Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2023-2024

Course Handout Part II

Date: 09-01-2024

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **BITS F442**
Course Title : **Remote Sensing & Image Processing**
Instructor – in – Charge : RAJITHA K

Scope & Objective: The course introduces the students to the fundamentals of digital images and its processing, focusing various satellite based images and medical images. The main objective of the course is to make the student familiar with the fundamentals of remote sensing and digital image processing techniques through case studies of real life applications using the remote sensing data and related products.

Course Outcomes: At the end of the course, student will be able to

- Solve problems related to image noises/poor quality of images acquired from different platforms by adopting proper image processing tasks
- Develop framework for analyzing the images obtained from satellite platform
- Solve pattern recognition related problems by integrating data obtained from different image acquisition platforms which include Unmanned Aerial Vehicle acquired datasets.
- Solve spatial related problems related to Civil Engineering discipline utilizing satellite images and ancillary datasets

Student Learning Outcomes (SLOs) assessed in this course: **(a), (b), (d), (j) and (k).**

Text Book:

T.1. Thomas M Lillesand, and Ralph W Kiefer; "Remote sensing and Image Interpretation", John Wiley & Sons, 7 th ed. 2015.

Reference Books :

R.1 Gonzalez, R. C. & R. E. Woods, Digital Image Processing, LPE, Pearson Prentice Hall, 3rd edition,
2007.

R.2. James B. Campbell and Randolph H.Wyne. Introduction to Remote sensing, Guilford Press,
5th edition, 2011.

Course Plan:

Lecture No.	Topics to be covered	Learning Objectives	Chapter in the Text Book	SLO *
1-5	Introduction to digital images and its fundamentals	Study the basics of Digital Image Processing List its advantages	T.1. Chapter-7 R.1. Chapter-2	(a), (k)
6-10	Landsat, IRS & SPOT Thermal, Microwave and Hyper-spectral Remote Sensing and LIDAR	List the important Satellite Remote Sensing	T.1. Chapter 5,6 and R2 chap 6,7,8&9 Lecture notes	(a), (d), (j)
11-13	Introduction to photogrammetry and its fundamental focusing its application on Unmanned Aerial Vehicle	Study the basics of photogrammetry and UAV remote sensing	Lecture notes	(a), (j), (k)
14-16	sampling, quantization and interpolation, Basic Image operations, Image	Study the basics of fundamental image processing	R.1. Chapter-2, T.1. Chapter-7	(a), (k)

	rectification and restoration			
17-20	Spatial domain based image enhancement; Histogram processing: equalization matching, Spatial filtering	Discuss the different Image Enhancement:- Spatial domain	R.1. Chapter-3 T.1. Chapter-7	(a), (j)
21-22	Fourier transform, discrete transform and properties	Study the basics of frequency transforms	R.1. Chapter-4	(a), (j), (k)
23-26	Frequency domain based image enhancement; Fourier transform, Frequency domain filtering, FFT	Discuss the different Image Enhancement techniques in frequency domain	R.1. Chapter-4	(a), (j)
27-29	Color images, color image transforms	Discuss and analyze color image processing	R.1. Chapter-6	(a), (b), (k)
30-32	Supervised and unsupervised classification ; ML classifier, ISODATA	Discuss different Image classifiers	T.1. Chapter-7	(a), (k)
33-34	Applications of Digital image Processing and Medical Image processing	Study and list the applications of Image processing	Lecture notes	(a), (d), (j)
35-	Applications of	Discuss the	T.1. Chapter.4	(a), (j), (k)

38	optical remote sensing and SAR remote sensing in various disciplines of Civil Engineering and related fields	applications of Remote sensing	Lecture notes	
39-40	UAV data acquisition and processing of dataset	Demonstrate the utility of UAV for terrain modeling and related analysis	Lecture notes	(a), (j), (k)

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Evaluation Scheme

EC No.	Evaluation Component	Duration (min)	Weightage (%)	Date & Time	Nature of

					Component
1	Mid Test	90	25	11/03 - 4.00 - 5.30PM	CB
2	*Seminar	Cont.	10		OB
3	Project work	Cont.	15		OB
4	**Assignment	Cont.	15		OB
5	Comp. Exam.	180	35	07/05 AN	CB

*** Each student must present a topic which is related to the image processing application referring appropriate Scopus indexed journals. Two seminars will be there in the semester and will be scheduled during the last 10 minutes of the class hour. The session will start after completing 6 lectures.**

****** The total number of assignments will be 8 and it will be related to Google Earth Engine Cloud platform, Matlab and Colab Python platform. All assignments will be performed in the lecture/extra lab hours.

Note: It is mandatory to complete the project to complete the course

Chamber Consultation Hour: To be announced

Notices: All notices will be uploaded in google classroom and CMS.

Make-up Policy: Take prior permission.

Academic honesty and academic integrity Policy: Academic honesty and academic integrity are to be maintained by all of the students throughout the Semester and no type of academic dishonesty is acceptable.

Instructor In-Charge

BITS F442