

**HAROLD WASHINGTON COLLEGE**  
**MASTER SYLLABUS – COLLEGE CREDIT COURSE**

**1. TITLE, NUMBER, AND CLASSIFICATION:**

Name of Course:

**FUNDAMENTALS OF VECTOR GEOGRAPHIC INFORMATION SYSTEMS  
(GIS)**

**General Course with Laboratory.**

**Department Name:** Physical Science

**Number Code** 201

**Course Number:** 0076-0201

**DIVISION:**                     College                     Continue education

**CURRICULUM:**             Liberal Arts             Pre Credit  
                                  Careers                     Community Service  
                                                                                  Vocational Skills

**PROGRAM:**                     General Education  
                                          Developmental  
                                          ESL  
                                          Career Occupational

**2. COURSE TERM:** 16 Week Semester

**3. CREDIT AND CONTACT HOURS:**

(i) Credit hours 4 (ii) contact hours per week 6 (iii) types of activities

- Lecture/Discussion**
- Lab**
- Clinical/Work Experience**
- Other** (Capstone project mentoring)

**4. PREREQUISITES:**

Grade of C or better in English 101 and completion of Math 99 or equivalent placement or Consent of Department Chairperson.

## 5. CATALOG DESCRIPTION

Fundamentals and application of vector GIS, using Arc-GIS. This class will focus on modeling and analyzing spatial problems in many economic sectors and environmental fields, in which spatial data can be represented by points, lines and planes. Writing assignments, as appropriate to the discipline, are part of the course. 2 hours lecture, 1 hour of discussion and 3 lab hours per week.

*Prerequisite:* Grade of C or better in English 101 and completion of Math 99 or equivalent placement or Consent of Department Chairperson.

## 6. STUDENTS FOR WHOM THE COURSE IS INTENDED:

1. This class is a regular requirement to obtain the Certificate in Basic Environmental GIS at Harold Washington College (HWC). Graduates will be able to compete in a globally-centered society and use new technology in geoinformatics. This program will also serve as a step from HWC to enrollment at four-year universities to pursue further education in GIS.
2. This class is attractive to the diverse student body at HWC and to professionals in the city that want to expand future opportunities with technology-driven skills. The students who want to enroll in this class are interested in application of scientific principals and computer modeling applied to the solution of spatial problems.

## 7. COURSE OBJECTIVES:

The Vector GIS class will be focused on achieving the following objectives:

1. Introduce students to the fundamental concepts of GIS and real-world representation, using GIS vector technology via spatial data input, topology, cartographic projections, and coordinate systems.
2. Provide students with background information and technological skills to explore, capture, manage, analyze, model, and perform spatial operations, and to find trends and patterns on the landscape.
3. Equip students with the problem-solving, critical and spatial-thinking skills, and technological expertise to model, interpret and find a suitable solution to an entry-level problem or applications that require the use of vector GIS.
4. Familiarize students with different GIS resources available on the internet and in the literature (e.g. specialized data bases, peer-reviewed papers, remote sensing imagery, and GIS-models), and provide students with critical-thinking skills to recognize the quality of scholarly information.
5. Familiarize students with Arc-GIS software for data capture, analysis, modeling and representation of a vector- spatial application.

6. Mentor students as they design and successfully complete a GIS project of their choice applying the background knowledge and understanding about vector-GIS technology and techniques.
7. Provide students with basic information and methodology on the presentation of results, and for other projects in different applications and disciplines that use vector GIS.

## **8. STUDENT LEARNING OUTCOMES**

Students who satisfactorily complete the Vector GIS class will be able to:

- 1a. Summarize concepts and common operations pertinent to vector GIS.
- 1b. Differentiate between spatial and attribute data.
- 1c. Utilize vector data models, features, and topology.
- 1d. Utilize different geographic coordinate systems, datum and map projections.
  
- 2a. Apply GIS concepts and common operations to emphasize trends and patterns on the landscape for a specific vector spatial problem.
- 2b. Perform standard GIS operations, including input, editing, management, display, analysis and modeling, for the data relevant to the project.
- 2c. Manage and link spatial and descriptive information to its geographic location.
- 2d. Interpret the results obtained from the vector GIS model to create meaningful outputs for the projects.
  
