AMITY UNIVERSITY
UTTAR PRADESH

# COURSE CURRICULUM

**Course Title: Digital Image Processing in Remote Sensing**

**Course Code:**

**Credit Units: 5**

| L | T | P/S | SW/FW | TOTAL CREDIT UNITS |
|---|---|---|---|---|
| 2 | 1 | 2 | - | 5 |

**Course Level: PG**

**Course Objectives:** The objective of the course is to describe about the procedure of digital image processing of satellite data in digital format with special emphasis on image classification and pattern recognition.

**Pre-requisites:** Student should have basic of Remote Sensing and computers. .

**Student Learning Outcomes:** On successful completion of this course, students will be able to:

- Demonstrate an understanding of the Digital Image Processing, spatial enhancement and pattern recognition.
- Illustrate the techniques of spatial and spectral enhancement, classification and change detection.
- Assess and select various techniques for digital image enhancement.

**Course Contents/Syllabus:**

| | Weightage (%) |
|---|---|
| **Module I Introduction and Basic Principles** | **20 %** |
| **Descriptors/Topics**<br>Concepts about digital image and its characteristics, Spectral, Spatial, Radiometric and Temporal resolution, Visual vs. Digital methods, Image data storage and retrieval, Types of image displays and FCC<br>System design considerations , Sources of image degradation - Image restoration and Noise abatement, Radiometric and Geometric correction technique, Interpolation methods – linear and non linear transformation for geometric corrections | |

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|---|---|
| | |
| **Module II Image Enhancement**<br>**Descriptors/Topics**<br>Look-up Tables (LUT) and Image display, Radiometric enhancement techniques, Spatial enhancement techniques, Contrast stretching: Linear and non-linear methods | **20 %** |
| **Module III Filtering Techniques**<br>**Descriptors/Topics**<br>Low Pass Filtering: Image smoothing, High Pass Filtering: Edge enhancement and Edge detection , Gradient filters , Directional and non-directional filtering | **20 %** |
| **Module IV Multi-Band Enhancement Techniques**<br>**Descriptors/Topics**<br>Band ratio, Types of Vegetation indices, Principal Component Analysis, Multi dated data analysis and Change detection | **20 %** |
| **Module V Pattern Recognition**<br>Concept of Pattern Recognition, Multi-spectral pattern recognition, Spectral discrimination, Signature bank, Parametric and Non-Parametric classifiers, unsupervised classification methods**.** Supervised classification techniques, Limitations of standard classifiers. Decision concepts- Fuzzy sets, Artificial neural network, Integration of data | **20 %** |

**Pedagogy for Course Delivery: :** The course is designed to be taught through the lecture and practical mode. However, during tutorial sessions group discussions and seminar presentations on various themes related to the course may be organized. Class room interaction will definitely have to be an integral part of the learning experience.

## Lab/ Practicals details:

**List of Experiments:**

- Introduction to ERDAS IMAGINE software
- Study of the marginal information given on the/Digital data
- Import / Export of files using ERDAS IMAGINE
- Geo-reference of the Toposheet and satellite Images

- Display, Analysis and interpretation of black & white images and FCC
- Study of the various contrast enhancement techniques
- Low Pass Filter: Compression of the high frequency component & enhancement of the low frequency component.
- High Pass Filter: Compression of the low frequency component and enhancement of the high frequency component.
- Sub-setting of area of interest from the satellite image
- Principal Component Analysis
- Resolution Merging
- Unsupervised Classification
- Supervised Classification
- Map composition

**Assessment/ Examination Scheme:**

| Theory L/T (%) | Lab/Practical/Studio (%) | End Term Examination |
|---|---|---|
| 30 % | 30 % | 70 % |

**Theory Assessment (L&T):**

| Continuous Assessment/Internal Assessment | | | | | End Term Examination |
|---|---|---|---|---|---|
| **Components (Drop down)** | **Class Test** | **Home Assignment** | **Presentation** | **Attendance** | |
| **Weightage (%)** | 10 | 05 | 10 | 05 | 70 |

**Lab/ Practical/ Studio Assessment:**

| | Continuous Assessment/Internal Assessment | | | End Term Examination | | | |
|---|---|---|---|---|---|---|---|
| **Components (Drop down** | **Class Test (Practical Based)** | **Attendance** | **Mid Term Viva** | **Major Lab Exercises** | **Minor** | **Practical Record** | **Viva** |

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|---|---|---|---|---|---|---|---|
| **Weightage (%)** | 15 | 05 | 10 | 35 | 15 | 10 | 10 |

**TEXT BOOKS:**


1. Sabins, Floyd F.2007, Remote Sensing: Principles and Interpretation, H. Freeman and C., New York.
2. Thomas M. Lillesand & Kiefer, Ralph W. 2007, Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
3. Jensen, JR. 2006, Remote Sensing of the Environment – An Earth Resources Perspective, Prentice Hall Inc.


**REFERENCE BOOKS:**


1. Rencz, Andrew N. , 1999, Remote Sensing for the Earth Sciences: Manual of Remote Sensing, 3rd ed., John Wiley & Sons, Inc., New York.
2. Curran, P., 1985, Principles of Remote Sensing, Longman, London.
3. Campbell, James B., 2006, Introductory Remote Sensing: Principles and Concepts, Routledge.
4. Gibson, P.J., 2000, Introduction to Remote Sensing, 2nd ed., Taylor & Francis, London.
5. Cracknell, A.P. & Hayes, L.W B., 2007, Introduction to Remote Sensing, Taylor & Francis, London.