Semester	JAN 2022
Open to semester	6,8,22
Course code	**EC3284/EC6264**
Course title	**Satellite Data Analysis & Image Processing**
Credits	4 /4
Course Coordinator & participating faculty (if any)	Sudipta Sarkar
Nature of Course	Lectures and Tutorials
Pre-requisites	Landscape evolution, Earth and Planetary Materials. Please fill the pre-registration google form https://forms.gle/hrAFg5rTkvZNApAV9 You need to bring a windows laptop with the following specifications. Software will be provided by the instructor. Processor 64-bit: Intel 64 (EM64T), AMD 64, or equivalent (four or more logical processors are strongly recommended); RAM 16 GB or more re
Objectives (goals, type of students for whom useful, outcome etc)	The objective of the course is to provide a foundation in satellite-based remote sensing techniques. It has an equal emphasis on the physics of remote sensing, digital image processing of remote sensing data, and application of remote sensing. The course will cover the key image processing approaches and methods as well as hands-on exercises and analyses. The focus of the course is on the acquisition, processing, and analysis of remote sensing data and imagery in the geosciences. Principles of remote sensing learned in the course could also be applied to exploring planetary surface materials and surface processes. Students are encouraged to bring a topic of their interest and explore how they can utilize the concepts learned from the class to help them solve the problem of their interest. Expected outcomes: 1. Assess how image processing and image analysis may help solve a specific problem in geosciences or related disciplines.

	2. Identify the appropriate imaging approaches or imagery pertinent to the problem. 3. Develop an approach and workflow that builds on the concept of the image-processing chain to move from raw imagery or geospatial data to a quantitative representation and digest information contained in the imagery. 4. Use their acquired proficiency in digital image processing to apply the appropriate tools out of the major image processing methods to solve geosciences, geospatial or societal problems. 5. Understand the limitations of the remote sensing technology.
Course contents (details of topics /sections with no. of lectures for each)	A. Fundamentals of remote sensing: The Electromagnetic Spectrum, radiation units and laws, atmospheric scattering, BRDF, Albedo, path radiance, principles of spectroscopy and spectral signatures. B. Sensors and sensor technology: (i) Biology and optics of image processing, cameras, scanners and acquisition devices, digitization, satellite and airborne image acquisition differences and applications. (ii) Geometric transformations-interpolation, geometric operations, and projections. C. Understanding digital image: image, imaging, computer vision, image histogram, global and local thresholding, gradient detection, linear filtering: neighborhoods, kernels, convolutions, and their application on satellite images, adaptive segmentation, frequency-domain operations, texture analysis (measures of texture, point- and neighborhood-based methods), image fusion. Tutorial: Spatial and frequency domain filtering. D. Processing of colour and multi-spectral images: Colour representation and transforms, multispectral transforms (principal component analysis and minimum noise fraction transformation) and classification (unsupervised and

	supervised techniques). Tutorial: Pre-processing VNIR/SWIR data, image rectification (geometric and radiometric corrections), multispectral image analysis, image classification. E. Thermal remote sensing: Principles, atmospheric corrections, temperature Estimation, sub-pixel temperatures and atmospheric corrections, emissivity and applications of thermal remote sensing. Tutorial: Thermal image processing of ASTER images. Determine emissivity. pixel purity index, end-member selection, n-dimensional data visualization, spectral angle mapping, match filtering, minimum noise fraction transformation, principal component analysis of hyperspectral images, decorrelation stretch, applications, and advantages). Tutorial: Complete hyperspectral processing workflow.
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-40% Others-20%
Suggested readings (with full list of authors, publisher, year, edn etc.)	Introductory Digital Image Processing: A Remote Sensing Perspective by John R. Jensen (Prentice Hall, 1996;318 p.; ISBN 0132058405, 9780132058407) Castleman K. R. (1996) Digital image processing, Prentice Hall Research articles will be provided by the instructor.