



Approved Innovative Course

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Course: Geographic Information Systems (GIS)

PEIMS Code: N1302805

Abbreviation: GIS

Grade Level(s): 10-12

Number of Credits: 1.0

Course description:

Geographic Information Systems (GIS) is a course designed to introduce students to Geographic Information Systems and Remote Sensing (RS) technology through academic study and applied instruction. Students will be introduced to terminology and concepts relating to GIS/RS technology and will apply these concepts through the use of GIS software programs. Students will participate in structured, applied learning exercises taken from existing data sources, as well as conduct new study of these data sources through self-driven study and analysis. An ongoing emphasis of the use of GIS and RS technology in various career fields will enhance the applied learning activities and exercises. Skill-based training in GIS is designed to introduce students to the use of GIS software and software extensions through academic study and extensive applied instruction. Students will be introduced to terminology and concepts relating to GIS and apply these concepts through the use of industry standard software.

Essential knowledge and skills:

- (a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Art, Audio/Video Technology, Principles of Information Technology, or Principles of Technology. 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) The Geographic Information Systems (GIS) course employs an analytic process using industry standard software to find trends and patterns in collected data. Whether



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collecting data first-hand or from reputable websites, GIS aims to use scientific methods to find solutions to various problems and issues. students

- (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) identify career development and opportunities in the GIS industry and related industries;
 - (D) apply competencies related to resources, information, and systems of operation in the geographical information technology industry;
 - (E) demonstrate knowledge of personal and occupational safety practices in the workplace; and
 - (F) identify employers' expectations, appropriate work habits, and good citizenship skills.
 - (2) The student demonstrates knowledge and appropriate use of computer hardware components, software programs, and their connections. The student is expected to:
 - (A) use operating systems, software applications, and communication and networking components appropriately;
 - (B) compare, contrast, and appropriately use the various input, processing, output, and primary/secondary storage devices;
 - (C) make decisions regarding the selection, acquisition, and use of software taking into consideration its quality, appropriateness, effectiveness, and efficiency; and
 - (D) delineate and make necessary adjustments regarding compatibility issues, including digital file formats and cross platform connectivity.
 - (3) The student uses data input skills appropriate to the task. The student is expected to:
 - (A) use a variety of input devices such as keyboard, scanner, or mouse by appropriately incorporating such components into the product; and
 - (B) use digital keyboarding standards for the input of data.



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- (4) The student demonstrates knowledge and understanding of what GIS is and the use of GIS technology in different career fields. The student is expected to:
- (A) identify the historical and contemporary developments in GIS;
 - (B) identify the basic components of GIS; and
 - (C) identify appropriate application of GIS technologies in different career fields.
- (5) The student demonstrates knowledge and appropriate use of database software. The student is expected to:
- (A) use database software to design and construct a relational database using a geographic data model;
 - (B) use joins, hyperlinks, and relational linking within the database;
 - (C) demonstrate proficiency in data depiction and classification;
 - (D) transfer data from different sources into a database for storage and retrieval;
 - (E) identify characteristics of maps and spatial data; and
 - (F) identify and use geographical scales, coordinates, and specific map projections.
- (6) The student demonstrates knowledge and appropriate use of spatial databases and sources. The student is expected to:
- (A) identify and utilize digital terrain models, digital orthophoto quadrangles, geographic databases, land use and land cover data, digital imagery, hydrographic spatial data, and demographic data; and
 - (B) demonstrate appropriate use of spatial analysis.
- (7) The student demonstrates knowledge and appropriate use of GIS software. The student is expected to:
- (A) log in to and launch GIS software;
 - (B) determine the appropriate software tool from GIS to use for a given task or project; and
 - (C) create queries and spatial queries for finding features, borders, centroids, and networks, as well as determining distance, length and surface measurements and shapes.
- (8) The student demonstrates knowledge and appropriate use of GIS data collection devices. The student is expected to:
- (A) plan and conduct supervised GIS and Global Positioning System (GPS) experiences.



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- (B) use a GPS receiver by initializing and preparing it for data collection;
 - (C) use a GPS receiver to collect geographical coordinates; and
 - (D) transfer data from a GPS device to a personal computer.
- (9) The student acquires electronic information in a variety of formats with appropriate supervision. The student is expected to:
- (A) acquire information in various electronic formats used for text, audio, video, graphics, and other digital content; and
 - (B) use a variety of resources, including the Internet, foundation and enrichment curricula, and various productivity tools, to gather authentic data as a basis for individual and group GIS projects.
- (10) The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:
- (A) identify project management guidelines for designing and developing GIS projects; and
 - (B) use visual organizers to design solutions such as flowcharts or schematic drawings.
- (11) The student delivers a product in a variety of media with appropriate supervision. The student is expected to:
- (A) publish information in a variety of formats, including hard copies and digital formats; and
 - (B) present GIS information in oral presentations using graphs, charts, maps and presentation software.
- (12) The student will define and describe maps, reports, and graphs. The student is expected to:
- (A) create map displays with industry-standard legends;
 - (B) use symbols, scaling, and other map elements; and
 - (C) generate reports and graphs.

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

This course will provide work-related training for individuals who intend to go into various career pathways, such as engineering, transportation systems, city planning, community development, environmental sciences, technology, space sciences, marketing, natural resources, health, law enforcement, cartography, real estate development, geology, architecture, disaster recovery, and



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emergency response. Additionally, this course provides instruction in the use of data from satellite technologies and promotes critical thinking skills in analyzing data. The course promotes collaboration, problem solving, and communication skills as well.

Major resources and materials:

GIS uses a combination of

- Computer lab
- Industry standard software
- Spatial Data

GIS does not involve “canned maps” but, instead, it involves the ability to construct maps showing answers to user-defined questions based on collected data and defined parameters. The software draws the integration of data: geographic coordinates (“where things are”) and sets of attributes (“what things are like”), processed according to rules set by the user. This requires high computer power since students will analyze, manipulate, and visualize vast amounts of data in order to understand relationships, patterns, and trends. It is recommended that this introductory class include class work using standards-based textbooks, hands-on projects, and case studies to learn basic GIS terminology, career field applications, and the use of GIS software for project development and management.

Recommended course activities:

Students master GIS concepts through the use of GIS software to create solutions to problems presented by the instructor. The completion of a project based on real-world community problems is recommended.

Sample Projects:

- (1) Using project management skills, students will plan a GIS project related to location of water services within the community. Students will:
 - (A) identify and collect necessary data to be used in the project. This includes fire hydrant locations, water towers, major water lines, cut-off valves, etc.;
 - (B) organize findings into an appropriate GIS layout, import this layout into a Word document, and summarize these findings in a concise written report; and
 - (C) communicate project findings via an oral presentation to school and community representatives.
- (2) Using project management skills, students will plan a GIS project related to bus route planning for the school district. Students will:
 - (A) identify and collect necessary data to be used in the project. This includes school locations, existing routes, types of roads traveled, miles traveled on each route, expenses involved with bus operation, etc.;
 - (B) organize findings into an appropriate GIS layout, import this layout into a Word document and summarize these findings into a concise written report; and
 - (C) communicate project findings via oral presentation to school representatives.



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Suggested methods for evaluating student outcomes:

- (1) Written exams
- (2) Projects, presentations, and group participation
- (3) Evaluation of oral and written communication skills

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: