

GIS – 825: Advanced Remote Sensing and Digital Image Processing (2+1=3)

1. **Course Objectives:**
 - a. To provide advanced knowledge on Emerging Remote Sensing Technologies
 - b. To acquaint students with advanced digital image processing techniques pertaining to various earth resources applications.

2. **Course Outcomes:**
 - a. Understand the advances in remote sensing technology
 - b. Analyze optical, thermal and microwave remotely sensed data
 - c. Apply advanced remote sensing techniques in earth resource management

3. **Course Code:**
 - a. GIS – 825

4. **Credit Hours:**
 - a. Theory = 02
 - b. Practical = 01
 - c. Total = 03

5. **Detailed Contents:**
 - a. Introduction to remote sensing, history, principles of remote sensing
 - b. Electromagnetic energy and remote sensing
 - c. RS platforms, sensors
 - d. Characteristics of the RS system
 - e. Multispectral remote sensing
 - f. Remote Sensing Satellite Systems
 - g. Digital image processing (preprocessing, enhancements, segmentation, transformations)
 - h. Image Analysis
 - i. Image classification, classification methods/ algorithms, and accuracy assessment
 - j. Use of ancillary data in classification
 - k. Aerial Imaging
 - l. Thermal Imaging
 - m. Hyperspectral remote sensing
 - n. LiDAR
 - o. Application of Remote Sensing data in different fields
 - p. Discrete Fourier transformations
 - q. Wavelet techniques, Stochastic Processing
 - r. Advance overview and applications of Active and hyperspectral remote sensing data/systems,
 - s. Advance data Fusion techniques,
 - t. DEM extraction from various data sources,
 - u. Futuristic approach
 - v. AI based Image Processing methods/ algorithms
 - w. Image classification using AI based algorithms

6. **Detail of Lab work, workshop practice, if applicable:**
 - a. Advance image 814
 - b. processing (radiometric corrections, geometric rectification, image enhancement)
 - c. Advanced information extraction techniques
 - d. Thematic accuracy assessment

- e. Digital change detection
- f. Ortho-rectification
- g. Image transformations
- h. DEM extraction from various data sources
- i. Processing of Thermal
- j. Hyperspectral, LIDAR data analysis.

7. **Textbooks/Reference Books:**

- a. Jensen, J. (2013) Remote Sensing of the Environment: An Earth Resources Perspective, 2nd Ed. Pearson Publishers, ISBN: 9789332518940
- b. Mather, P M (2011). Computer Processing of Remotely Sensed Images, 4th Ed. (John Wiley and Sons), ISBN: 9780470742389
- c. Campbell, James B. (2011) Introduction to Remote Sensing, 5th Ed., (The Guilford Press) ISBN: 9781609181765.
- d. Aronoff, S. (2005) Remote Sensing for GIS Mangers. Redlands. California: ESRI Press ISBN: 9781589480810.
- e. George Vosselman (2010) Airborne and terrestrial laser scanning, Hans-Gerd Maas ISBN: 9781439827987
- f. Jie Shan, Charles K. Toth (2008) Topographic Laser Ranging and Scanning: Principles and Processing, CRC Press ISBN: 978-1420051421
- g. D. A. Landgrebe (2003) Signal theory methods in multispectral remote sensing, John Wiley and Sons ISBN: 0-471-42028-X
- h. Pramod K. Varshney, Manoj K. Arora (2004) Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data, Springer, ISBN: 3540216685
- i. Henderson, F. M and Lewis, A. J (1998). Principles and Applications of Imaging Radar. Manual of Remote Sensing, 3rd Edition Volume 5. John Wiley and Sons. ISBN 0-471029406-3.
- j. Related Journal Papers (Class handouts)