

Syllabus for Short Course on GIS

1. Principles of Aerial Photographs and Photogrammetry

- a. **Unit 1:** Aerial photography - Introduction to aerial photography – Basic information and specifications of aerial photographs; Planning and execution of photographic flights Basic; Geometric Characteristics of Aerial Photographs- Types of Aerial Photograph, Flight Strips, Nadir Line, End Lap; Side Lap, Stereoscopic Coverage and Stereopairs, Intervalometer, Air Base and Base Height Ratio; Types of Aerial Camera.
- b. **Unit 2:** Photogrammetry - Definitions and Development of Photogrammetry; Classifications of Photogrammetry; Uses of Photogrammetry; Soft-Copy Photogrammetry- Interior Orientation, Exterior Photogrammetry, Aero Triangulation.
- c. **Unit 3:** Photographic Scale¹ - Concept of Photographic Scale; Methods for Determining Photo Scale; Scale of a Vertical Photograph over Flat Terrain; Scale of a Vertical Photograph over variable Terrain; Other methods for determining scale of Vertical Photographs; Scale of Tilted Photograph.
- d. **Unit 4:** Stereo Photogrammetry - Stereo Photogrammetry: Model deformation & Rectification, Relief displacement, vertical exaggeration, Triangulation, Control & Mapping.

2. Principles of Remote Sensing.

- a. **Unit 1:** Concepts of Remote Sensing - Introduction; Definition and Scope; Stages of Remote Sensing data acquisition; Process of Remote Sensing data analysis; Type of Remote Sensing- Active and passive remote sensing; Advantages and Limitations of Remote Sensing.
- b. **Unit 2:** Electromagnetic energy - Introduction; Electromagnetic energy- Electromagnetic spectrum, Radiation Principal's; EMR interaction with Atmosphere- scattering, Absorption and Atmospheric Windows; EMR interaction with earth surface features - reflection, absorption, emission and transmission; Spectral response pattern - vegetation, soil, water bodies
- c. **Unit 3:** Remote Sensing Platforms and Sensors - Platforms – Types and their characteristics; Satellites and their characteristics – Geo-stationary and sun-synchronous; Earth Resources Satellites- LANDSAT, SPOT, IRS, IKONOS, QUICKBIRD satellite series; Meteorological satellites – INSAT,



NOAA, GOES; Sensors – Types and their characteristics, Across track (whiskbroom) and Along track (pushbroom) scanning; Optical mechanical scanners – MSS, TM, LISS, WiFS, PAN; Concept of Resolution – Spatial, Spectral, Temporal, Radiometric

- d. **Unit 4:** Image Interpretation - Introduction; Fundamental of Visual Image Interpretation; Elements of Image Interpretation; Image Interpretation strategies; Image Interpretation keys
- e. **Unit 5:** Remote Sensing Data Requirement and Ground Investigation - Remote Sensing Data Products and their procurement, Ground Truth Collection –Spectral Signatures, Commonly used Ground Truth equipment’s - use of Radiometers, Display Forms – Computer printouts, Thematic maps.

3. Earth Positioning System

- 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

4. 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.

