Asian Institute of Technology
School of Engineering and Technology

AT76.01 ***Geographic Information Systems*** **3 (2-3)** **Semester: August/January**

Course Objective: This course aims at introducing concept, principles and applications of Geographic Information Systems (GIS). Course also aims to develop the skill of using software and other tools of GIS in students.

Learning Outcomes:

The students on the completion of the course will be able to :

1. Explain and communicate the concept of various kind of maps and geospatial data
2. Develop, edit and update geospatial data
3. Create digital maps, apply projections and other characteristics of mapping
4. Integrate various kind of data from various sources and analyse the same using GIS concept and tools
5. Apply the knowledge and skill for various applications

Prerequisite: None

Course Outline:

I. Introduction
   1. Overview, History and Concepts of GIS, Scope and Application Areas
   2. Purpose and Benefits of GIS
   3. Functional Elements of GIS
   4. Importance of Remote Sensing Data in GIS

II. Digital Mapping and Cartography
   1. Map concept – Map elements, Map Layers, Map scales and representation
   2. Map Projection – Coordinate system and projection systems
   3. Cartographic Design

III. Spatial Data Structure
   1. Raster Data Structure
   2. Vector Data Structure
   3. Data Compression Techniques

IV. Data Acquisition and Data Management
   1. Analogue to digital conversion- online digitization
   2. Geospatial and environmental data from Remote Sensing Satellites
   3. Global Navigation and Satellite Systems (GNSS) based data acquisition
   4. Data Management

V. Data Manipulation and Analysis
   1. Data Manipulation Techniques
   2. Geoprocessing Techniques
   3. Spatial Analysis Techniques
   4. Digital Elevation Modelling

VI. Advances in GIS
   1. Internet GIS
   2. 3D GIS
   3. Open Source GIS

VII. GIS Applications Case Studies
   1. GIS application in Urban
   2. GIS application in Health
   3. GIS application in Environment

Laboratory Session(s):

1. Introduction to GIS Software - demonstration of structure, tools, management, formats
2. Introduction to Spatial database development, Linking non-spatial and spatial database, database editing and updating
3. GPS data integration in GIS
4. Remote Sensing Data Integration
5. Geoprocessing techniques
6. Spatial Analysis – Charting and tabular representation, Spatial statistics, information development
7. Network Analysis and Digital Elevation Modeling
8. Model Builder
9. Open source software – hands on
10. Case Studies - Application

Learning resources:

Text Books:

Chang, K.T.:

Introduction to Geographic Information Systems (Sixth Edition). McGraw Hill, New York, 418 pp, 2012

Reference Books:

Ian Heywood, Sarah Cornelius and Steve Carver:

An Introduction to Geographic Information Systems, Pearson, London, 2012

Elaheh Pourabbas:

Geographic Information Systems-Trends and Technologies, Taylor and Francis, London, 2013

Andy Mitchell:

ESRI guide to GIS Analysis , ESRI Press, Red Lands, Ed. 2005.

Journals and Magazines:

International Journal of GIS, Taylor & Francis
International Journal of Geoinformatics, Association of Geoinformation Technology

Others: Online Moodle Based Platform is used to provide all lecture materials/ reference books/ notes/ assignmen

Teaching and Learning Methods:

Additional reading materials are also provided online time to time.

1. **Lectures:** Students receive the lecture materials and reference materials and taught using power points and extensive discussion and explanation on white board.
2. **Tutorials:** Mathematical problems are solved in the class-exercises and support is provided to students to learn.
3. **Laboratory Sessions:** 10 Laboratory sessions expose students to different tools in GIS.
4. **Miniproject:** Students are provided miniproject to show their ability to apply tools of GIS in problem solving. Data is provided and proposals are evaluated. They are also evaluated extensively on concept and expertise on the GIS software.
5. **Assignments:** Assignments are given and students are encouraged to answer them by hand as they have to write the exams by hand only. They normally streamline the thought process of students to respond or reply the questions.
6. **Discussion Sessions:** Every class will have discussion sessions and all the students are involved.

Time Distribution and Study Load:

Lecture: 30 Hrs
Laboratory: 30 Hrs
Miniproject: 15 Hrs
Assignments and Discussion: 30 Hrs
Self-study: 90 Hrs

Evaluation Scheme:

The final grade will be based on the following weight distribution: assignments (10%), midsem exam (20%), final exam (40%) and Mini Project (30%). Closed book examinations are used for both midsem and final exams.

An "A" would be awarded if a student can show the ability of having extensive knowledge on in all learning outcomes and ability to display excellent performance in practical exercises and miniproject. A "B" would be awarded if a student shows an overall understanding of the topics covered, a "C" would be given if a student meets below expectation on both knowledge acquired and analysis. A "D" would be given if a student does not meet basic expectations of the topics presented in the course.

Instructor: Prof. Nitin K. Tripathi