Course Title: Introduction to Remote Sensing			
Course code: SEC 102	**No. of credits: 3**	**L-T-P:** 35-05-10	**Learning hours: 45**
			L: Lectures**; T:** Tutorials**; P:** Practical
Pre-requisite course code and title (if any): None			
Department: Natural and Applied Sciences			
Course coordinator:		**Course instructor:**	
Contact details:			
Course type: Skill Enhancement Course		**Course offered in:** Semester 2	

Course Description

Remote sensing has transformed our understanding of the earth system science as an integrated system providing us an essential source of environmental information to get in-depth understanding of trends and strategize management plans for a range of environmental applications. This course is designed for the undergraduate students to appreciate the development of remote sensing discipline as a cutting-edge science. With introduction to its development the student would also dwell into understanding the science and art of remote sensing discipline. This course will focus on the basic concepts of physics used in understanding of the remote sensing processes for application of satellite datasets in environmental studies and its management. With this necessary background, course participants will use remote sensing data to understand the information extraction about the features using elements of image interpretation. The course will also provide the insights in wider domain of monitoring and applications in different domains of environment.

Course objectives

- To develop broader understanding of fundamentals of remote sensing.
- To describe developmental stages/evolution of remote sensing.
- To understand remote sensing data applications in various domains of environment

Course content

Module	Topic	L	T	P
1	**Remote Sensing of Environment**			
	The objective of this module is to gain familiarity with the phrases, terms and jargons used in remote sensing. The module introduces remote sensing concepts, its development, application, and future scope. The module further strengthens the broader understanding of different domains where remote sensing can be applied for problem understanding and its solution. The thematic(s) in this module are: i. What is remote sensing, how remote sensing helps in identifying the challenges of environment, advantages/disadvantages. ii. Historical development of camera (sensor) and platform aided in development of remote sensing, active and passive sensors. iii. International and National Space Programs iv. Sources and requirements of remote sensing data	6	2	2
2	**Physics of Remote Sensing, Platforms, Sensors**			
	This module introduces the concepts of electromagnetic radiation, its interaction with atmospheric components. The physical laws associated with matter and energy would be introduced. The students are made aware of how to use electromagnetic radiation understanding to visualize satellite data and features. This module addresses the concepts of: i. Electromagnetic radiation models ii. Laws of reflection and refraction iii. Electromagnetic radiation-matter interaction iv. Principles of transmission, absorption, reflection, and emission	8		3
3	**Data Models, Resolutions, Elements of Image Interpretation**			

	This module discusses "raster and vector data models." The student is exposed to what types of data exists in domain of geoinformatics and how this can be used for depiction and visualization, and information. The module also describes different resolutions associate with satellite datasets. The following topics are introduced in this module: i. Data models and sources ii. Spectral response patterns and spectral signature iii. Elements of image interpretation iv. Resolutions: spatial, spectral, temporal, radiometric	6		3
4	**Remote Sensing Applications**			
	Once the students are aware of the basic concepts of remote sensing, data types, they would be made aware about the applications of satellite data in the domain of forest/vegetation/urban landscape/atmosphere/earth surface. The module will cover the following topics: i. Remote sensing of vegetation (forest and agriculture) ii. Remote sensing of water iii. Remote sensing of urban objects/landscape iv. Remote sensing of atmosphere and clouds	15	3	2
	Total	35	5	10

Practical Modules			
Websites for data sources (knowing about different sensors and their characteristics)			2
Interpret features of satellite dataset			3
Explore ERDAS Imagine Interface/QGIS			3
Spectral Signature			2
Total			10

Evaluation criteria

- Minor Test 1: Written test [at the end of teaching of modules 1 and 2] -- 20%
- Minor Test 2: Written test [at the end of teaching of module 3] -- 20%
- Major Test: Written test [at the end of the semester, full syllabus] -- 40%
- Practical -- 20%

Learning outcomes

By the end of the course, students will:

- Command a broader understanding of how the current technology has evolved over the years and how development of different technologies contributed to development of this discipline. Understand the key concepts of remote sensing involving physical laws to understand the satellite data. [Module 1 and 2; Minor Test 1]
- Develop knowhow of types of data models used and its requirement. Understanding the foundation how to interpret satellite images/extract features from satellite dataset [Module3; Minor Test 2]
- Develop understanding on the information content of remotely sensed data and how to retrieve the information. To understand the conceptual, theoretical, basis for use of satellite datasets for various applications by developing understanding based on module 1, 2 and 3. [Module 1, 2, 3, 4; Practicals, Major Test]

Pedagogical approach

- The course critically evaluates the concepts of remote sensing and builds the discussion in classroom through lectures, case studies, tutorials, practical.
- The course infuses the interest in remote sensing through hands-on on satellite data as well as through the tutorials.

Reading Resources (* = compulsory readings)

- Jensen, J. R. (2009). *Remote sensing of the environment: An earth resource perspective* 2/e. Pearson Education India.
- Campbell, J. B., & Wynne, R. H. (2011). *Introduction to remote sensing*. Guilford press.
- Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.
- Joseph, G. (2005). *Fundamentals of remote sensing*. Universities Press.

Student Responsibilities

The students are required to come prepared with readings that would be given in the class. The students are required to participate in the discussion.

Course Designed by:

- Dr. Chander Kumar Singh, Department of Natural and Applied Sciences, TERI School of Advanced Studies, New Delhi

Course Reviewers:

The course is reviewed by the following reviewers:

- Dr. Pawan Kumar Joshi, Professor School of Environmental Sciences, Jawaharlal Nehru University, New Delhi-67, India
- Dr. Ram Avtar, Associate Professor, Faculty of Environmental Earth Science, Hokkaido University, Japan