

COURSE SYLLABUS

Subject: Space material	Academic field: Space and Aeronautics
Lecturer: Viginie Griseri	
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Academic year: 2015-2016	

COURSE DESCRIPTION :

Credit points	03	
Level	Undergraduate	
Teaching time Location	University of Science and Technology of Hanoi	
Time Commitment	Lecture	Hrs 26
	Exercises	Hrs 10
	Practicals	
	Total	Hrs 36
Prerequisites	General knowledge on materials	
Recommended background knowledge	Basic math	
Subject description:	<p>In the chapter 1: The course start with a general introduction of the satellites orbit available and describe theirs characteristics, advantages and drawbacks Chapter 2 is describing the satellite and the importance of thermal control In chapter 3 the heating sources are describe, the Earth and satellite temperature variation are studied Chapter 4 is used to introduce the various tools used for satellite thermal control Chapter 5 describe the earth spatial environment and its composition and the danger that might be encountered by satellite depending on their orbit Chapter 6 introduce the spacecraft charging phenomena and conditions to observe critical discharges Chapter 7 presents some ground experiments that are necessary to understand the behaviour of the materials that are used in space environment.</p>	
Objectives & Out-come	<p>(Knowledge &/ Skills gained via the course) The objective is to give the basis of materials that used on satellites. We will focus our attention on thermal insulation materials that are fundamental to keep the satellites at a stable operational temperature. However this material that are also often good electric insulators and are ate the origin of spacecraft charging. These phenomena must be prevented that is why the mains discharges configuration must be understood.</p> <p>These objectives will be assessed during the class while practical exercises are performed and by final control.</p>	
	Assessment/ Evaluation	Attendance/Attitude
	Exercise(s)	% 10

	Practicals	0%
	Mid-term test	0%
	Final exam	%80
Prescribed Textbook(s)		

COURSE CONTENTS & SCHEDULE

Class	Contents	Hours			Ref./Resources	Assignment(s)
		Lect.	Exr.	Prc.		
Ch 1	Chapter I : Satellites general presentation 1) Introduction of satellites and probe First satellites launching, Domain of use 2) Orbit around the Earth From GEO to LEO Specific orbits such as Lagrange Orbit, Escape orbit, Graveyard orbit 3) Debris Example of collision and spread of debris Solutions to keep future satellites safe	5	1			
Ch 2	Chapter II : Satellite model and design 1) Mains satellites parts (payload, Bus) 2) Material selection 3) Thermal insulation – heat transfer phenomena 4) Thermal insulation in space environment 5) Eclipse phenomena Eclipses on GEO and LEO	5	5			
Ch 3	Chapter III : Thermal environment for the Earth and satellite 1) Heating sources 2) Situation at the Earth ground level 3) Situation at the satellite surface level	3				
Ch 4	Chapter IV : Satellite Thermal control 1) Passive heat sink presentation MLI, radiators, Mirrors... 2) Active heat sink presentation Resistive electric heaters, fluid loops, shutters 3) Materials selected for satellite passive thermal control Description of MLI, Solar reflectors, Mirrors composition	4				
Ch 5	Chapter V: Satellite general environment 1) Introduction to the terrestrial magnetic probe 2) The Sun magnetic field 3) the Earth magnetic field distortion 4) Satellite localisation and environment	3				
Ch 6	Chapter VI: Spacecraft charging 1) What is spacecraft charging? 2) What are the effects? 3) How does it occur? 4) Material behaviour in a charging environment	3	2			

Ch 7	Chapter VII: Ground experiments in laboratories 1) Classics experimental set-up used to characterize materials in laboratories 2) Presentation to experimental data recently recorded materials	3	2			

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]. CNES spacecraft techniques and technology courses, Cepadues edition, I.S.B.N. 2854286855, 2005
- [2]. S.T. Lai, Fundamentals of spacecraft charging, Princeton University press, 2011