONS.** The fundamental issues in creating, updating, assessing, and using land cover and land use information that has been derived from remotely sensed data. **Prerequisites:** REM 316 or equivalent. 3

**REM 491. ONLINE. REMOTE SENSING OF WATER.** An overview of how satellite remote-sensing technologies may be used for the study and monitoring of surface waters (rivers, streams, lakes, and wetlands). The remote sensing of snow and ice is also covered. 3