

# Career & Technical Education | Information Technology

## Introduction to Geospatial Information Systems

**Subject Code: 145145**

### Outcome & Competency Descriptions

#### Course Description:

In this course students will be introduced to geospatial information systems and the basic principles of cartography, coordinate systems, and map projections. Students will learn to analyze data for quality and accuracy, assess the quality of data sources, and interface with spatial databases.

#### Strand 1. Business Operations/21st Century Skills

Learners apply principles of economics, business management, marketing, and employability in an entrepreneur, manager, and employee role to the leadership, planning, developing, and analyzing of business enterprises related to the career field.

#### Outcome: 1.1. Employability Skills

Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

#### Competencies

- 1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.
- 1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.
- 1.1.3. Develop a career plan that reflects career interests, pathways, and secondary and postsecondary options.
- 1.1.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop and maintain professional relationships.
- 1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, resumé writing, interviewing skills, portfolio development).
- 1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
- 1.1.9. Give and receive constructive feedback to improve work habits.

## **Outcome: 1.2. Leadership and Communications**

Process, maintain, evaluate, and disseminate information in a business.  
Develop leadership and team building to promote collaboration.

### **Competencies**

- 1.2.1. Extract relevant, valid information from materials and cite sources of information.
- 1.2.2. Deliver formal and informal presentations.
- 1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
- 1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.
- 1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
- 1.2.8. Identify the strengths, weaknesses, and characteristics of leadership styles that influence internal and external workplace relationships.
- 1.2.11. Write professional correspondence, documents, job applications, and resumés.
- 1.2.12. Use technical writing skills to complete forms and create reports.

## **Outcome: 1.3. Business Ethics and Law**

Analyze how professional, ethical, and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

### **Competencies**

- 1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.
- 1.3.2. Follow protocols and practices necessary to maintain a clean, safe, and healthy work environment.
- 1.3.4. Identify how federal and state consumer protection laws affect products and services.
- 1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.
- 1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC]).
- 1.3.8. Verify compliance with computer and intellectual property laws and regulations.

#### **Outcome: 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in business operations.

##### **Competencies**

- 1.4.3. Verify compliance with security rules, regulations and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to the industry pathway.
- 1.4.6. Use an electronic database to access and create business and technical information.
- 1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).

#### **Outcome: 1.7. Entrepreneurship / Entrepreneurs**

Analyze the environment in which a business operates, and the economic factors and opportunities associated with self-employment.

##### **Competencies**

- 1.7.13. Protect intellectual property and knowledge (e.g., copyright, patent, trademark, trade secrets, processes).

#### **Outcome: 1.8. Operations Management**

Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

##### **Competencies**

- 1.8.2. Select and organize resources to develop a product or a service.
- 1.8.4. Identify alternative actions to take when goals are not met (e.g., changing goals, changing strategies, efficiencies).
- 1.8.7. Collect information and feedback to help assess the organization's strategic planning and policymaking processes.
- 1.8.9. Develop a budget that reflects the strategies and goals of the organization.
- 1.8.10. Analyze how business management and environmental management systems (e.g., health, safety) contribute to continuous improvement and sustainability.

## **Strand 2. IT Fundamentals**

Learners apply fundamental principles of IT, including the history of IT and its impact on society, common industry terms, systems theory, information storage and retrieval, database management, and computer hardware, software, and peripheral device configuration and installation. This base of knowledge and skills may be applied across the career field.

### **Outcome: 2.8 Databases**

Describe the fundamentals of databases.

#### **Competencies**

- 2.8.1. Identify types of databases (e.g. Relational, Object-oriented, NoSQL, Graph, Data Warehouse, Distributed, Open Source, Cloud, Artificial Intelligence).
- 2.8.4. Describe the elements of a database (e.g., table, record/row, field, relationships, transactions, schema, normalization, keys).
- 2.8.5. Describe the elements of the database front-end that allow users to access, modify, delete, or insert data. (e.g., form, filters, reports)
- 2.8.7. Describe how data can be stored in and extracted from a database.
- 2.8.8. Explain the importance of data integrity and security.
- 2.8.9. Differentiate between a front-end interface and a back-end database.

### **Outcome: 2.9. Project Concept Proposal**

Develop a project concept proposal.

#### **Competencies**

- 2.9.1. Identify the scope and purpose of branding.
- 2.9.2. Determine the scope and purpose of the project.
- 2.9.3. Determine the target audience, client needs, expected outcomes, objectives, and budget.
- 2.9.4. Develop a conceptual model and design brief for the project.
- 2.9.5. Develop a timeline, a communication plan, a task breakdown, costs (e.g., equipment, labor), deliverables, and responsibilities for completion.
- 2.9.6. Develop and present a comprehensive proposal to stakeholders.

