

[Course information is subject to change]

## GEOG 490/590: GIS Programming

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**4 credits with lectures and lab components.**

### Course Objectives

Introduction to Visual Basic GIS programming languages for customizing applications and streamlining spatial analysis. Topics include GIS software environment, programming syntax and styles, interface customization, GIS routines and functions, and basic algorithms. Programming lab included. Prerequisite: GEOG 488/588. After completing the course, students will be able to design and develop VBA applications in ArcGIS.

### Text and Readings

The text for this course is *Getting to Know ArcObjects: Programming ArcGIS with VBA* by Robert Burke, 2003 (ESRI Press. ISBN: 1-58948-018-x). The book is available at the Portland State Bookstore and from Amazon.com or ESRI.com. The optional book is *Programming ArcObjects with VBA: A Task-Oriented Approach* (2<sup>nd</sup> Edition) by Kang-Tsung Chang, 2007 (CRC Press. ISBN: 0-8493-9283-7).

The lecture component of this course consists of discussions of the readings and therefore you should have read the material before class. Students are expected to come to class ready to be active participants in the discussion.

### ArcObjects References

- ESRI ArcObjects Library Reference

### Grading

The instructor will grade graduate and undergraduate students based on separate distribution curves. The components of a student's grade are listed in the table below.

Class Participation	15%
Lab Assignments	45%
Midterm	15%
Term Project	25%

### Class Participation (15%)

Attendance to this course is mandatory. If you miss more than two class periods then you will be penalized five percent of your final grade per absence. PLEASE DO NOT MISS CLASS. You are expected to take part in the discussions and if you are not in class then you cannot. If you are repeatedly late you will be given an absence.

All students are required to select a programming topic from a list provided by the instructor (see the last page of the syllabus) and give a 10 to 15 minutes discussion on a VBA script in class. You must **find** a bug-free VBA program and walk through the program in class. Students who are responsible for the week's topics must email the program and its source to the course mailing list by 5pm the day before the class. The discussion should include an overview of the program, a quick demonstration, and a line-by-line walkthrough of the

program. Sample programs can be found from the textbook CDs, ESRI ArcScripts, ESRI Developer Network (EDN), or other sources.

**Lab Assignments (45%):**

During the lab sessions (i.e., the second part of the class) you will develop VBA programs on the computers. If you do not finish the labs during the assigned time periods the lab also has open hours. CH 475, CH 1, CH 324, and Broadway Computer Lab all have ArcGIS on the computers. Students should submit their lab work digitally, with the source code, test data, and write-up documents zipped in one file. If the file size is too big to send via email, please put the zipped file in a network space and send the link to the instructor.

**Midterm Exam (15%):**

There will be one in-class, closed-book midterm exam and no final exam. Unscheduled in-class quizzes will be administered without notifications. Results of these quizzes will be counted toward class participation.

**Term Project (25%):**

Individual students will work on a GIS application they identify and develop VBA program to implement the application. Each student must submit a one-page description of the VBA application on the 5th week and present and demonstrate the VBA application during the scheduled final exam time.

**VBA Application Description Guideline**

It's a good idea to browse online sources to see what VBA scripts have been developed. This will give you a sense of the scope and complexity of the program. Each student is required to submit a typed project description. Your final VBA application will be implemented following the description. The description should include the following information.

1. **VBA application Title:** A sentence highlighting the main function of your AP.
2. **Major function:** A brief description of the functions of the AP.
3. **Background:** A short paragraph describing the why the AP is needed, the major problem it resolves, and the expected users and benefits.
4. **GIS data will be used:** Describe your study area, the GIS data layers, and the topological characteristics of these data layers.
5. **Particular algorithm:** Describe any particular algorithms that will be implemented (e.g., sorting, random number generator, etc).