- 3a. Demonstrate the cartographic skills needed to generate suitable outcomes for specific problems.
- 3b. Represent natural landscape components using vector features.
- 3c. Select different types of vector-spatial operations and models to show patterns on the landscape.
  
- 4a. Identify and apply different ways to retrieve and to input vector data into a GIS project.
- 4b. Access different databases to retrieve vector and attribute information for the final project.
- 4c. Use information, methods, and GIS models reported in the literature to apply to a particular spatial problem.
- 4d. Use spatial analysis techniques to combine geographic data.
- 5a. Use GIS software and technology to represent, model and solve spatial problems in real-world applications.
- 5b. Recognize both the potential and limitations of GIS software for vector applications.
  
- 6a. Summarize the purpose, research question, spatial extent, and analyses to be performed on their final capstone project.
- 6b. Identify the project's information needs: the type and sources of vector spatial and attribute data and the project results and outputs.

- 6c. Formulate effective methodology for the final project by selecting logical steps for spatial analysis.
- 6d. Assess the accuracy and validity of the results obtained in their final project.
- 7a. Generate appropriate graphics and maps representing the geographic location and the tendency and patterns of the data.
- 7b. Write an executive report explaining the outputs and findings.
- 7c. Deliver a Power Point Presentation discussing the methodology, findings and results of the project.

## **9. SUGGESTED TOPICAL COURSE OUTLINE:**

- Week 1. Introduction to GIS** - Applications, components, history, operations, spatial data, and attribute data.
- Week 2. Coordinate Systems** – Datum, map projections, coordinate systems.
- Week 3. Vector Data Model** – Data models, features, topology, data structure, and TIN.
- Week 4. Object-Based Vector Data Model** – Classes, and geodatabase.
- Week 5. Data Input** – GIS data resources, metadata, and creation and conversion of data.
- Week 6. Spatial Data Editing** – Errors, data accuracy, topological errors, and other editing operations.
- Week 7. Attribute Data Input and Management** – GIS attribute data, data entry, and management of fields for attribute data.
- Week 8. Vector Data Display and Cartography** – Type of maps, map design, symbols, colors, legend, topography, hierarchy, and map generation.
- Week 9. Vector Data Exploration** – Data exploration and query for attribute and spatial data.
- Week 10. Vector Data Analysis** – Buffering, overlay, distance measurement, pattern analysis, and map management.
- Week 11. Terrain Mapping** - Using Triangulated Irregular Network (TIN)
- Week 12. GIS Models and Modeling** – Elements of GIS modeling, and vector-based index and binary models.
- Week 13 – 16 Mentoring Capstone Project.** Embedded performance task or final project consists of a capstone experience. Each student will develop a vector GIS model to represent and resolve an entry-level-spatial problem for an application of his/her choice.

## **10. SUGGESTED TEXTS AND MATERIALS USED:**

- 1) Introduction to Geographic Information Systems, 4th Edition, 2008, by Kang-tsung Chang, McGraw Hill, 450 p.  
ISBN 978-0-07-305115-4

- 2) GIS Tutorial, Workbook for ARC-View 9, 2005, by Wilpen L. Gore and Kristen S. Kurland, ESRI Press, 352 p.  
ISBN 13:978-1-58948-127-5

**11. AMOUNT OF WRITING REQUIRED:**

Laboratory reports, executive report for the final project, and short answer essays questions.

**12. SUGGESTED METHODS OF EVALUATION:**

<b>Item</b>	<b>Percentage</b>	<b><u>Scale</u></b>
1) Quizzes	15%	<b>A</b> = 90 -100% <b>B</b> = 80 – 89% <b>C</b> = 70 – 79% <b>D</b> = 60 – 69%
2) Final Exam	20%	
3) Laboratories	30%	
4) Capstone Assignment	30%	
5) Participation	5%	
<b>TOTAL</b>	<b>100%</b>	

**13. AUTHORIZED SIGNATURE AND FILE DATE:**

DEPARTMENT AND CAMPUS

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Physical Science Department  
Harold Washington College