PY745 - Experimental Surface Physics and Chemistry
Spring 2020

Course Information

Class Time: Tuesday and Thursday, 2:00 PM to 3:15 PM

Class Location: SCI B58

Instructor: **Professor Kevin Smith**.
Office: SCI 357. Phone: 3-6117; E-mail: ksmith@bu.edu;
Office Hours: By appointment.

Text: Optional: Modern Techniques of Surface Science (Cambridge Solid State Science Series) by T. A. Delchar, D. P. Woodruff, 2nd edition, Cambridge Univ Press; ISBN0521424984

Syllabus: See attached.

Grades:
Research Presentation 50%
Final Exam 30%
Homework 20%

Exam Dates: TBA

Course Prerequisites:

PY543 (Introduction to Solid State Physics) **or** permission of instructor.

Course Description

This is an introductory course that presents the principles and experimental techniques of surface physics and chemistry. The course is intended for graduate students in physics, chemistry, and materials science. The most important prerequisites for the course are completion of undergraduate courses in quantum mechanics, and of an introductory course in solid state physics (preferably at the level of PY543). Graduate level mathematics or quantum mechanics are not required. Topics to be covered include the electronic, structural, chemical, vibrational, and magnetic properties of solid surfaces and interfaces. The emphasis of the course will be on how these properties are measured, with examples taken from the current literature. Also covered will be techniques for attaining ultra-high vacuum, and diverse sources of radiation for use in spectroscopic probes. There will be periodic homework assignments, and a take home final exam. Furthermore each student will present a 30 minute seminar to the class on a topic of current surface physics, chemistry, or materials science experimental research. A list of suitable topics will be provided towards the middle of the semester, and students will prepare a presentation through literature searches and consultation with the faculty.

Administrative Comments

1: **Attendance at lectures is compulsory**

2: Each student will present a 30 minute research seminar. Details will be provided during the semester. This will be worth 50% of the final grade.

3: The final exam is a take home exam at the end of the semester. This exam counts for 30% of your final grade.

4: All homework will be distributed by e-mail, as will general course announcements.

5: **All electronic devices are banned during lectures. This includes cell phones and audio/visual recording or playback devices of ANY kind.**

******* VERY IMPORTANT *******

YOU MUST BE AVAILABLE TO TAKE THE FINAL EXAM DURING THE WEEK OF MAY 4. DO NOT make travel plans that require you to miss the exam since this will result in an automatic fail for the course (F grade).

Please read the College of Arts and Sciences Academic Conduct Code, which applies to this course.

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PY745: Experimental Surface Physics and Chemistry – Spring 2019		
Week	**Date**	**Lecture Topic**
1	Tuesday, 1/21	Surfaces - Properties, Preparation, Significance
	Thursday, 1/23	Interfaces - Properties, Preparation, Significance
2	Tuesday, 1/28	Review of key concepts in Solid State Physics
	Thursday, 1/30	Ultra-High Vacuum
3	Tuesday, 2/4	Low Energy Electron Diffraction (LEED)
	Thursday, 2/6	LEED
4	Tuesday, 2/11	Auger electron spectroscopy (AES)
	Thursday, 2/13	Radiation Sources
5	Tuesday, 2/18	*No class – substitute Monday*
	Thursday, 2/20	X-Ray Photoemission Spectroscopy (XPS/ESCA)
6	Tuesday, 2/25	Angle Resolved Photoemission (ARPES)
	Thursday, 2/27	Spin Resolved Photoemission
7	Tuesday, 3/3	Two Photon and Time Resolved Photoemission
	Thursday, 3/5	Inverse Photoemission Spectroscopy (IPS)
8	Tuesday, 3/17	Soft X-ray Emission Spectroscopy (XES)
	Thursday, 3/19	Scanning Tunneling Microscopy (STM)
9	Tuesday, 3/24	He Atom Scattering (HAS)
	Thursday, 3/26	He Atom Scattering (HAS)
10	Tuesday, 3/31	Electron Energy Loss Spectroscopy (EELS)
	Thursday, 4/2	Electron Energy Loss Spectroscopy (EELS)
11	Tuesday, 4/7	Electron Microscopy
	Thursday, 4/9	Infra-Red Spectroscopy (IR)
12	Tuesday, 4/14	Infra-Red Spectroscopy (IR)
	Thursday 4/16	Ion Scattering Spectroscopy (ISS)
13	Tuesday, 4/21	Surface Extended X-Ray Absorption Fine Structure (SEXAFS)
	Thursday, 4/23	Research Presentations
14	Tuesday, 4/28	Research Presentations
	Thursday, 4/30	Research Presentations