**AP Demonstration:**

You must develop a Powerpoint presentation that includes the essential information described in the VBA AP description and a reflection of the main challenges and major breakthrough in the project. Accompanying the presentation is a live demonstration of your AP. **You must acknowledge the sources of any codes that you borrow in your AP. You will fail this class if you commit plagiarism.**

## Student Discussion Schedule

Week	Topics	Presenters
2	<ul style="list-style-type: none"> <li>• CASE and IF THEN Statements</li> <li>• FOR NEXT and DO WHILE Statements</li> </ul>	
3	<ul style="list-style-type: none"> <li>• Using Subroutines and Functions</li> <li>• Using the Debug Tools in VBA IDE</li> </ul>	
4	<ul style="list-style-type: none"> <li>• Adding a Feature Class to ArcMap</li> <li>• Adding a Raster Data Set</li> </ul>	
5	<ul style="list-style-type: none"> <li>• Getting and Setting Values</li> <li>• Adding Fields in Attribute Tables, Calculating Field Values</li> <li>• ArcObjects Geoprocessing (Chang CH1, 5)</li> </ul>	
6	<ul style="list-style-type: none"> <li>• Setting Layer Color</li> <li>• Class Breaks Renderer</li> <li>• Selecting Features</li> </ul>	
7	<ul style="list-style-type: none"> <li>• Making UITool</li> <li>• Drawing Graphic Elements</li> <li>• ArcGIS Toolbar Commands</li> </ul>	
8	<ul style="list-style-type: none"> <li>• Vector Buffering</li> <li>• Vector Overlay</li> <li>• Joining Data by Location</li> </ul>	
9	<ul style="list-style-type: none"> <li>• Raster Objects</li> <li>• Raster Local Operations</li> <li>• Raster Neighborhood Operations</li> </ul>	

## Course Schedule & Readings

Week	Discussion Topic/ Readings	Lab
1	<ul style="list-style-type: none"> <li>• Course Overview</li> <li>• VBA Programming Environment (Chang Ch1)</li> </ul>	Lab 1: Hello World
2	<ul style="list-style-type: none"> <li>• Object-Oriented Programming (Burke Ch 1, 4)</li> <li>• VB Syntax (Burke 5, 7)</li> </ul>	Lab 2: VBA GUI Objects and Numerical Approximation (Burke Ch 2, 3)
3	<ul style="list-style-type: none"> <li>• Basic Programming Algorithms (Burke Ch 6, 8)</li> <li>• QuickSort</li> </ul>	Lab 2.
4	<ul style="list-style-type: none"> <li>• Introduction to ArcObjects (Burke Ch 9, 10)</li> <li>• ArcGIS Dataset and Layer Management (Burke Ch 14)</li> </ul>	Lab 3: Sorting & File I/O
5	<ul style="list-style-type: none"> <li>• Using ArcObjects: Attribute Data (Burke Ch 20, Chang Ch 5)</li> </ul> <p><b>Project Description Due</b></p>	Lab 3.
6	<ul style="list-style-type: none"> <li>• Using ArcObjects: Layer Symbology (Burke Ch 15, 16, 17)</li> </ul> <p><b>Midterm exam</b></p>	Lab 4: ArcMap Layers & Attribute Manipulation
7	<ul style="list-style-type: none"> <li>• Using ArcObjects: Command Tools (Burke 11, 12, 13)</li> </ul>	Lab 4.
8	<ul style="list-style-type: none"> <li>• Using ArcObjects: Vector Data (Chang Ch 10)</li> </ul>	Lab 5: ArcMap UITool, Commands, and Vector Features Operations
9	<ul style="list-style-type: none"> <li>• Using ArcObjects: Raster Data (Chang Ch 11)</li> </ul>	Lab 5.
10	<ul style="list-style-type: none"> <li>• Optimizing VB codes (AiVosto VBShop)</li> </ul>	Students work on project
<b>Final</b>	<ul style="list-style-type: none"> <li>• <b>Final presentation</b></li> </ul>	