## Term Information

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|---|---|
| **Effective Term** | Autumn 2015 |

## General Information

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|---|---|
| **Course Bulletin Listing/Subject Area** | Geography |
| **Fiscal Unit/Academic Org** | Geography - D0733 |
| **College/Academic Group** | Arts and Sciences |
| **Level/Career** | Graduate, Undergraduate |
| **Course Number/Catalog** | 5212 |
| **Course Title** | Spatial Databases for GIS |
| **Transcript Abbreviation** | Spatial Databases |
| **Course Description** | This course focuses on designing, implementing, querying and managing spatial databases or persistent data stores where most entities have footprints in geographic space and time. This is critical for designing and implementing GIS for projects and organizations. It is also crucial for moving beyond GIS to the bigger world of geographic information services. |
| **Semester Credit Hours/Units** | Fixed: 3 |

## Offering Information

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|---|---|
| **Length Of Course** | 14 Week |
| **Flexibly Scheduled Course** | Never |
| **Does any section of this course have a distance education component?** | No |
| **Grading Basis** | Letter Grade |
| **Repeatable** | No |
| **Course Components** | Lecture |
| **Grade Roster Component** | Lecture |
| **Credit Available by Exam** | No |
| **Admission Condition Course** | No |
| **Off Campus** | Never |
| **Campus of Offering** | Columbus |

## Prerequisites and Exclusions

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|---|---|
| **Prerequisites/Corequisites** | Prereq: 5210 |
| **Exclusions** | |

## Cross-Listings

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|---|---|
| **Cross-Listings** | |

## Subject/CIP Code

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|---|---|
| **Subject/CIP Code** | 45.0701 |
| **Subsidy Level** | Doctoral Course |
| **Intended Rank** | Senior, Masters, Doctoral |

## Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors

## Course Details

**Course goals or learning objectives/outcomes**

- Understand database design with spatial objects;
- Be able to write spatial queries;
- Understand physical data storage and performance tuning;
- Understand spatio-temporal and moving objects data;
- Have practical GIS data skills

**Content Topic List**

- GIS
- Spatial databases
- Spatial queries
- Spatial data modeling

## Attachments

- GEOG 5212 generic syllabus.pdf

*(Syllabus. Owner: Miller,Harvey Jay)*

## Comments

## Workflow Information

| Status | User(s) | Date/Time | Step |
|---|---|---|---|
| Submitted | Miller,Harvey Jay | 08/27/2014 03:14 PM | Submitted for Approval |
| Approved | Miller,Harvey Jay | 08/27/2014 03:15 PM | Unit Approval |
| Approved | Haddad,Deborah Moore | 08/27/2014 07:53 PM | College Approval |
| Pending Approval | Hogle,Danielle Nicole<br>Jenkins,Mary Ellen Bigler<br>Hanlin,Deborah Kay<br>Vankeerbergen,Bernadette Chantal<br>Nolen,Dawn | 08/27/2014 07:53 PM | ASCCAO Approval |

**GEOGR 5212 Spatial Databases for GIS - <Term, Year>**

| | |
|---|---|
| **Instructor** | Harvey J. Miller |
| **Lecture meeting time and location** | TBD (two course meetings per week) |
| **Office hours and location** | TBD |
| **Phone** | 614-292-5207 |
| **Internet** | miller.81@osu.edu |
| **Prerequisite** | GEOG 5210 Fundamentals of GIS |

**Texts**

1. Required
   - (WD) Worboys, M. and Duckham, M. (2004) *GIS: A Computing Perspective*.
   - Other readings – see course outline and schedule**.**
2. Optional
   - (SC) Shekhar, S. and Chawla, S. (2003) *Spatial Databases: A Tour*.
   - Zeiler, M. (2010) *Modeling Our World: The ESRI Guide to Geodatabase Concepts*, second edition.

**Course description**

The future will be data-driven. Most scientific and professional enterprises, as well as consumers, are generating and using data in most activities. Much of these data will be georeferenced and have geospatial footprints.

This course focuses on designing, implementing, querying and managing *spatial databases* or persistent data stores where most entities have footprints in geographic space and time. This is critical for designing and implementing GIS for projects and organizations. It is also crucial for moving beyond GIS to the bigger world of *geographic information services*.

In designing any GIS project, a fundamental decision is how to represent the world of interest in the computer. This is critical since no GIS or spatial analysis tools – no matter how powerful – can extract more information than is designed in the database representation. The growing size of geospatial databases requires these databases to support efficient querying and searching. A well designed spatial database can also evolve as the questions in the project or organization change over time. A poorly designed spatial database is difficult to rewind and fix.

Understanding spatial database design and management is not only essential for designing and implementing GIS, but also to support a much wider range of geographic information services such as Google Maps and location-based services such as the location apps on your smartphone. This is a much bigger market than the market for professional GIS services.

**Database technology**

The most common spatial database management system (SDBMS) technology is a specialized object-relational database management system (ORDBMS). An ORDBMS supports objects within a relational (table-based) database and its associated query language, Structured Query Language (SQL). An ORDBMS is a SDBMS if it also supports spatial objects through spatial indexing and spatial (geometric) operations.

ORDBMS with spatial objects is the approach used by ESRI's Geodatabase as well as open-source software such as PostGreSQL/PostGIS. It is also supported by other major vendors such as IBM.

In this course, we will be working with ESRI's Geodatabase. There will be a series of assignments using this technology. These will be provided via Carmen and discussed in class.

**Learning objectives**

After successful completion of this course, you should:

1. Understand database design with spatial objects;
2. Be able to write spatial queries;
3. Understand physical data storage and performance tuning;
4. Understand spatio-temporal and moving objects data;
5. Have practical GIS data skills

**Evaluation**

Examinations: 50% of the final grade
Assignments: 50% of the final grade
Grading scale: (OSU standard scale) A 93-100%; A- 90-92%; B+ 87-89%; B 83-86%; B- 80-82%; C+ 77-79%; C 73-76%; C- 70-72%; D+ 67-69%; D 60-66%; E 0-59%

**Examinations**

Examinations will be online using the CARMEN website. There will be approximately 4 midterm examinations and a final examination. The final is not comprehensive.

**Policies**

1. **Disability services.** Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/

**2. Academic misconduct.** It is the responsibility of the Committee on Academic

Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct: http://studentlife.osu.edu/pdfs/csc_12-31-07.pdf

**3. Technology policy:** This is the 21st century, so I will not ban the use of laptops, tablets and other digital devices. However, there are some guidelines and restrictions:
**Be mindful –** when you are emailing, tweeting, texting, updating, surfing, etc. you are not paying attention. Research shows that no one can multitask that well – not even you. Paying attention and taking good notes is essential to success in this course. Why are you here?
**Be courteous** – your use of digital devices should not distract other students in the class. It is unlikely that taking notes or searching class-relevant topics will be distracting. However, viewing videos of kittens or ice bucket challenges will likely distract others. Complaints about inappropriate technology use in class will result in your privileges being curtailed or revoked.
**Be honest -** emailing, surfing, and the use of any other applications or technologies is not allowed during the computer-based examinations. Be aware that your activity on the lab desktop computers may be monitored during exams.

**Carmen**

You are responsible for all announcements, additional reading, assignments and other material posted at the Carmen site, so be sure to check it frequently. I will also be posting PDFs of the slides I use in the lectures, as well as links to helpful and interesting websites.

**Course outline and schedule (assume Spring 2015)**

| **Topic** | **Readings** | **Date** |
|---|---|---|
| **Course overview** | Syllabus | 12 Jan 2015 |
| **Introduction** | | |
| Introduction to databases | WD 1-43 | 14 Jan 2015 |
| Introduction to spatial databases | SC 1-20 | 21 Jan 2015 |
| Spatial object-relational databases | Zeiler 1-19 | 21 Jan 2015 |
| **Exam 1: 26 Jan 2015** | | |
| **Object-relational databases and spatial objects** | | |
| Relational databases | WD 43-45 | 28 Jan 2015 |
| Database development | WD 55-71 | 28 Jan 2015 |
| Object-orientation and spatial objects | WD 71-82 | 2 Feb 2015 |
| **Relational algebra and SQL** | | |
| Overview of relational algebra and SQL | WD 46-52 | 4 Feb 2015 |
| Examples | SC 52-82 | 9 Feb 2015 |
| **Exam 2: 11 Feb 2015** | | |
| **Structures and access methods** | | |
| General database structures and access | WD 221-229 | 16 Feb 2015 |
| From one to two dimensions | WD 229-234 | 18 Feb 2015 |
| Raster structures | WD 234-240 | 23 Feb 2015 |
| Point structures | WD 240-248 | 25 Feb 2015 |
| Linear objects | WD 248-250 | 2 March 2015 |
| Object collections | WD 250-255 | 4 March 2015 |
| Spherical data structures | WD 255-258 | 9 March 2015 |
| **Exam 3: 11 March 2015** | | |
| **Architectures** | | |
| Hybrid, integrated and composable architectures | WD 259-262 | 23 March 2015 |
| Syntactic and semantic heterogeneity | WD 262-266 | 25 March 2015 |
| Distributed systems | WD 266-278 | 30 March 2015 |
| Location-aware computing | WD 278-291 | 1 April 2015 |
| **Exam 4: 6 April 2015** | | |
| **Time** | | |
| Introduction | WD 359-367 | 8 April 2015 |
| Temporal databases and versioning | WD 367-371 | 13 April 2015 |
| Spatio-temporal databases | WD 371-382 | 15 April 2015 |
| Moving objects concepts | Andrienko et al. (2008) | 20 April 2015 |
| Moving objects databases | Frentzos et al. (2008) | 22 April 2015 |
| **Exam 5: 27 April 2015** | | |

**Readings:**

1. **Andrienko et al. (2008)**: Andrienko, N., Andrienko, G., Peelkis, N. and Spaccapetra, S. (2008) “Basic concepts of movement data,” in F. Gianotti and D. Pedreschi (eds.) *Mobility, Data Mining and Privacy*, Springer.
2. **Frentzos et al. (2008):** Frentzos, E., Pelekis, N., Ntoutsi, I. and Theodoridis, Y. (2008) “Trajectory database systems,” in in F. Gianotti and D. Pedreschi (eds.) *Mobility, Data Mining and Privacy*, Springer
3. **SC 1-20**: Chapter 1 of Shekhar and Chawla.
4. **SC 52-82**: Chapter 3 of Shekhar and Chawla.
5. **WD** : Worboys and Duckham
6. **Zeiler 1-19**: Chapter 1 of Zeiler (2010)