## **Outcome: 2.10.      Equipment**

Select, prepare, operate, and maintain equipment.

### **Competencies**

- 2.10.5. Prepare and operate equipment per project design specifications.
- 2.10.6. Monitor equipment operation and troubleshoot issues and problems.
- 2.10.7. Backup, restore, test, archive, and manage data.
- 2.10.8. Prepare equipment for storage or decommissioning.

## **Outcome: 2.13.      Rollout and Handoff**

Plan rollout and facilitate handoff to customers.

### **Competencies**

- 2.13.1. Include overall project goals and timelines in the rollout plan.
- 2.13.2. Communicate rollout plans to key stakeholders in a timely manner.
- 2.13.3. Conduct final review and approvals according to company standards.
- 2.13.4. Identify support staff, training needs, and contingency plans in the rollout plan.
- 2.13.5. Test delivered application to assure that it is fully functional for the customer or user and meets all requirements.
- 2.13.6. Deliver support and training materials.

## **Strand 5.      Programming and Software Systems**

Learners apply principles of computer programming and software development to develop code; build, test, and debug programs; create finished products; and plan, analyze, design, develop, implement, and support software applications.

### **Outcome: 5.2.      Computational and String Operations**

Develop code that performs computational and string operations.

#### **Competencies**

5.2.2.    Identify the scope of data (e.g., global versus local, variables, constants, arrays).

### **Outcome: 5.7.      Configuration Management**

Describe configuration management activities.

#### **Competencies**

5.7.1.    Explain version management and interface control.

5.7.3.    Analyze the impact of changes.

## **Strand 8. Databases**

Learners apply principles of designing, creating, and maintaining databases, including data storage, retrieval, modeling, manipulation, and formatting; database access, management, and administration; and database hardware and software issues.

### **Outcome: 8.2. Design and Creation** Design and create databases.

#### **Competencies**

- 8.2.1. Name database objects with proper naming conventions.
- 8.2.2. Define constraints to satisfy project goals (e.g., primary key, foreign key, index).
- 8.2.3. Implement data integrity, security, encryption and regulatory restrictions (e.g. HIPPA, FERPA).

### **Outcome: 8.3. Data Entry and Access** Enter and access data in databases.

#### **Competencies**

- 8.3.1. Collect and maintain data in the database (e.g., insert, update, delete).
- 8.3.2. Import large data sets into a database (e.g., bulk command, SQL script, CSV file).

8.3.3. Implement data validation (e.g., format check, range check, length check).

**Outcome: 8.4. Database Management**

Manage databases.

**Competencies**

- 8.4.1. House database files in an environment appropriate to anticipated user demand.
- 8.4.2. Control user access to data.
- 8.4.3. Log access to the database by user and type of transaction.
- 8.4.4. Backup, verify, and recover data.
- 8.4.5. Optimize a database for best performance (e.g. indexes, query generation, monitoring efficiency)
- 8.4.6. Implement data migration (e.g. different location, environment, file format, application).

**Outcome: 8.5. Queries and Transactions**

Perform data queries and database transactions.

**Competencies**

- 8.5.2. Commit and roll back transactions.
- 8.5.3. Retrieve, filter, sort, and parse data.
- 8.5.4. Generate and print forms, reports, and results of queries (e.g., calculated fields, functions).


**Outcome: 8.6. Geospatial Information Systems**

Store, visualize, analyze, and interpret geographic data.

**Competencies**

- 8.6.1. Explain the components, context, and aspects of a Geographic Information System (GIS), including advantages and limitations.
- 8.6.2. Recognize map projections and coordinate systems and apply them appropriately to spatial data.
- 8.6.3. Demonstrate knowledge of how reality is represented and transformed in spatial datasets.
- 8.6.4. Demonstrate the ability to acquire, create, update, and/or manage spatial data from disparate sources.
- 8.6.5. Demonstrate the basic ability to visualize, summarize, analyze, and interpret spatial data.
- 8.6.6. Demonstrate an understanding of basic cartographic principles through designing and producing effective maps.
- 8.6.7. Recognize real-world applications of a Geographic Information System (GIS).



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- 8.6.8. Identify various map types and interpret geographic spatial relationships within these maps.
  - 8.6.9. Understand differences between GIS data file formats.
  - 8.6.10. Demonstrate the use of various GIS software applications in map design.