

## **GEOL 503. Geomatics (3 credits)**

### **Unit – 1**

Concept and foundations of remote sensing: energy sources and radiation principles, energy interactions in the atmosphere, energy interaction with earth surface features – Spectral Reflectance - Spectral Response Patterns - data acquisition and interpretation, reference data – elements of photographic system - types of aerial photographs.

Photogrammetry: basic principles – geometric characteristics of aerial photographs - visual image interpretation – stereoscopes – photogrammetric workstations – landform identification and evaluation

### **Unit – 2**

Digital Image Processing: Properties of Digital Remote Sensing Data – Data Formats: BSQ, BIL, GeoTIFF, JPEG, HDF. Preprocessing – Cosmetic operations, destriping, Geometric correction and registration, image enhancement, image transformation, change detection, image classification: supervised & unsupervised classification, data merging. Thermal, multispectral and hyperspectral sensing: Hyperspectral sensing, Microwave sensing - radars, SLAR system, spatial resolution of SLAR, interpretation of SLAR – SRTM.

### **Unit – 3**

Fundamentals of GIS : Components of GIS. Geodesy: Ellipsoid – Geoid. Datums – benchmarks, triangulation survey, Great Trigonometrical Survey of India, datum shift, datum transformation. Geographic coordinates. Cartesian coordinates. Coordinate conversions. Map projections. Global Positioning System: Basic features, GNSS, NAVSTAR GPS, GLONASS, IRNSS.

### **Unit – 4**

Vector data model. Arcs, nodes, vertices, polygon inclusions, boundary generalization. Spaghetti vs Topological vector models. Shape files and coverages. Vector features and attribute tables – Relational Database Management Systems. Raster data model – vector vs raster, raster to vector & vector to raster conversion. Data structures for elevation data: TIN, DEM. Data Input and Editing in GIS – Data Sources. Map registration – Georeferencing, GCPs, Coordinate Conversion, Data Editing – Detecting and correcting errors, transformation and Generalization, Edge matching and rubber sheeting. Metadata

### **Unit – 5**

Spatial Data Analysis: Local, neighbourhood and global spatial operations. Selection. Set algebra:  $<$ ,  $>$ ,  $=$ ,  $\diamond$ . Boolean operators: OR, AND, NOT Measurements in GIS, Queries, Reclassification, Buffering and neighbourhood analysis, Integrating data by map overlay. Spatial selection operations: Raster vs Vector buffers. Overlay operations, Raster vs Vector overlay operations, point-in-polygon overlay, clip, intersection, union. Network analysis – geocoding. Terrain analysis.

## **References**

- Campbell, J. B. and Wynne, R. H. (2008), Introduction to Remote Sensing, Fifth Edition, The Guilford Press, New York, 718p.
- Falkner, E. and Morgan D. (2002), Aerial Mapping: Methods and Applications, Lewis Publishers, Boca Raton, 192p.
- Lillesand, T.M., Kiefer, R.W. and Chipman, J.W. (2004), Remote sensing and image interpretation, Fifth Edition, Wiley, NJ, 812p.
- Mather, P.M. and Koch, M. (2011), Computer Processing of Remotely-Sensed Images – An Introduction, Fourth Edition, John Wiley, New York, 462p.
- Mc Coy, R. M. (2005), Field methods in remote sensing, Guilford Press, New York, 177p.
- DeMers, M. N. (2009), GIS for dummies, Wiley, NJ, 388p.
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- Shekar, S., Xiong, H. eds. (2008), Encyclopedia of GIS, Springer-Verlag, New York, 1392p.
- Sickle, J. V. (2010), Basic GIS Coordinates, CRC Press, FL, 190p.
- Verbyla, D. L. (2003), Practical GIS analysis, Taylor & Francis, London, 305p.