

**ENSC-307: GEOGRAPHICAL INFORMATION SYSTEMS & REMOTE SENSING
(THEORY) (02 Credit hrs)**

PRE-REQUISITES: ENSC-109

LEARNING OUTCOMES

The students will learn about;

- Spatial, non-spatial data including vector and raster datasets
- Georeferencing, Digitization and Topological techniques
- Digital cartography
- Freely available online spatial data platforms
- GIS and Remote sensing in Environmental sciences

CONTENTS

This course provides knowledge about spatial and non-spatial datasets, spatial data creation, Data joining and import & export, digital cartography, spatial analysis, Applications of GIS & Remote sensing in environmental studies

Unit-1: Fundamentals of GIS & RS

- 1.1. Introduction to Globe and Coordinate Systems
- 1.2. Raster and Vector models
- 1.3. Georeferencing and Spatial adjustment

Unit-2: Spatial Data Creation

- 2.1. Shapefiles and Geodatabases
- 2.2. Digitization and Topological errors
- 2.3. Attributes and Data joining and Geodatabases

Unit-3: Data Acquisition and Vector Analysis

- 3.1. Online freely available platforms
- 3.2. Spatial Data import and Export
- 3.3. Spatial Analysis

Unit-4: Digital Cartography

- 4.1. Digital Cartography
- 4.2. Cartography techniques
- 4.3. Large and Small-scale maps

Unit-5: Remote Sensing Science

- 1.1. Remote sensing resolutions
- 1.2. Electromagnetic Spectrum (EMR)
- 1.3. Remote sensing platforms, sensors, orbits

Unit-6: Raster Analysis

- 1.1. Imagery rectification and processing
- 1.2. Introduction to Digital Elevation Model
- 1.3. Satellite Imagery for Land use Landcover Classification

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Petrou, M. M., & Kamata, S. I. (2021). *Image processing: dealing with texture*. John Wiley & Sons.
2. Pucha-Cofrep, F., Fries, A., Cánovas-García, F., Oñate-Valdivieso, F., González-Jaramillo, V., & Pucha-Cofrep, D. (2018). *Fundamentals of GIS: applications with ArcGIS*. Franz Pucha Cofrep.
3. Wise, S. (2018). *GIS fundamentals*. CRC Press.
4. Emery, W., & Camps, A. (2017). *Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications*. Elsevier.
5. Bolstad, P. (2016). *GIS fundamentals: A first text on geographic information systems*. Eider (PressMinnesota).
6. Fox, L. (2015). *Essential Earth imaging for GIS*. Esri Press.
7. Lavender, S., & Lavender, A. (2015). *Practical handbook of remote sensing*. CRC Press.
8. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.

ENSC-307: GEOGRAPHICAL INFORMATION SYSTEMS & REMOTE SENSING (PRACTICAL) (01 Credit Hr)

PRE-REQUISITES: ENSC-109

LEARNING OUTCOMES

In this course students will get practical knowledge about;

- Georeferencing, Digitization and Topological techniques
- Large and Small-scale maps preparation
- Downloading of different freely available spatial datasets
- Image processing and classification

CONTENTS

This course provides practical knowledge about spatial and non-spatial datasets, Data joining and import & export, digital cartography, spatial analysis, digital Elevation Model and Image analysis. Applications of GIS & RS in environmental studies. Different software's will be used to perform these activities

Unit-1: Measurements on Globe and Google Earth

- 1.1. Working with Geographic and Projected Coordinate Systems
- 1.2. Understanding about different unit types of Geographic coordinate system
- 1.3. Working on Google Earth / Google Maps

Unit-2: Data Acquisition and Processing

- 2.1. Absolute and Relative Georeferencing
- 2.2. Digitization and Topological errors
- 2.3. Attributes and Data joining and Geodatabases
- 2.4. Data Downloading (DIVA GIS, USGS Earth Explorer)
- 2.5. Spatial Data import and Export (KMLs, Cad and Excel files)

Unit-3: Spatial Analysis and Digital Cartography

- 3.1. Buffer analysis, Masking, Clipping and querying
- 3.2. Vector and Raster Overlays OR Overlay analysis
- 3.3. Creation of Large and Small-scale maps

Unit-4: Satellite Image Analysis and Processing

- 4.1. Digital Elevation Model and Satellite Imagery Downloading and Processing
- 4.2. Elevation, Contours, Slope, Aspect extraction
- 4.3. Image classification using supervised and unsupervised techniques
- 4.4. Watershed and Hydrological analysis using DEM

TEACHING – LEARNING STRATEGIES

- Lecture based examination
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