University of Science and Technology of Hanoi
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COURSE SYLLABUS

Subject: Remote Sensing **Academic field: Physics**

Lecturer: Pierre-Louis Frison

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Academic year: 2014-2015

COURSE DESCRIPTION

Credit points		
Level	Undergraduate	
Teaching time **Location**	University of Science and Technology of Hanoi	
Time Commitment	Lecture	15 hrs
	Exercises	6 hrs
	Practicals	15 hrs
	Total	36 hrs
Prerequisites	General scientific skills	
Recommended background knowledge	Calculus (vectors, derivative, integral, matrices, ...) Basis in mechanics and electromagnetism.	
Subject description:	The course starts with a general overview of remote sensing applications with different illustrations consisting in images acquired by different spaceborne sensors. The chapter I is focused on photometry, introducing the basis of the physics governing the remote sensing acquisitions according to the corresponding spectral domain. In addition to the introduction to the measured physical properties of the surface, applications of these concepts are given for the study of the terrestrial climate. The chapter II is dedicated to the basis in image processing. First, basic knowledge concerning numerical images are given. Then specific processing to remote sensing images are tackled The last chapter (optional, treated if time permits) will tackle radar remote sensing. The basis of the physics governing the radar acquisitions are given and the specificity of the 3 spaceborne radar sensors (SAR, scatterometer, altimeter) are given. Then, applications (polarimetry, interferometry, ...) of SAR data are presented.	
Objectives & Out-come	(Knowledge &/ Skills gained via the course) The objective is to give the basis of the different techniques used for acquisitions and interpretation of remote sensed data, in the whole	

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	spectrum used in remote sensing (Optical, Infrared and microwaves domain). These objectives will be assessed by the participation in class discussion as well as performance on homework problem sets and written exams	
Assessment/ Evaluation	Attendance/Attitude	10%
	Exercise(s)	10%
	Practicals	10%
	Mid-term test	_%
	Final exam	70%
Prescribed Textbook(s)	See § reference literature.	

COURSE CONTENTS & SCHEDULE

Class	Contents	Hours			Ref./Resources	Assignment(s)
		Lect.	Exr.	Prc.		
Chpater I	Photometry Physics on the radiative energy Radiance, intensity, emittance, luminance blackbody radiation bidirectional reflectance, brightness temperature, radar cross section Earth's energy budget	6	6	3		
Chpater II	Image Processing Basic knowledge image operations histogram manipulations spatio/frequential filtering color management Applications to Remote Sensing Resampling - Georeferencing PanSharpening Classifications	6		9		

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Chpater III	Radar Remote Sensing Acquisition principles: Side-looking radar (SAR, scatterometer) Geometric distorsion (Speckle, spatial filtering) Nadir-looking radar: altimeter Polarimetry Interferometry	3		3		

Notes:

- *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*
- *Exercises may include assignment, reports, student's presentation, homework, class exercises ...for each class sessions*
- *Practicals mostly refer to Lab- work or outside practice such as field trip.*

Reference Literature:

[1]. W. G. Rees, « Physical Principle of Remote Sensing », ed. Cambridge, 2012
[2]. C. Elachi, J. van Zyl, « Introduction to the Physics and Techniques of Remote Sensing », ed. J. Wiley & sons, 2006
[3]. J. Campbell, R. Wynne, « Introduction to Remote Sensing », ed. Guilford Press, 2011
[4]. T. Lillesand, R. Kieffer, J. Chipman, « Remote Sensing and Image interpretation », ed. John Wiley & sons, 2008
[5] M. Canty, « Image Analysis, Classification, and Change Detection in Remote Sensing », ed. CRC Press, 2010