جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Advanced topics in materials science - MSE 392

Division	Physical Science and Engineering Division
Course Number	MSE 392
Course Title	Advanced topics in materials science
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Aurelien Christophe Francois M. Manchon	aurelien.manchon@kaust.edu.sa	+966128084410	3232, 3, Ibn Sina (bldg. 3)	Upon appointment

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	This course aims at introducing the field of spin electronics to advanced graduate students. This course will cover fundamentals of magnetism and magnetization dynamics, spin transport in hybrid magnetic structures, magnetoresistance, spin transfer torque and spin pumping, spin-orbit effects such as spin Hall effect, Rashba effect and Dzyaloshinskii-Moriya interaction. The current-driven magnetization dynamics of magnetic textures such as domain walls and skyrmions will also be covered. The targeted audience concerns advanced Master students or PhD students working in the field of modern magnetism, spintronics and non-equilibrium transport.
Course Description from Program Guide	Lecture-based class.
Goals and Objectives	The goal of this course is to provide graduate students both fundamental and state-of-the-art knowledge about spintronics. Objectives are -Understanding the physical origin of magnetism in various classes of materials -Solving drift-diffusion equations in magnetic multilayers -Predicting current-velocity relations using Thiele's formalism
Required Knowledge	Undergraduate solid state physics, electromagnetism, electro- and magnetostatics.
Reference Texts	This course is based on research reviews and papers that will be delivered in the course of the class.
Method of evaluation	**50.00**% - Oral presentation **50.00**% - Scientific review article presentation
Nature of the assignments	The students will be evaluated through two 15-min presentations on topics related to fundamental (50%) and applied spintronics (50%). The list of topics will be given at the beginning of the course. The students will be required to read selected articles distributed during the class to prepare the course.
Course Policies	Attendance is obligatory.

Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/23/2017 Thu 01/26/2017	Origins of Magnetism – Mean field theory
2	Mon 01/30/2017 Thu 02/02/2017	Magnetism of transition metals
3	Mon 02/06/2017 Thu 02/09/2017	Fundamental magnetic interactions: anisotropy & Dzyaloshinskii-Moriya
4	Mon 02/13/2017 Thu 02/16/2017	Micromagnetism and magnetization dynamics
5	Mon 02/20/2017 Thu 02/23/2017	Magnetic domain walls - statics
6	Mon 02/27/2017 Thu 03/02/2017	Magnetic domain walls - dynamics
7	Mon 03/06/2017 Thu 03/09/2017	Spin transport in metals I
8	Mon 03/13/2017 Thu 03/16/2017	Spin transport in metals II
9	Mon 03/20/2017 Thu 03/23/2017	Students' presentations: fundamental spin physics
10	Mon 03/27/2017 Thu 03/30/2017	Spin-orbit effects I
11	Mon 04/03/2017 Thu 04/06/2017	Spin-orbit effects II
12	Mon 04/10/2017 Thu 04/13/2017	Interfacial spin dynamics
13	Mon 04/17/2017 Thu 04/20/2017	Spin transfer torque & pumping I
14	Mon 04/24/2017 Thu 04/27/2017	Spin transfer torque & pumping II
15	Mon 05/01/2017 Thu 05/04/2017	Students' presentations: spin devices
16	Mon 05/08/2017 Thu 05/11/2017	
17	Mon 05/15/2017 Thu 05/18/2017	
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Note

The instructor reserves the right to make changes to this syllabus as necessary.