



Course Outline

Introduction:

This course will introduce Students to the fundamental concepts of Geographic Information Systems (GIS) technology. Topics will include definition, components and functions of GIS, hardware, software, spatial reference frameworks, data structures and analysis, data capture and management, in addition to apply some real-world application of GIS in Civil engineering field.

Objectives :

By completing this course, students will:

- Gain a basic, practical understanding of GIS concepts, applications and how it can be used to create maps, charts, images and other types of presentations.
- Understand basic GIS data and analysis concepts.
- Gain practical experience using basic GIS tools.
- Gain practical applications of GIS in many engineering fields.

<u>Topics</u>
I. Introduction and Overview of Geographic Information Systems
Definition of a GIS; ; historical development of GIS, why GIS is important; GIS as an Information System, Function of GIS, Components of GIS.
II. Data Models and Structure
Exploring GIS Data, Database concepts, Data formats, Topology, Data Source, Database Models, Benefits of database, Data quality,
III. Query and Analysis Data
Query, Reclassification, Coverage Rebuilding, Overlay, Connectivity Analysis, Boundary operations, Measurements, Transformations, Optimization techniques
IV. Planning a GIS project
Identify your objectives, Create a project database, Analyze the data, Present the results



<u>Topics</u>
V. Making Maps
Presenting the results; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, Creating the report , adding report and charts on map
VI. GPS Overview
GPS definition and component, how GPS does work?, Velocity and Time, GPS Data, Accuracy and error, Differential GPS (DGPS) Technique. Applications
VII. Coordinate Systems & Map projection
Global coordinate systems, Cartesian coordinate system, Selected Map Projections, Map projection, Spheroid, Datum,
VIII. Georeferencing , Geocoding and Network analysis
Concept and Definitions , Georeferencing a raster , Data collection method and Applications, Geocoding , Network analysis
IX. Introduction to Remote Sensing , Definition, Resolution, Electromagnetic Energy (EMR), Types, Interpretation, Applications
X. The Future of GIS & Application Areas

Presentation Methodology:

Lectures using LCD , discussion classes, Laboratory Works, project.

Grading Policy:

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| • Lab & Class Participation | 10 % |
| • Midterm Exam | 30 % |
| • Project and Presentation | 20 % |
| • Final Exam | 40 % |

References :

1. Longley, Goodchild, Maguire and Rhind. 2011. **Geographic Information Systems and Science., 3 rd. edition, John Wiley & Sons.**
2. Bolstad, Paul (2005) GIS Fundamentals. 2nd edition, Eider Press.
3. Environmental Systems Research Institute. 2000. Getting to Know Arc GIS. Third Edition. ESRI.
4. Burrough, P.A. and R. A. McDonnell, 1998. Principles of Geographic Information Systems. New York: Oxford University Press, 333 p.
5. Chrisman, N. R., 2001. Exploring Geographic Information Systems (2nd). John Wiley & Sons, New York.
6. GIS Concepts and ARCGIS Methods, David M. Theobald, (2003). Conservation Planning Technologies, Fort Collins, CO. ISBN: 0-9679208-2-5.



Laboratory Works:

- 1) Exploring Geographical data (1 week)
- 2) Working with geographic features... (1 week)
- 3) Working with tables..... (1 week)
- 4) Editing features..... (2 week)
- 5) Working with map elements..... (1 week)
- 6) Project..... (9 weeks)