LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		06-186	App. 11-14-06	App-4/28/09

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
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Proposing Department/Unit: Geography & Regional Planning	Phone: 724.357.7652

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

__X__ New Course _____ Course Prefix Change _____ Course Deletion

_____ Course Revision _____ Course Number and/or Title Change _____ Catalog Description Change

Current Course prefix, number and full title	*Proposed* course prefix, number and full title, if changing
GEOG 425: Global Positioning Systems (GPS) Concepts and Techniques	

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____ Catalog Description Change _____ Program Revision

_____ New Degree Program _____ Program Title Change _____ Other

_____ New Minor Program _____ New Track

Current program name	*Proposed* program name, if changing

4. Approvals		**Date**
Department Curriculum Committee Chair(s)		10/12/06
Department Chair(s)		10/12/06
College Curriculum Committee Chair		10/18/06
College Dean		10/18/06
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S Sechrist	11/14/06

Received
OCT 25 2006
Liberal Studies

* where applicable

Received
NOV - 3 2006
Liberal Studies

held for grad approval then sent forward due to inaction

Part II. Description of Curricular Change

1. Syllabus of Record

I. Catalog Description

GEOG 425 Global Positioning Systems (GPS) Concepts and Techniques

3 class hours
0 lab hours
3 credits
(3c-01-3cr)

Prerequisites: Student must have completed 60 credits of coursework or have permission of the instructor.

Provides students with knowledge of the theoretical basis and practical applications of Geographic Positioning Systems (GPS). Students will gain hands-on experience using GPS receivers and GPS observables, as well as the ability to determine point and relative position fixes from pseudorange and carrier phase measurements. Students will be exposed to industry-standard GPS hardware and software, as well as appropriate techniques for processing GPS data to achieve necessary levels of horizontal and vertical positional accuracy. Integration of GPS and geographic information systems (GIS) will also be discussed.

II. Course Objectives:

By the end of the semester, students will be able to:

1. explain the concepts and theory underlying the GPS system and the analytic methods used to obtain solutions
2. interpret datums, and three-dimensional and planar coordinate systems that are the basis of GPS position specification
3. evaluate the relationship between GPS as data collection systems and geographic information systems (GIS) as spatial databases
4. employ industry-standard GPS equipment to collect GPS field data and process data using appropriate techniques to achieve necessary horizontal accuracy for specified applications
5. appraise existing geospatial data to determine appropriate methods to integrate GPS data
6. assess the role and importance of GPS in present technological and societal contexts

III. Course Outline

A. Theories and Concepts of GPS; Development of the System (6 hours)

- **Satellite systems and orbits**
- **GPS History**
- **Development of Global Positioning System and NAVSTAR**
- **GPS Segments: Space, Control, User**
- **The logic of position derivation using GPS**

B. Geodesy and Spatial Coordinate Systems (6 hours)
- **The science of geodesy**
- **Ellipsoids and Datums**
- **3-D and planar coordinate systems**
- **The 3-D geodetic model**

C. Understanding GPS Satellite Orbits (6 hours)
- **Normal Orbital Theory**
- **Satellite Visibility and Topocentric Motion**
- **Signal Structures**
- **Civil and M-Codes**

D. GPS Observables (6 hours)
- **Pseudoranges and Carrier Phases**
- **Differencing**
- **Satellite Clock Corrections**
- **Topocentric range and cycle slips**
- **Satellite code offsets**

E. Point Position and Precise Point Position Derivation with GPS (9 hours)
- **Sources of Error**
- **Processing Pseudoranges and Carrier Phases**
- **Lineralized solutions and dilution of precision**
- **Differential correction**
- **Precise point positioning**

F. Advanced Applications of GPS/Integration With GIS (9 hours)
- **Mission Planning**
- **Geographic Information Systems**
- **Collecting data with Trimble GeoXT equipment**
- **Methods of integrating GPS data with existing geospatial data**
- **Dataset development to specifications**

G. Culminating Activity (2 hours)

IV. Evaluation Procedures

The final grade in the course will be determined as follows:

15% Three in-class quizzes designed to test mastery of conceptual and factual material regarding the Global Positioning System.

35% Attendance and Participation; In-class exercises and laboratories. Students will need to attend class very regularly to be able to keep up with course material, and to be present for in-class exercises and laboratories. Exercises and labs conducted during class are cumulative, and intended to illustrate concepts and allow students to develop technical knowledge necessary to undertake GPS data collection/outside class assignments.

50% Student Projects. These assignments will be based upon lecture and in-class laboratories, and will be designed to have the students apply what they have learned to

position calculation, data collection in the field, and geospatial data integration.

V. Grading Scale

A: 90% or above – A; 80-89.9% - B; 70-79.9% - C; 60-69.9% - D; below 60% - F

VI. Attendance Policy

Attendance will not be taken, but you are *strongly encouraged* to attend. In an upper-level course such as this, the instructor will assume that students are attending every class. Students who miss class will miss important course material, which will adversely affect their performance on quizzes, assignments and their class participation grade.

VII. Required Texts

A. P. Misra and P. Enge. 2006. *Global Positioning System: Signals, Measurements, and Performance.* 3rd Edition. Ganga-Jamuna Press: Lincoln, MA. (required) **B.** *Global Positioning System Concepts and Techniques Class Notes* available at Pro Packet (required). A course web site that you will be introduced to is also a resource.

VIII. Special Resource Requirement

There are no special resource requirements expected of the students who enroll in this course.

