

Syllabus for Short Advanced Course on GIS

1. Computer Cartography

- a. **Unit 1:** Introduction- Introduction to cartography: nature and scope, Significance of Computer Mapping, Mapping in a Digital Age. Categories & Characteristics of maps, Study of different types of maps, Basics of Map scales, Component of Map, Conventional mapping VS Digital Mapping
- b. **Unit 2:** Toposheet - Survey of India national series maps Interpretation of topographic maps, Indexing and Numbering of topographical maps.
- c. **Unit 3:** Map Generalization 1 - Concepts and Definition of Map Generalization, Factors Influencing, Generalization, Different operation in Generalization; Semantic Generalization; Geometric Generalization.
- d. **Unit 4:** Map Design - Fundamentals of Cartographic Design, Colour, Pattern, lettering, compilation, border information, aesthetics, Generalization: Semantic & Geometric, Symbolization, dot, isopleth and choropleth mapping, Multivariate and dynamic mapping, Map production, methods of map printing Principles of Remote Sensing.

2. Geographic Information System

- a. **Unit 1:** Introduction to GIS Basic concepts - Definition and history, Components of GIS, Recent trends and applications of GIS; Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Data inputting in GIS. Rectification, Transformation Methods; Root Mean Square (RMS) Error.
- b. **Unit 2:** Data Types and Data Models - Data Types; Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models.
- c. **Unit 3:** Spatial Data Editing - Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules.

- d. **Unit 4:** Attribute Data and Data Exploration - Attribute Data in GIS, Attribute Data Entry, Manipulation of Fields and Attribute Data, Data Exploration; Attribute Data Query, Raster Data Query, Map- Based Data Manipulation.
- e. **Unit 5:** Spatial Analysis Spatial Data - Definition, Analysis, Processes & Steps, Software and Tools, Geodatabase Model, Role of Databases in GIS, Creating, Editing and Managing, Classification scheme of Vector- Based and Raster- Based GIS Operation Raster- Based Techniques: Methods of reclassification, overlay analysis, Digital Terrain Analysis and Modeling- TIN and DEM, Surface representation and analysis, Slope and Aspect, Geographic Visualization Data Classification, Map Comparison.
- f. **Unit 6:** Geo Statistical Analysis Techniques - Introduction to Spatial Interpolation: Control Points, Global Method- Trend surface analysis, regression model, local methods- Thiessen polygons, density estimation, Inverse Distance weighted Interpolation, Kriging- Ordinary Kriging and Universal Kriging, GIS and decision support system, Introduction to AHP, basic principle of AHP. Principal and components of multiple criteria decision making

3. Advanced Remote Sensing & GIS

- a. **Unit 1:** Thermal Remote Sensing, Microwave Remote Sensing, Radar Environment Considerations, LIDAR, Hyperspectral, Application of Advance Remote Sensing.
- b. **Unit 2:** Web GIS Concepts and Principles of Web GIS; Definition and History of Web GIS; Significance of Web GIS; Transferred Geo data, Interactive Web Maps, Internet Map Services, Web GIS Architectures, Web GIS development, Requirement Analysis, Conceptual design, Web GIS system Integration, Open-Source GIS; Web Based Geo Portal, India Geoportal; State Geoportal and District Geoportal. Vehicle Tracking System, Mobile mapping, Location Based Services, Intelligent transportation systems
- c. **Unit 3:** GIS Modeling Concepts and Principles of GIS Model, Types of GIS models, Modeling Process, Application of GIS Modeling.
- d. **Unit 4:** Mobile GIS Mobile GIS- Concepts, Portable PCs Personal digital assistance (PDAs) or Palm Top, Mobile Phone,



Arc GIS Mobile, Characteristics of Mobile GIS, Benefits of Mobile GIS, Mobile Applications. Earth Positioning System

4. GPS – Navigation:

- a. **Unit 1:** Introduction - Introduction; History of Navigation and Positioning; Objectives, Types of Earth's, Positioning System- GPS, GALILEO, GLONASS and GAGAN; Comparison of Main Parameters for GPS, GLONASS GALILEO and GAGAN.
- b. **Unit 2:** Datum, Coordinate Systems and Map Projections - Basics Geodesy, Geoid/ Datum/Ellipsoid-Definition and Basic Concepts; Datum, Transformations; Map Projections.
- c. **Unit 3:** Fundamentals of Positioning Systems GPS Components – space segment, control segment, user segment; GPS Receiver and its Types -; GPS Errors. GPS Positioning Modes: GPS point positioning, GPS relative positioning; RTK GPS, Factor affecting GPS accuracy
- d. **Unit 4:** Differential Positioning System (DGPS) - Components, Function and applications. Differential RTK, Differential Real Time, Wide Area Augmentation System (WAAS).
- e. **Unit 5:** Applications of GPS - Route Navigation, Forestry and Natural Resources, GPS Tracking, Utility, Mapping, Civil Engineering, Cadastral Surveying and Seismic Applications.
