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

Course Syllabus: Materials Characterization - MSE 307

Division	Physical Science and Engineering Division
Course Number	MSE 307
Course Title	Materials Characterization
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	04:00 PM - 05:30 PM | Wed Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Enzo Mario Di Fabrizio	Enzo.DiFabrizio@KAUST.EDU.SA	+966128084307	4220 Sea siade, 2, Ibn Al-Haytham (bldg. 2)	Monday/Tuesday 4:00-5:30 pm

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	Course description including prerequisites: This course will introduce the basic principles of materials characterization and the common characterization techniques available at KAUST. It will cover the following topics: Basic principles, interaction of radiation and particle beams with matter. Diffraction methods. Images, optical, scanning, transmission electron, scanning tunneling and field ion microscopy. Microanalysis and Spectroscopy, energy dispersive, wavelength dispersive, Auger Processes, Electron, Ion growth, SIMS, ESCA. Spectroscopy: Raman, Infrared. Depending on availability and functionality of equipments, lab visits and demonstrations will be scheduled to the class to discuss some case studies.
Course Description from Program Guide	This course will introduce the basic principles of materials characterization and the common characterization techniques available at KAUST. It will cover the following topics: Diffraction methods: basic principles, interaction of radiation and particle beams with matter, XRD, scattering techniques; Spectroscopic methods; Imaging: optical including confocal microscopy, scanning, transmission electron, scanning tunneling and field ion microscopy; Microanalysis and Tomography: energy dispersive, wavelength dispersive, Auger Processes, Electron, Ion and Atom Probe Tomography, SIMS, photoelectron spectroscopy; thermal analysis: DTA, DSC. Lab visits and demonstrations will be scheduled to the class to discuss some case studies.
Goals and Objectives	Course Objectives The objectives of the course are 4. They are aimed to guide the student to become aware of: 1) the latest Fabrication Technologies and their relation with material structuring and properties 2) the most advanced imaging instruments for investigating the modern material at the highest topographic resolution. 3) the common used analytical tools for characterizing modern materials at highest sensitivity 4) the latest advancement in spectroscopy for getting structural and elemental analysis of Material

Required Knowledge	Basic Knowledge on Electromagnestism, general physiscs and chemistry and basic optics
Reference Texts	Required textbook(s): Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, Yang Leng, Wiley & Sons; 1st Edition, June 2008, (Optional) Materials Characterization (Vol. 10), George M. Crankovic, Kathleen Mills, Ruth E. Whan, ASM Handbook Committee Additional lecture notes/ Hand outs
Method of evaluation	**100.00**% - Oral presentation
Nature of the assignments	Exam: Comprehensive Final (50%), and Mid-Term (50%). Both are oral exams. Students will be examined in four different topics. Students are free to select one topic and one is random selected for both the mid- term and for the final exam.
Course Policies	Homework policy: Home work will be announced and solution will be posted later, students are asked to verify their own solutions.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Wed 01/25/2017 Thu 01/26/2017	Introduction and review of Micro and Nano structures
2	Wed 02/01/2017 Thu 02/02/2017	Waves and Geometrical optics
3	Wed 02/08/2017 Thu 02/09/2017	Optics and Light Microscopy
4	Wed 02/15/2017 Thu 02/16/2017	Optics-X-ray spectroscopy
5	Wed 02/22/2017 Thu 02/23/2017	X-ray spectroscopy/ Electron Spectroscopy
6	Wed 03/01/2017 Thu 03/02/2017	Electron Spectroscopy/SEM
7	Wed 03/08/2017 Thu 03/09/2017	SEM (Scanning Electron Microscopy)
8	Wed 03/15/2017 Thu 03/16/2017	TEM (Transmission Electron Microscopy)
9	Wed 03/22/2017 Thu 03/23/2017	Nanofabrication Lithographies
10	Wed 03/29/2017 Thu 03/30/2017	Scanning Probes (Atomic Force Microscopes, Scanning Tunneling Microscopes
11	Wed 04/05/2017 Thu 04/06/2017	Physical Methods-IR (Infra-Red) Spectroscopy
12	Wed 04/12/2017 Thu 04/13/2017	Raman Spectroscopy I
13	Wed 04/19/2017 Thu 04/20/2017	Raman Spectroscopy II
14	Wed 04/26/2017 Thu 04/27/2017	Plasmonics & Nanostructures I
15	Wed 05/03/2017 Thu 05/04/2017	Plasmonics & Nanostructures II
16	Wed 05/10/2017 Thu 05/11/2017	Raman & Nanostructures I
17	Wed 05/17/2017 Thu 05/18/2017	Raman & Nanostructures II
18		05/20 Final Exam (tentative)

Note

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