Introduction to Geographic Information Systems
Geography 316 / 516 and Regional Planning 316
Instructor: Dr. Richard J. Hoch, AICP, CFM

Class Time: Monday, Wednesday, Friday, 12:20 AM – 1:10 PM
Office: 1-C Leonard Hall Telephone: (724) 357-5990
Office Hours: Monday: 11:15am – 11:45 / Wednesday: 11:15am – 11:45am and 5:00 – 6:00 / Friday: 2:30pm – 3:30pm
Course Website: http://www.people.iup.edu/rhoch/
Location: 14 Leonard Hall
Email: rhoch@iup.edu
Graduate Assistant: Gabe Caprio

Course Description:
Introduction to Geographic Information Systems (GIS) is a Geography course. It introduces students to the emerging Geography sub-discipline of Geographic Information Science (GISc), focusing primarily on the utility and functionality of GIS. This is a comprehensive lecture course that is designed to cover material pertaining to the history, theory, application, and computer structure of GIS. There will be assignments given that require the use of GIS software intended to introduce the students to various topics that will be discussed in class. This course is not designed to “teach software”. Understanding the use of various GIS software packages is an important skill-set for a student to learn, however, the fundamental purpose of this course is to learn about the geographic underpinnings of manual and automated methods for creating, maintaining, and analyzing spatial data.

Course Objectives:
1. To gain knowledge of geographic principles as they apply to data and information.
2. To understand the geographic approach to computer science that has emerged as GIS/GISC.
3. To understand the meaning of spatial data and spatial relationships between digitally represented entities.
4. To gain a working knowledge of GIS software and to apply geographic principles in practice using GIS.
5. To understand what GIS can and cannot do by learning about metadata and standards developed by the Federal Geographic Data Committee.
6. To identify, access, and operate spatial data WWW portals of the National Spatial Data Infrastructure and beyond.
7. To be able to critically examine and identify the proper and improper application of spatial data/GIS/GISC.
8. To identify when, where, and how GIS/GISC intersects with society.


Course Policies and Requirements:
1. Attendance – it is required that students attend class (if you want to hear all of the information that may be on an exam). There will be material discussed during class time that will not be found in the text. Participation and attendance will be considered when determining final grades. However, I will not take attendance before every class period. You are allowed 3 absences per university policy (See 3 below).
2. Class Notes – students are responsible for notes and other class materials, including films and on-line material.
3. Exams – it is required that all exams are completed in order to be eligible to pass the course. Make-up exams will only be given in extreme circumstances and you must contact me before the exam if you know you will not be in class during the exam period. All unexcused make-ups will be all-essay exams. Verification of illness is required for unexcused make-ups. Make-up exams will be given at the end of the semester.
4. Students are required to be present at all class meetings. Cheating will not be tolerated!
6. During class, please do not talk to your classmates about subject matter other than class material.
7. Please turn off all communication and music devices (mobile phones, iPods, mp3 players, etc.).
8. Audio and/or video recording of class lectures must be approved by the instructor.
9. Do not sleep in class – this will not be tolerated. I will wake you up and ask you to go home and get some sleep.
10. Please do not come to class under the influence of intoxicating substances. If you choose to do so, do not sleep!

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>1st exam</td>
<td>40 pts</td>
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<tr>
<td>2nd exam</td>
<td>40 pts</td>
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<tr>
<td>Final exam</td>
<td>60 pts</td>
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<tr>
<td>Quizzes (4 @ 10 pts. each)</td>
<td>40 pts</td>
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<tr>
<td>Lab assignments / Project (6 @ 10 pts)</td>
<td>60 pts</td>
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<tr>
<td>*Project and presentation</td>
<td>10 pts</td>
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<td>250 pts</td>
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The project that each student must present is a culmination of the 6 lab assignments, plus some additional formatting work and presentation preparation. This project involves addressing the scope requirements for a Pennsylvania Dept. of Conservation and Natural Resources (DCNR) River Conservation Plan. An outline of minimum requirements is attached. *This project serves as a Portfolio item.*
Tentative Class Schedule
The structure of the topics covered in this course is designed to follow the format of the Longley, et.al text, however, lectures rarely cover the same material as the text. Lectures bring additional material to the course. Additional readings will be assigned most weeks. Class topics may be changed or delayed at my discretion.