IX. Bibliography

Audoin, Claude, and Bernard Guinot. 2001. The Measurement of Time: Time, Frequency and the Atomic Clock. Cambridge University Press.

Boa-Yen Tsui, James. 2005. Fundamentals of Global Positioning Systems Receivers, A Software Approach, 2nd Edition. John Wiley & Sons.

Dixon, T.H., 1991. "Introduction to the Global Positioning System and some geological applications", Reviews of Geophysics, 29, 249-276.

Gao, Yang, and Kongzhe Chen. 2004. "Performance Analysis of Precise Point Positioning Using Real-Time Orbit and Clock Products." Journal of Global Positioning Systems Vol. 3, No. 1-2: 95-100.

Grewal, Mohinder, Lawrence Weill, and Angus Andrews. 2001. Global Positioning Systems, Inertial Navigation and Integration. John Wiley & Sons.

Herring, T.A., 1996. "The Global Positioning System", Scientific American, 44-50.

Hofmann-Wellenhof, B. et al., 1997. GPS, Theory and Practice, Springer-Verlag.

Hofmann-Wellenof, B., K. Legat, and M. Wieser. 2003. Navigation, Principles of Positioning and Guidance. Springer-Verlag.

Kaplan, Elliott D., and Chris Hegarty (eds.) 2005. Understanding GPS : Principles and Applications, 2nd Edition. Artech House.

Kennedy, Michael. 1996. The Global Positioning System and GIS. Ann Arbor Press.

Kleusberg, Alfred and Peter J. G. Teunissen (eds.) 1996. GPS for Geodesy. (Lecture Notes in Earth Sciences, Vol 60) Springer-Verlag.

Leick, A., 2004. GPS Satellite Surveying, 3rd Edition. John Wiley & Sons, Inc.

Misra, Pratap and Per Enge. 2001. A GPS Textbook for the Graduate Classroom. Ganga-Jamuna Press.

Montenbruck, O. and E. Gill. 2000. Satellite Orbits. Springer Publishing.

Parkinson, Bradford and James Spilker. 2005. Global Positioning System: Theory and Application. American Institute of Astronautic and Aeronautics.

Strang and Borre, 1997. Linear Algebra, Geodesy, and GPS, Wellesley-Cambridge Press.

Thurston, Jeff, Thomas Poiker, and J. Patrick Moore. 2003. Integrated Geospatial Technologies. John Wiley & Sons, Inc.

2. Course Analysis Questionnaire

Section A: Details of the Course

2A1. *How does this course fit into the programs of the department? For which students is the course designed? (majors, students in other majors, liberal studies). Explain why this content cannot be incorporated into an existing course.* The course is designed for Geography & Regional Planning majors, as well as non-majors who would like to learn about the science and applications of global positioning systems (GPS) and increase their technical skills. The course is meant to provide a thorough conceptual and technical basis for students who may specialize in GPS applications in a professional sense to some degree in the future. This course differs from GEOG 219, in that it is designed for advanced students and covers the conceptual and scientific underpinnings of GPS in much greater detail. GEOG 219 conversely is designed for students who would like to learn the basics of GPS for basic knowledge or recreational purposes.

2A2. *Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a*

result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements. The course will not require changes in the content of other existing courses. Presently brief modules on GPS are covered in GEOG 316 Introduction to GIS and GEOG 417 Technical Issues in GIS, however, these modules will continue to be taught as they are only short introductions to the logic and use of GPS.

2A3. *Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students).* The course has not been offered on a trial basis.

2A4. *Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.* This course will be proposed as a dual level course (GEOG 425/525). Graduate approval will be sought after the proposal has been reviewed by UWUCC.

2A5. *If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?* The course will not be offered for variable credit.

2A6. *Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).* Some other universities offer comparable courses, for example: University of Arkansas, Introduction to the Global Positioning System; University of Denver, GPS for GIS; and Depauw University, Introduction to GIS and GPS Mapping.

2A7. *Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.* The content of this course is not presently required for accreditation or professional membership.

Section B: Interdisciplinary Implications

2B1. *Will this course be taught by instructors from more than one department or team taught within the department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.* This course will not be taught by instructors from more than one department.

2B2. *What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).* The content of this course does not overlap with that of any other course at the university.

2B3. *Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.* This course will not be cross listed with other departments.

2B4. *Will seats in this course be made available to students in the School of Continuing Education?* Seats in this course could be made available to students in the School of Continuing

Education.

Section C: Implementation

2C1. *Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated workload will be assigned for this course.* No additional faculty will be needed to teach this course at this time. The course will fit into the schedule of current faculty by rotating this course with other geospatial techniques courses -- GEOG 417 Technical Issues in GIS and GEOG 421 Enterprise GIS.

2C2. *What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy?* Current resources are adequate to teach the course. All of the department's geospatial courses require the use of the Spatial Environmental Analysis Laboratory (SEAL) and the James Payne GIS Laboratory, which are adequately equipped. The SEAL lab presently has 6 Trimble GeoXT GPS units which will be used for the course.

2C3. *Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired?* None of the resources for this course are funded by a grant.

2C4. *How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?* We expect the course to be offered once an academic year.

2C5. *How many sections of this course do you anticipate offering in any single semester?* Not Applicable (see above).

2C6. *How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?* The course will be designed for a maximum of 18 students per section. The rationale for this is one GPS unit for every three students, although it would be good for the number of GPS units to be increased through time to provide increased student access to the units.

2C7. *Does any professional society recommend enrollment limits or parameters for a course of this nature?* No.

2C8. *If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.* This course is not a distance education course.