



Continuing Studies/Geography Department  
Advanced Diploma in GIS Applications

## GEOG 525: GLOBAL POSITIONING SYSTEMS AND SURVEY ANALYSIS (ONLINE)

### Course Outline

January 10 - March 4, 2011

### Course Instructor:

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### Course Overview

This course is an introduction to the Global Positioning System, other Satellite Navigation Systems, and Survey Data collection. Particular emphasis will be placed on the use and processing of these data within GIS.

The GPS component of the course will consist of four modules, and will begin with an overview of GPS and the history of GPS and GPS applications. The course will cover fundamentals of GPS satellite navigation (how GPS works, GPS signal structure, GPS and time, pseudo-ranging, carrier phase ranging, error budget, differencing). Also covered will be types of receivers, geoid modelling, vertical positioning, mission planning, and GPS markets and applications.

The survey analysis component of the course will consist of one module, and will examine how surveys work, how coordinate systems and datums are used in survey and GPS work, and the use of Coordinate Geometry (COGO) as a tool to enter survey information into Geographic Information Systems. The component will conclude with a discussion of survey instruments, in particular total stations. The course will conclude with a discussion of future trends in GPS and surveying.

### Course Objectives

The goal for learners studying GPS and Survey Analysis is to understand the theoretical and practical aspects of the use of GPS receivers as tools for data entry into GIS. In addition, students will be taught the basic procedures of surveying, and how COGO can be used to precisely enter survey data into GIS.

Upon successful completion of the course material, the student should understand:

- The physics, mathematics, and electronics used in GPS technology
- How and why GPS and other navigation systems were developed
- The configuration of the NAVSTAR GPS system and related satellite navigation systems
- Capabilities and limitations of civilian and military GPS receivers
- Basic surveying techniques and equipment

### Specific Software Skills

- How to use GPS equipment to locate targets for observation, navigate to those targets, and collect data at the target site
- How to perform mapping using GPS receivers
- How to upload and download data from GPS receivers
- Use of post-processing differential correction techniques to improve GPS accuracy.
- How to enter survey information into GIS using Coordinate Geometry (COGO)

### Course Resources

#### Online resources:

- Field GIS: Collecting and Editing Data Using ArcPad 10
- Introduction to Trimble GPS Analyst
- Customizing ArcPad

Software:

- ESRI ArcMap (currently available on Ruxton)
- ESRI Survey Analyst Extension for ArcMap (currently available on Ruxton)
- ESRI GPS Analyst for ArcMap (currently available on Ruxton)
- ESRI ArcPad Software (currently available through campus-wide license)
- GPS Utility Software (shareware)
- Google Earth (freeware)

**Course Materials**

- Garmin Vista HCx or Vista H GPS Receiver (Note: you may use another receiver with equivalent capabilities, but instructions will only be provided for these receivers).

**Course Delivery**

The course is delivered entirely online. Lecture materials are made available on Moodle, (VIU's online course management system) and are supplemented by online and textbook readings. Lab assignments are made available available through Moodle, and are answered either by submitting files to Moodle, or by answering questions directly.

Modules from the ESRI virtual campus will be assigned as homework assignments. Submission of completion certificates for these modules will be required at the end of the course.

Two online exams will take place; there will be a midterm and a final exam at the end of the course.

**Proposed Schedule**

<b>Module 1: The Need for Positioning</b>				
<b>Week of</b>	<b>Lectures</b>	<b>Assignments</b>	<b>Due Dates</b>	<b>Value</b>
<b>Jan. 10</b>	<ul style="list-style-type: none"> <li>• Basic Concepts of Positioning</li> <li>• A History of Navigational Devices</li> <li>• Radionavigation Systems</li> </ul>	Lab 1: GPS Navigation and Web 2.0	Jan. 14, 9:00 (firm)	5.1%
<b>Module 2: The Global Positioning System</b>				
<b>Week of</b>	<b>Lectures</b>	<b>Assignments</b>	<b>Due Dates</b>	<b>Value</b>
<b>Jan. 17</b>	<ul style="list-style-type: none"> <li>• GPS Segments</li> <li>• Physics of GPS</li> <li>• Geometry of GPS</li> <li>• Frequencies and Codes</li> <li>• Types of GPS Positioning</li> <li>• GPS Receiver Algorithm</li> </ul>	Lab 2: Google Earth Photo Essay	Jan. 21, 9:00 (firm)	3.6%
<b>Module 3: GPS in the Field</b>				
<b>Week of</b>	<b>Lectures</b>	<b>Assignments</b>	<b>Due Dates</b>	<b>Value</b>
<b>Jan. 24</b>	<ul style="list-style-type: none"> <li>• Civilian GPS Units</li> <li>• Military GPS Units</li> <li>• GPS Receiver</li> </ul>	Lab 3: GPS Mission Planning and Preparation Field GIS: Collecting and Editing Data Using	Jan. 28, 9:00 (firm) Jan. 28 (suggested)	13.9% 0%

	Purchasing Considerations <ul style="list-style-type: none"> <li>• Mission Planning and Preparation</li> <li>• GPS Field Operatons</li> <li>• GPS Data Processing</li> </ul>	ArcPad 10 (video seminar)		
<b>Jan. 31</b>		Lab 4: GPS Mission Simulation	Feb. 4, 9:00 (firm)	4.7%
<b>Feb. 7</b>	<b>Midterm Exam (1 Hour)</b> Opens Feb 7, 00:00 PST, Closes Feb. 11, 23:59 PST			20%
<b>Module 4: Positional Accuracy</b>				
<b>Week of</b>	<b>Lectures</b>	<b>Assignments</b>	<b>Due Dates</b>	<b>Value</b>
<b>Feb. 14</b>	<ul style="list-style-type: none"> <li>• Selective Availability</li> <li>• Satellite Availability and Visibility</li> <li>• Measures of Error (PDOP, LDOP)</li> <li>• Signal Errors</li> <li>• Position Correction Techniques</li> <li>• Determining Elevations and Directions using GPS</li> </ul>	Lab 5: Differential GPS Correction	Feb. 18, 9:00 (firm)	10.9%
		Introduction to Trimble GPS Analyst (video seminar) (9.2)	Feb. 18, 9:00 (suggested)	0%
<b>Module 5: Geodesy and Surveying</b>				
<b>Week of</b>	<b>Lectures</b>	<b>Assignments</b>	<b>Due Dates</b>	<b>Value</b>
<b>Feb. 21</b>	<ul style="list-style-type: none"> <li>• Coordinate Systems and Datums</li> <li>• Heights and the Geoid</li> <li>• How Surveys Work</li> <li>• Using COGO to Enter Survey Notes</li> <li>• Total Positioning Systems</li> <li>• Future Trends in GPS and Surveying</li> </ul>	Lab 6: Coordinate Geometry (COGO)	Feb. 25, 9:00 (firm)	11.6%
		Customizing ArcPad (ArcPad 7)	Feb. 25, 9:00 (firm)	5%
<b>Feb. 28</b>	<b>Final Exam (1.5 Hours)</b> Opens Feb. 28, 00:00 PST, Closes Mar. 4, 23:59 PST			25%

**Course Evaluation**

<b>Course Component</b>	<b>Percentage of final grade</b>
Lab Submissions	50
ESRI Virtual Campus Certificates	5

Midterm Exam	20
Final Exam	25

**Important Notes:**

This syllabus is the definitive description of course policy and supersedes all other course descriptions.

Students are expected to work in a professional manner. This involves respect of the facilities, colleagues, ADGISA staff, and the educational process.

The ADGISA staff does not wish to set up an environment that restricts the student's ability to work on the computers. Software that restricts access to the system can slow down operations and cause other problems for lab users. We prefer to simply log operations on the computers, rather than restrict access. However, the changing of any computer settings, defaults, or other components of the hardware, operating system, or application software without the express direction of either the course instructor or the GIS lab technician will not be tolerated. The distribution of pirated software or media is illegal and the use of VIU's facilities for the distribution of such will not be tolerated.

Group work makes it possible for individuals to appear to understand more than they actually know. Fair and effective evaluation requires that a certain portion of the project work be completed during scheduled class lab time.

Participation and performance during these sessions is a component of the evaluation process. The submission of a project as a group does not necessarily mean that all members of the group will get a similar grade for any project.

Performing analysis on your own computers is both a privilege and a responsibility. In return for the flexibility of being able to work on their own laptops, students are solely responsible for the maintenance and upkeep of their machines. This includes regular maintenance tasks, such as cleaning up hard drives, defragmenting hard drives, installing and using an appropriate firewall, and performing backups. In particular, students are expected to make backup copies of their work on a daily basis.

In this program, you receive unprecedented access to state-of-the-art software and equipment, a great deal of access to your instructors, and the opportunity to work with some other fantastic students. If you use these resources effectively, you can learn an amazing amount in eight months. In this program, however, as in the real world, you are graded on your results, not on your efforts, so it is important to be efficient at producing quality work.