<table>
<thead>
<tr>
<th>Week</th>
<th>Week of</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Jan 21/23</td>
<td>Introduction to GIS and GiSc / Review of Syllabus</td>
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**SECTION 1: INTRODUCTION**

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<th>Week</th>
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<tr>
<td>2</td>
<td>Jan 26/28/30</td>
<td>Longley – Chapter 1 – GIS as a system: Input / database / analysis / output. ‘A broad introduction’</td>
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<td>3</td>
<td>Feb 02/04/06</td>
<td>Longley - Chapter 2 - How GIS interacts with society and individuals through its multitude of applications. ‘A Gallery of Applications’</td>
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**SECTION 2: PRINCIPLES**

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<th>Topic</th>
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<tr>
<td>4</td>
<td>Feb 09/11/13</td>
<td>QUIZ #1 – Wednesday, Feb 12th - Chapter 3 ‘Representing Geography’ - introduction to digital geographic representation, data types, and the utilization of computers in representing spatial entities. Chapter 4 ‘The Nature of Geographic Data’ – Understanding the way real-world phenomenon is represented digitally, spatially, and temporally (Perhaps the most important class of the entire course – try not to miss this day). Data capture, visualization, generalization, structure, scale, and representation are discussed and analyzed.</td>
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<td>5</td>
<td>Feb 16/18/20</td>
<td>Chapter 5 ‘Georeferencing’ – Introduction to linking digital representations to geographic information / Datums, Projections and coordinate systems / Introduction to Global Positioning Systems (GPS)</td>
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<td>6</td>
<td>Feb 23/25/27</td>
<td>QUIZ #2 – Wednesday, Feb 26th - Chapter 6 ‘Data Uncertainty’ – Error, accuracy, estimation and generalization of spatial data sets.</td>
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<td>7</td>
<td>March 02/04/06</td>
<td>EXAM 1 – Friday, March 7th - Chapter 7 ‘GIS Software’ – Understand architecture of GIS software packages / GIS interface customization / types of commercial software and hardware / Review of various software packages</td>
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**SECTION 3: TECHNIQUES**

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<td>8</td>
<td>March 09/11/13</td>
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<td>9</td>
<td>March 16/18/20</td>
<td>Chapter 8 ‘Geographic Data Modeling’ – Vector and Raster data types / Topology / Triangulated irregular networks (TIN), digital elevation models (DEM), object-oriented</td>
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<td>10</td>
<td>March 23/25/27</td>
<td>Chapter 9 ‘GIS Data Collection’ – Examines data capture from primary and secondary sources. Metadata documentation. Review of remote sensing data collection and analysis methods</td>
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<td>11</td>
<td>March 30, April 01/03</td>
<td>QUIZ #3 (Will be announced) Chapter 10 ‘Creating and Maintaining Geographic Databases’ – Reviews database management, query language, digital data structure (i.e., topology, indexing) / Geodatabases</td>
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<td>12</td>
<td>April 06/08/10</td>
<td>EXAM 2 – Wednesday, April 16th - Chapter 12 ‘Cartography and Map Production’ – Review of map design principles, attribute representation and map symbolization. Chapter 13 ‘Geovisualization’ – Scale and representation, transformation, cartograms, GEO-VR systems</td>
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**SECTION 4: ANALYSIS**

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<tr>
<td>12</td>
<td>April 13/15/17</td>
<td>QUIZ #4 (Will be announced) Chapter 14 ‘Query, measurement, and transformation’ - ‘Query, Measurement, and Transformation’ and ‘Descriptive summary, design and inference’</td>
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<td>13</td>
<td>April 20/22/24</td>
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<td>14</td>
<td>April 27/29 May 1</td>
<td>Chapter 16 ‘Spatial modeling’ – Types of models, Analysis applications / spatial decision support systems (SDSS), GIS and Multi-criteria Decision Analysis (MCDA)</td>
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<td>15</td>
<td>May 04/08</td>
<td>FINALS WEEK: Final exam is Friday, May 8th from 12:30PM – 2:30PM – NO EXCEPTIONS</td>
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Indiana University of Pennsylvania Civility Statement:
As a university of different peoples and perspectives, IUP aspires to promote the growth of all people in their academic, professional, social, and personal lives. Students, faculty, and staff join together to create a community where people exchange ideas, listen to one another with consideration and respect, and are committed to fostering civility through university structures, policies, and procedures. We, as members of the university, strive to achieve the following individual commitments:

