Approved Innovative Course

- *Districts must have local board approval to implement innovative courses*
- *Innovative courses may meet state elective credit only*
- *CTE Innovative courses may not be the final course in a coherent sequence for an endorsement*
- *Course requirements must be met without modification*

Course: Raster-Based Geographic Information Systems
PEIMS Code: N1302806
Abbreviation: RBGIS
Grade Level(s): 10-12
Number of Credits: 1.0

Course description:

This course introduces the principles of Geographic Information Systems (GIS) data sets including raster-based information such as images or photographs. Students will study local problems and acquire information, including images or aerial photographs, process the data they acquire, and merge the acquired data with vector data. Students will plan, conduct, and present solutions for locally-based problems.

Essential knowledge and skills:

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Geographic Information Systems. Students shall be awarded one credit for successful completion of this course.

(b) Introduction

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing and providing scientific research and professional and technical services, including laboratory and testing services and research and development services.

(3) In Raster-Based GIS students will study local problems, acquire information, including images or aerial photographs, process the acquired data, and merge the acquired data with vector data. Students will plan, conduct, and present solutions for locally-based problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) employ effective reading and writing skills;

(B) employ effective verbal and nonverbal communication skills;

(C) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and worksite;

(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities;

(E) demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed; and

(F) demonstrate respect for diversity in the workplace.

(2) The student demonstrates knowledge of the GIS field and related careers. The student is expected to:

(A) identify employment and career opportunities in GIS-related fields;

(B) explore career preparation learning experiences, including job shadowing, mentoring, apprenticeship training, and preparation programs;

(C) identify industry certifications for GIS related careers, including careers related to raster-based GIS; and

(D) discuss ethical issues related to GIS and technology and incorporate proper ethics in submitted projects;

(3) The student participates in team projects in various roles. The student is expected to:

(A) explain the importance of teamwork in the field of GIS;

(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution; and

(C) cooperate, contribute, and collaborate as a member of a group to attain agreement and achieve a collective outcome;

(D) demonstrate proper attitudes as a team leader and team member.

(4) The student investigates the history and use of photography in aerial photography. The student is expected to:

(A) explain the fundamental principles of cameras and lenses as they pertain to GIS and aerial photography;

(B) conduct and present research on the history of photography, particularly in regards to aerial platforms;

(C) compare and contrast vertical and oblique aerial photography; and

(D) identify cities, bridges, shorelines, roads and other important features in aerial photos.

(5) The student develops an understanding of electromagnetic and thermal radiation. The student is expected to:

(A) explain how forms of radiation propagate through space and interact with matter;

(B) investigate the behavior of waves, including refraction, scattering, absorption, and reflection, in relation to radiation;

(C) describe the properties and laws of thermal radiation;

(D) compare and contrast the particle and wave models of electromagnetic energy;

(E) differentiate maps based on electromagnetic versus thermal radiation imagery; and

(F) evaluate whether electromagnetic or thermal radiation imagery is appropriate based on the conditions.

(6) The student explores active and passive microwave remote sensing. The student is expected to:

(A) compare and contrast active and passive microwave remote sensing;

(B) explain geographic characteristics, including surface roughness, moisture content, vegetation, backscatter and biomass, and urban structures, detected by remote sensing images; and

(C) give detailed analysis of radar images.

(7) The student learns the functions and applications of the tools, equipment, and materials used in GIS and raster-based analysis. The student is expected to:

(A) demonstrate the use of raster-based software;

(B) download spatial data and raster images and re-project them to match the Digital Orthophoto Quadrangle (DOQ) or Digital Orthophoto Quarter Quadrangle (DOQQ);

(C) identify remote sensing equipment and the difference between the Global Positioning System (GPS) and the Global Navigation Satellite System (GLONASS);

(D) describe and perform measurements with handheld GPS devices using GPS or GLONASS systems; and

(E) compare the advantages, disadvantages, and limitations of remote or unmanned sensing.

(8) The student uses scientific methods in imagery analysis. The student is expected to:

(A) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology;

(B) collect data individually or collaboratively;

(C) organize, analyze, evaluate, make inferences, and predict trends from data; and

(D) communicate valid conclusions using essential vocabulary and supportive maps, summaries, oral reports, and technology-based reports.

(9) The student uses project management skills to research and analyze locally-based problems. The student is expected to:

(A) identify and collect data necessary to evaluate a local problem, including defining the problem and identifying locations of the concern;

(B) develop a plan and project schedule for completion of a project;

(C) create a GIS map to illustrate a problem using remote sensing images gathered from sites such as the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administrations (NOAA), and United States Geological Survey (USGS);

(D) evaluate map features to identify solutions to a problem;

(E) develop solutions to minimize, reverse, or solve the problem; and

(F) present findings to the class, school, or community.

Description of specific student needs this course is designed to meet:

Raster-based GIS is an emerging technology used in many career pathways and industries, such as engineering, transportation systems, city planning, community development, environmental sciences, technology, space sciences, marketing, natural resources planning, law enforcement, cartography, real estate development, geology, and architecture. Raster-based GIS also builds job skills in advanced concepts in imagery, the Global Positioning System, geospatial networks and routing, and geographic information systems.

Major resources and materials:

A project-based learning instructional design is recommended for this course. Students should be provided with the opportunity to use industry standard tools and equipment and have access to data from public and private databases to complete their projects. The following is a list of resources and equipment that are recommended for the course

(1) Computer lab
(2) Spatial, image, and 3-D analysis software
(3) GPS equipment
(4) Internet access
(5) Unmanned systems - aerial, terrestrial, and/or submersible for data collection

Recommended course activities:

A project-based learning instructional design is recommended for this course. The students can use raster-based technologies to solve locally-based problems. A project-based learning instructional design focused on a locally-based problem enable students to plan, conduct, and present solutions.

Sample Projects

1. Plan a project related to invasive species.

Students conduct research on invasive plants, animals, insects or pathogens in a specific area or location. Researching the issue, history, spread and possible solutions, the students create maps to present their findings and possible solutions to address the problem.

2. Plan a project related to natural disasters

Students select a location where a natural disaster such as wildfire, tornado, flood, earthquake, or hurricane has occurred since 1980. Researching the disaster, students create before and, during or aftermath, maps using satellite imagery. Students can present their findings such as the role the topography, structures, and environment played in the disaster.

Approved Innovative Course

- *Districts must have local board approval to implement innovative courses*
- *Innovative courses may meet state elective credit only*
- *CTE Innovative courses may not be the final course in a coherent sequence for an endorsement*
- *Course requirements must be met without modification*

Suggested methods for evaluating student outcomes:

The students will be evaluated through the use of written tests, observation, worksheets, quizzes, skills-based tests, and projects.

Teacher qualifications:

(1) Any business or office education certificate.
(2) Business and Finance: Grades 6-12.
(3) Business Education: Grades 6-12.
(4) Secondary Industrial Arts (Grades 6-12).
(5) Secondary Industrial Technology (Grades 6-12).
(6) Technology Education: Grades 6-12.
(7) Technology Applications: Early Childhood-Grade 12.
(8) Technology Applications: Grades 8-12.
(9) Trade and Industrial Education: Grades 6-12. This assignment requires appropriate work approval.
(10) Trade and Industrial Education: Grades 8-12. This assignment requires appropriate work approval.
(11) Vocational Trades and Industry. This assignment requires appropriate work approval. (12) Computer Science: Grades 8-12.
(13) Secondary Computer Information Systems (Grades 6-12)

Additional information: