1. Description:
Geographic Information Systems (GIS) deals with the analysis and management of geographic information. This course offers an introduction to methods of managing and processing geographic information. Emphasis will be placed on the nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modelling techniques, and error analysis.

The course is made of two components: lectures and labs. In the lectures, the conceptual elements of the above topics are explained. The labs are designed in such a way that students will gain first-hand experience in data input, data management, data analyses, and result presentation in a geographical information system.

Students must be clear that this is not a class on ArcGIS or any specific GIS software. It is a course on the underpinning theory and concepts in GIS. The understanding of these concepts and theories will help you to perform spatial analysis in a GIS system properly and better.

2. Objectives:
In general, this is an ice-breaking course into GIS and serves as the foundation course for other advanced courses in GIS. The basic objectives of this course for students are:
1) To understand the basic structures, concepts, and theories of GIS.
2) To gain a hand-on experience with daily routines of GIS operations.

3. Prerequisites:
Introductory courses in environmental or mapping sciences or instructor consent.

4. Computing Environment and Software:
ArcGIS (both the vector and the raster components) will be used for class assignments to illustrate the practical use of certain geographic information processing concepts and techniques.
5. Grading:

5.1 Components:

- Exercises ........................................................................................................... 40%
- Exam One ......................................................................................................... 30%
- Exam Two ......................................................................................................... 30%

5.2 Grading policy:

Grades of exercises are based on:
1) academic merit of your answers to the questions
2) conciseness of answers. **NO BEATING AROUND THE BUSH**
3) organization of presentation. No one wants to flip through a messy assignment report looking for answers. Here is a general format for your presentation:

- **Question:**
  - Your answer and discussion
  - Your support documents (images, graphs, tables, etc.)

The grade for each of the exercises and examinations is reported as $\frac{\text{points scored}}{\text{total points of exercise}}$. For example, if an assignment is worth 20 points and your answers score 16 points then you should see $\frac{16}{20}$ on your marked assignment.

5.3 Due date and time:

Each of the assignments will have a due day clearly written under the title of the assignment. The due time is the beginning of the lab session on the due day. Any assignment that is turned in after the due time on the due day is considered late. As you know, late assignments will receive penalty.

5.4 Penalty for late assignments:

The penalty for a late assignment is based on the number of days late (including weekends). If an assignment is late less than 24 hours, it is considered 1 day late. If an assignment is late less than 48 hours but more than 24 hours, it is considered 2 days late, and so on. Late assignments are penalized 10% per day. Here is the formula for calculating the points of a late assignment:

$$\text{Points get} = \text{Points scored} - 0.1 \times \text{num days late} \times \text{Points scored}$$

The minimum value of $\text{Points get}$ is 0. Assignments handed in after the TA has returned the graded assignment to class (usually a week after the due date) will receive no points.

6. Other Important Issues:

This class is always full at the beginning of each semester and there are people waiting to get into the class. Those of you who are registered for this class but fail to show up in the first week of classes (unless I am notified ahead of time!), I will have to remove your name from the class list and make the space available for the people on the waiting list.

Sickness often gets in the way of completing assignments, particularly after a long weekend. If sickness is used as an excuse for turning in an assignment later or missing an examination, we (the TA and the instructor) need to see a written report from a medical doctor stating your inability to attend class and/or to complete an assignment.
We will certainly give you ample time to complete each assignment. There is no reason for us to be told that the computer is down or the software is not working a day before the assignment is due. This will NOT be taken as an excuse for a late assignment!

7. Course Materials:

7.1 Text:

7.2 Other key texts:

7.3 Other texts:
8. Intended Topics:

8.1. An Overview:

- Measurement
- Connectivity
- Interpolation
- Terrain
- Statistical
- Point Pattern
- Classification
- Modeling
- Data Analysis
- Uncertainty
- GIS
- GeoVisualization
- Database Creation & Management
- Data Representation
- Meta Data
- Coordinate Transfer
- Data Editing
- Data Input
- DBMS in GIS
- Data Models
- Measuring Systems
- Nature of Data

8.2 Intended Lectures:

Lecture 1: (Sept. 4)
Introduction (I)
GIS: System v.s. Background
Introduction to Geog. 377

Lecture 2: (Sept. 6)
Introduction (II)
The nature of geographical information
What is GIS

Lecture 3: (Sept. 11)
Data Representation (I)
Measuring Systems
Location: coordinate systems

Lecture 4: (Sept. 13)
Data Representation (II)
Measuring Systems (continued…)
Topology: Basic geometric elements
Attributes: data types
Data in Computers

Lecture 5: (Sept. 18)
Data Representation (III)
Data Models:
Introduction: data models: spatial and attribute
Spatial Data Models:
Raster Data Models
Lecture 6: (Sept. 20)
Data Representation (IV)
Data Models:
Spatial Data Models:
Relational Data Models (for attributes)
Vector Data Models I

Lecture 7: (Sept. 25)
Data Representation (V)
Data Models:
Spatial Data Models:
Vector Data Models II

Lecture 8: (Sept. 27)
Data Representation (VI)
Data Models:
Spatial Data Models:
TIN:
Summary of Spatial Data Models (Raster v.s. Vector and TIN)

Lecture 9: (Oct. 2)
Data Representation (VII)
Summary of Data Models:
Linking attribute data with spatial data
Recent Development of Data Models

Lecture 10: (Oct. 4)
GIS Database Creation and Maintenance (I)
Data Input (spatial and thematic)
Data Editing (spatial and thematic)

Lecture 11: (Oct. 9)
GIS Database Creation and Maintenance (II)
Coordinate Transformation
Resampling (image data)
Address matching

Lecture 12: (Oct. 11)
GIS Database Creation and Maintenance (III)
DBMS and its use in GIS

Lecture 13: (Oct. 16)
GIS Database Creation and Maintenance (IV)
Metadata
Database creation Guidelines
NSDI

Review Session: (Oct. 18)

Exam One: (75 minutes) (Oct. 23)

Lecture 14: (Oct. 25)
Data Analysis (I)
Measurement operations
Connectivity operations
Lecture 15: (Oct. 30)
Data Analysis (II)
Interpolation operations

Lecture 16: (Nov. 1)
Data Analysis (III)
Digital terrain analysis

Lecture 17: (Nov. 6)
Data Analysis (IV)
Statistical operations
Point Pattern Analysis

Lecture 18: (Nov. 8)
Data Analysis (V)
Classification

Lecture 19: (Nov. 13)
Data Analysis (VI)
GIS-Based Modeling and Spatial Overlay: part I

Lecture 20: (Nov. 15)
Data Analysis (VII)
GIS-Based Modeling and Spatial Overlay: part II

Lecture 21: (Nov. 20)
Data Analysis (VIII)
Data Analysis Summary - Spatial Queries
Uncertainty

Lecture 22: (Nov. 27)
Geo-representation and geo-presentation
GeoVisualization

Lecture 23: (Nov. 29)
Spatial Modeling with GIS I
Application in Physical Geography

Lecture 24: (Dec. 4)
Spatial Modeling with GIS II
Application in Human Geography

Lecture 25: (Dec. 7)
Establishing A GIS Site

Review Session: (Dec. 11)

Exam Two: (75 minutes) (Dec. 13)