Geographical Information System

Course Title: Geographical Information System
Course No: CSC482
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers about spatial data structure, modeling and database design, different techniques for capturing the real world, spatial data manipulation, analysis and visualization, spatial data infrastructure and data standardization, overview of open GIS and open source GIS data.

Course Objectives:
The main objective of this course is to provide both theoretical and practical knowledge of Geographical Information System.

Course Contents:

Unit 1: Introduction to Geographic Information System (GIS) (5 Hrs.)

1.1 Overview, concepts of GIS, components of GIS
1.2 Origin of GIS, History of *GIS* and geospatial technology
1.3 Functions and benefits of GIS
1.4 Scope and application areas of GIS
1.5 Data base management system (DBMS) and concept of spatial and attribute data

Unit2: Digital Mapping Concepts and Visualization (5 Hrs.)

2.1 Database and mapping concept: geographic features and attributes, thematic maps, map layers, map scales, resolution and representation
2.2 Map outputs and elements, map design and layout
2.3 Map projection: coordinate systems, projection systems, common map projections in GIS, conversion among coordinate systems

Unit 3: Spatial Data Structure and Database Design (6 Hrs.)

3.1 concepts of geographic phenomena and data modeling, geographic objects and fields
3.2 vector data and raster data model
3.3 spatial relationships and topology
3.4 GIS data formats and data conversion
3.5 Spatial database design with the concepts of geo-database

Unit 4: Data Acquisition, Data Quality and Management (9 Hrs.)

4.1 different methods of data capture
4.2 geo-referencing and digitization
4.3 data preparation, conversion and integration
4.4 spatial data quality and accuracy
4.5 introduction to global navigation and satellite systems (GNSS)
4.6 Basics of remote sensing (RS) technology

4.7 integration of RS and GNSS data into GIS

Unit 5: Spatial Analysis (10 Hrs.)

5.1 vector data analysis: geo-processing, overlay analysis, buffering, network analysis

5.2 raster analysis: local operations, focal operations, zonal operations, re-sampling, mosaic and clip, distance measurement

5.2 spatial interpolation techniques, geo-statistics, GIS modeling

5.3 GIS programming and customization: Opening and exploring Model Builder, Python script tools, Customizing QGIS with Python

Unit 6: Introduction to Spatial Data Infrastructure (3 Hrs.)

6.1 SDI concepts, components of SDI and trends

6.2 The concept of metadata and clearing house

6.3 System Architecture for SDI Interoperability, Client Server Architecture, SDI technologies

6.4 legal aspects of SDI

Unit 7: Open GIS (7 Hrs.)

7.1 Introduction of open concept in GIS

7.2 Open source software for spatial data analysis

7.3 Web Based GIS system

7.4 Open source GIS data

7.5 GIS application case studies

Laboratory work:

The lab should cover at least the concepts given in each chapter.

Recommended Books:

1. Chang, K. T. *Introduction to geographic information systems*. Ninth edition, Boston: McGraw-Hill.
2. Principles of geographic information systems: An introductory textbook, international institute for Geo-information science and Earth observation, the Netherlands- By rolf De By, Richard A. knippers, yuxian sun
3. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands
4. GIS Cook BOOK