**Course Policies**Handling of Student Work

- Students are responsible for retaining a copy of all submitted work.
- All assignments to be submitted online before the assignment due date and time (times listed are Pacific Standard Time or Pacific Daylight Time)
- Every effort will be made to return assignments to students within two weeks.
- Students can make an appointment with their instructor to review and discuss their exams, assignments or course grade.
- Unclaimed assignments will be kept for one month after the grade submission deadline
- Final grades will be posted in a secure location on the Internet.

Student Supports

- Vancouver Island University Calendar
- Writing Centre
- Student Services Department

Attendance

Regular participation in online classes is mandatory. Students are required to contact the instructor in advance if they are unable to participate for more than one week due to illness, family or work duties (see VIU policy on "Non-attendance", below). Extended absence may result in the student being removed from the course.

Late Policy

This course is conducted online, but is not self-paced. Students are expected to submit assignments according to the schedule shown above. Each assignment has a clearly defined due date. ESRI Virtual Campus materials may be

completed at your leisure, but the final course certificate must be submitted on the final day of this course. Assignments received after the due date without prior notice will drop by 10% per week and after 3 weeks will be automatically given a grade of F. All course assignments must be submitted in order to receive a Course Grade.

## Grades

GRADE	PERCENTAGE	COMMENTS
A+	90+	Outstanding performance and exceptional work. Demonstrates sound critical thinking skills, innovative ideas and shows depth and breadth of understanding. Content, organization and style demonstrate ability to synthesize and apply course material. Detailed reference to existing literature is demonstrated.
A	85 - 89	
A-	80 - 84	
B+	76 - 79	Strong performance and work. Demonstrates the use of critical thinking skills and clear understanding of course material. Clear reference to existing literature is demonstrated.
B	72 - 75	
B-	68 - 71	
C+	64 - 67	Satisfactory performance and adequate work. Content, organization and style demonstrate basic understanding of course material. Adequate use of existing literature is demonstrated.
C	60 - 63	Marginal performance and work. Content, organization and style demonstrate poor comprehension of course material. Poor use of existing literature.
C-	55 - 59	
D	50 - 54	
F	Below 50	Did not successfully complete course requirements.
W		A grade which can be issued only by Registration when a student officially withdraws from a course. This can only be done during the first five weeks of class (students' responsibility to check calendar for deadline). Instructors can not issue "W" grades.
UW		Unofficial withdrawal. No longer accepted by Registration.

## Academic Misconduct

Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances, are prohibited and will be handled in accordance with the [Student Academic Code of Conduct Procedures](#). If you have any concerns about possible plagiarism or other academic misconduct, please contact your instructor **before** handing in the assignment in question.

**Academic misconduct includes, but is not limited to, the following acts:**

### Cheating

Cheating is an act of deception by which students misrepresent that they or others have mastered information for an academic exercise.

### Fabrication

Fabrication is the intentional use of false information or the falsification of research or other findings with the intent to deceive.

### Plagiarism

Plagiarism is the intentional unacknowledged use of someone else's words, ideas, or data. When a student submits work for credit that includes the words, ideas or data of others, the source of that information must be acknowledged through complete, accurate, and specific references, in a style appropriate to the area of study, and, if verbatim statements are included, through quotation marks or block format as well. By placing their names on work submitted for credit, students certify the originality of all work not otherwise identified by appropriate acknowledgments.

### Facilitation of Academic Misconduct

Helping or attempting to help another to commit act(s) of academic misconduct as outlined above.

### Non-attendance

Non-attendance, where attendance is deemed to be mandatory, is not acceptable. Absences due to personal illness, family illness, death of an immediate family member, religious ceremonies, or sports events in which the student represents Vancouver Island University are allowed and must be approved by the appropriate instructor or coordinator. Non-attendance must be for valid reasons and not falsified. Some departments have specific attendance requirements, and details may be obtained from the instructor, department chair, or program coordinator.

**Disciplinary Action**

Every reasonable effort should be made to deal with student conduct concerns at the instructional and departmental level. Formal discipline is designed for serious intentional academic misconduct.

Acts of academic misconduct may make a student subject to a range of disciplinary action – including failure for a course assignment or a course, or possible suspension by the President.

No student shall be allowed to withdraw from a course, or the University-College, to avoid receiving a failing grade based upon academic misconduct. A withdrawal under such circumstances shall result in an “F” grade being recorded on the student’s transcript for the course(s) in question.

Please refer to the [Student Academic Code of Conduct Procedures \(procedure 99.01.001\)](#) for information on handling breaches of this policy.

**Student Conduct Code (policy 32.05)**

Please refer to the [Student Conduct Code policy](#), available on the [Policies/Procedures website](#), for information on handling breaches of this policy.