**Social Justice Statement:**
I expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

Indiana University of Pennsylvania Civility Statement:
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**To strengthen the university for academic success,** I will act honestly, take responsibility for my behavior and continuous learning, and respect the freedom of others to express their views.

**To foster an environment for personal growth,** I will honor and take care of my body, mind, and character. I will be helpful to others and respect their rights. I will discourage intolerance, hatred, and injustice, and promote constructive resolution of conflict.

**To contribute to the future,** I will strive for the betterment of the community: myself, my university, the nation, and world.
Outline of Course Project Scope:
PA DCNR – River Conservation / Watershed Planning Plan Format

I. Project Area Characteristics
   A. Location--Geographic location within the state including counties, townships, etc.
   B. Size--Watershed area in acres or square miles and length of river.
   C. Topography--Mountainous, upland, bottomland, wetland, type of cover, etc.
   D. Major Tributaries--Names, lengths, etc.
   E. Corridor--Drainage area, approximately one mile on either side of river.
      1. Land Use--Farming, residential, commercial/industrial, etc.
      2. Zoning--Public or private.
   F. Social/Economic Profile
      1. Population Centers--Proximity to river corridor, trends, etc.
      2. Transportation Facilities--Roads, highways, trails, railroads, airports, terminals, etc.
      3. Major Sources of Employment--Location, size, commercial, industrial, etc.
   G. Outstanding or Unique Features--River related values, etc.

II. Issues, Concerns, Constraints, and Opportunities--This section is provided for the purpose of addressing problem areas on a unique and individual basis. Any noteworthy situation not accounted for by other sections of this outline should be included here.

III. Land Resources
   A. Soil Characteristics--Group, type, classification, geology, etc.
      1. Limitations / Suitability--Erosion, building, drainage, wet, etc.
   B. Ownership (%)
      1. Public
      2. Private
   C. Critical Areas
   D. Landfills
   E. Hazard Areas
      1. Waste Sites
      2. Abandoned Mines--Quarries.
      3. Sinkholes

IV. Water Resources
   A. Major Tributaries--Name, length, protected use, confluence points, HQ/EV, etc.
   B. Wetlands--Map, characteristics, etc.
   C. Floodplain--Map, insurance, problems, etc.
   D. Lakes and Ponds
   E. Water Quality
      1. Point Sources
      2. Non-Point Sources
      3. Monitoring
   F. Water Supply (surface)--Use of surface and underground, locations, service area, yield, etc.
      1. Public / Private
      2. Well Head Protection Areas

V. Biological Resources
   A. Wildlife
      1. Terrestrial--Amphibian, reptile, bird, mammal, etc.
      2. Aquatic--FISH, invertebrates, etc.
   B. Vegetation--Native, exotic, etc.
   C. PNDI Species
   D. Important Habitats

VI. Cultural Resources
   A. Recreation
      1. Use (demand)--Day, night, seasonal, special, etc.
         a. Type--Hiking, biking, picnicking, birdwatching, organized sports, scenic enjoyment, fishing, boating, camping etc.
      2. Facilities (supply)--Private, public, federal, state, local, etc.
         a. Kind--Hiking trails (mi), biking trails (mi), picnic tables (#), group shelters (#), sports fields (#), river access, boat access, scenic vistas, camper sites, tent sites, etc.
   B. Archaeological / Historical
      1. Sites / Structure / Districts--Type, location, age, size, etc.
      2. Importance (recognition)--National register, state significance, local significance, etc.
      3. Ownership (public / private)--Security, etc.
      4. Condition

VII. Management Options (recommended action based upon resources)
   A. Restoration
   B. Maintenance
   C. Enhancement

VIII. Appendices and Figures (maps and other appropriate graphics)