



University of Science and Technology of Hanoi

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COURSE SYLLABUS

Subject: Magnetism

Academic field: Materials Science and Nanotechnology

Lecturer: Nguyen Luong Lam

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Academic year: 2017-2018

COURSE DESCRIPTION

Credit points	2 ECTS	
Level	Undergraduate	
Teaching time	2017 ó 2018	
Location	University of Science and Technology of Hanoi	
Time Commitment	Lecture	20 hrs
	Tutorial	0 hrs
	Practice	0 hrs
	Lab-work	0 hrs
	Total	20 hrs
Prerequisites	Electromagnetism, Electronic structure of materials	
Recommended background knowledge	Basic knowledge in Physics, Chemistry, Materials science	
Subject description:	This course covers the fundamentals of magnetism and magnetic materials in the first two thirds of the class. Topics included magnetic moments in classical versus quantum mechanical pictures, diamagnetism, paramagnetism, crystal field environments, dipolar and exchange interactions, ferromagnetism, antiferromagnetism, magnetic domains, magnetic anisotropy and magnetostriction. Magnetic materials covered include transition metals, their alloys and oxides, rare earths and their oxides, organic and molecular magnets. Throughout the course, experimental techniques in magnetic characterization will be discussed. The second part of the course will focus on particular magnetic materials and devices that are of technological interest (e.g., magnetoresistive and magneto-optical materials and devices)	
Objectives & Out-come	By the end of the course, students should be able to: Outline and synthesize the basic theory of magnetism to understand the properties and characteristics of magnetic materials and outline further its application	
Assessment/ Evaluation	Attendance/Attitude	10 %



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	Class exercise(s)	0 %
	Assignment(s)	0 %
	Lab work	0 %
	Mid-term test	30 %
	Final exam	60 %
Prescribed Textbook(s)	<p>[1] Introduction to Magnetism and Magnetic Materials , David Jiles, Springer 1991</p> <p>[2] Fundamental of Magnetism, Mario Ries, Academic Press 2013</p> <p>[3] Principal of Nanomagnetism, Alberto P.Guimaraes, Spinger 2017</p>	

COURSE CONTENTS & SCHEDULE

Class	Contents	Hours			Ref./Resources	Assignment(s)
		Lect.	Exr.	Prc.		
1	Magnetic Fields 1.1 The Magnetic Field 1.2 Magnetic Induction 1.3 Magnetic Field Calculations	2			[1]	
2	2 Magnetization and Magnetic Moment 2.1 Magnetic Moment and Magnetization 2.2 Permeability and Susceptibility of Various Materials 2.3 Magnetic Circuits and Demagnetizing Field	2			[1]	
3	Magnetic Measurements 3.1 Induction Methods 3.2 Methods Depending on Changes in Material Properties 3.3 Other Methods	2			[1]	
4	Magnetic Properties 4.1 Hysteresis and Related Properties 4.2 The Barkhausen Effect and Related Phenomena 4.3 Magnetostriction	2			[1]	
	Electronic Magnetic Moments 5.1 The Classical Model of Electronic Magnetic Moments	2			[1]	



	5.2 The Quantum Mechanical Model of Electronic Magnetic Moments 5.3 Magnetic Properties of Free Atoms				
6	Magnetic Order and Critical Phenomena 6.1 Theories of Diamagnetism and Paramagnetism 6.2 Theories of Ordered Magnetism 6.3 Magnetic Structure			[1]	
7	Magnetic Domains 7.1 Development of Domain Theory 7.2 Energy Considerations and Domain Patterns	2		[1]	
8	Domain Walls 8.1 Properties of Domain Boundaries 8.2 Domain-Wall Motion	2		[1]	
9	Magnetic Materials 9.1 Important Magnetic Properties of Ferromagnets 9.2 Different Types of Ferromagnets Materials for Applications 9.3 Paramagnetism and Diamagnetism	3		[1]	
10	Soft Magnetic Materials 10.1 Properties and Uses of Soft Magnetic Materials 10.2 Materials for a.c. Applications 10.3 Materials for d.c. Applications Hard Magnetic Materials 10.4 Properties and Applications 10.5 Permanent Magnet Materials	3		[1]	

Notes:

- *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*
- *Assignments may include assignments, practical work, reports, exercises ...for each class sessions*

Reference Literature:

[1]
[2]