Course Schedule of MST Program ,TIGP

Semester: Fall, 2011(100 學年度上學期)

Course(科目): Modern Experimental Techniques 現代實驗技術
Time(時間): F6F7F8 Friday (14:20~17:10)
Room(教室): R311 IAMS 中研院原分所 R311(台大校園)
A507 Institute of Chemistry in Academia Sinica(only for Prof. Tzou)
NTHU coordinator(清大教師): 倪其焜
Course speakers(授課老師): Jim Lin 林志民、Ker-Jar Song 宋克嘉教授、
Juen-Kai Wang 王俊凱、Jyhpyng Wang 汪治平教授、
Ta-Chau Chang 張大釗老師、Yu-Ju Chen 陳玉如老師、
Der-Lii Tzou 鄒德里老師
Required(必修課), credit(學分): 3
Course No.(科號): TIGP722100

Date	lecturer	Date	lecturer
9/16 Friday 14:20~17:10	Prof. Juen-Kai Wang	11/18 Friday 14:20~17:10	Prof. Ker-Jar Song
9/23 Friday 14:20~17:10	Prof. Juen-Kai Wang	11/25 Friday 14:20~17:10	Prof. Ker-Jar Song
9/30 Friday 14:20~17:10	Prof. Juen-Kai Wang	12/2 Friday 14:20~17:10	Prof. Jyhpyng Wang
10/7 Friday 14:20~17:10	Prof. Juen-Kai Wang	12/9 Friday 14:20~17:10	Prof. Jyhpyng Wang
10/14 Friday 14:20~17:10	Prof. Jyhpyng Wang	12/16 Friday 14:20~17:10	Prof. Ta-Chau Chang
10/21 Friday 14:20~17:10	Prof. Jyhpyng Wang	12/23 Friday 14:20~17:10	Prof. Ta-Chau Chang
10/28 Friday 14:20~17:00	Prof. Jyhpyng Wang	12/30 Friday 14:20~17:10	Prof. Yu-Ju Chen
11/4 Friday 14:20~17:10	Prof. Jim Lin	1/6/2012 Friday 14:20~17:10	Prof. Der-Lii Tzou
11/11 Friday14:20~17:10	Prof. Jim Lin		

The course of Modern Experimental Techniques is composed of four component mini-courses: (1) Vacuum Technology taught by Profs. Ker-Jar Song and Jim Jr-Min Lin, (2) Optics, Lasers, and Optical Signal Detection taught by Prof. Juen-Kai Wang, (3) Laboratory Electronics taught by Prof. Jyhpyng Wang, and (4) Charged-Particle Optics taught by Prof. Yuh-Lin Wang. An introduction of each component mini-course is listed below:

Speaker	Part 4 (2 Weeks) Prof. Jim J. Lin 林志民教授 Part 1 (2 Weeks) Prof. Ker-Jar Song 宋克嘉教授
Class Outline	Part 4(Lin): Vacuum concepts; vacuum generation, measurement, and diagnosis. Part 1 (Song):
Introduction	Part 4 (Lin): Gas mean free path, gas flow, outgas, differential pumping, sealing, pumps, pressure measurements, leaks, etc. Practical way to achieve good vacuum. Part 1 (Song): 1. Do and don't, stories and lessons learned from years of ultra-high vacuum practice. 2. Experimenting with a real ultrahigh vacuum system for one week. A residual gas analyzer is available so that students get to know what happens in the chamber for each step of his operation. Students will practice venting the system, replacing components, pumping it down, leak/dirt testing, baking, e-beam bombardment, and all kind of tricks that can help bring good vacuum the fastest way.
Grading	Part 4 (Lin): Exam and Homework. Part 1 (Song): 40% from written examination on general principles of vacuum technology, 60% from how good a vacuum one can obtain.
Textbook	1. Building Scientific Apparatus, 2nd edition or 3rd edition by Moore, Davis and Coplan 2. Operating manuals of components of the UHV system.

Speaker	Part 3 (4 Weeks) Prof. Juen-Kai Wang 王俊凱教授
Class Outline	**Optics, Lasers, and Optical Signal Detection** 1. ABC of optical components: optics, opto-mechanics, vibration isolation and motion control 2. Know your laser system: basic principles, laser engineering, frequency conversion and laser safety 3. Detect optical radiation: intensity, wavelength, polarization and phase 4. Build an optical instrument: initial concept, computer drawing/simulation, revision and construction
Introduction	This course is to provide basic knowledge to use optical and laser instruments in laser laboratories and eventually to have a basic training about how to construct an optical setup for a specific experiment. Furthermore, the course provides a hand-on experimental experience to learn how to manipulate optical components.
Grading	1. A construction plan for an optical setup: (60%) 2. A hand-on experiment: on-site test (20%) and report (20%)
Textbook	1. Fundamentals of Photonics, B. E. A. Saleh and M. C. Teich (John Wiley & Sons, New York 1991). 2. Laser Spectroscopy: Basic concepts and instrumentation, W. Demtröder (Springer-Verlag, Berlin, 1996)

Speaker	Part 2 (5 Weeks) Prof. Jyhpyng Wang 汪治平教授
Class Outline	(3) Laboratory Electronics List of subjects: Part 1: circuit construction: circuit elements and diagrams, construction and diagnosis tools, soldering and assembling, shielding and grounding, circuit protection Part 2: basic electronics: diodes and transistors, impedance and passive filters, amplifiers, active filters and oscillators, negative-feedback control, digital circuits, digital/analog interface

Introduction	In a modern laboratory, data are transmitted by electronic signals. Machines are also controlled by electronic signals. Therefore it is extremely important for students to know what is going on behind the switches, knobs, cables, detectors, etc. In this course we will teach students the basics of real-world electronics. In part 1, we begin with an extensive introduction to common electronic components and tools, and then we teach some important techniques of circuit construction. In part 2, we shall discuss common building blocks of electronic circuits. Starting from the most basic diodes and transistors, we show the construction of filters, amplifiers, and oscillators. Then we move to feedback control, and finally to digital circuits and digital/analog interface. These building blocks are so often used in laboratory electronics that by knowing them well, students can build up the confidence in handling laboratory electronics.
Grading	1. Constructing a working electronic device, such as an electronic clock, a stepping motor system, a function generator, a regulated power supply, an audio amplifier, an electronic door-bell, a telephone answering machine, an effect box for electric guitars, an automatic egg boiler, an echo circuit for karaoke, an infrared alarm circuit, a flood alarm circuit, etc. (50%) 2. Written examination. (50%)
Textbook	The art of electronics, 2nd ed. Horowitz and Hill, Cambridge Univ. Press.

Speaker	Part 5 (2 Weeks) Prof. Ta-Chau Chang 張大釗教授
Class Outline	
Introduction	
Grading	

Textbook	

Speaker	Part 6(1 Week) Prof. Yu-Ju Chen 陳玉如教授
Class Outline	質譜技術 Mass Spectrometry

Speaker	Part 7 (1 Week) Prof. Der-Lii Mike Tzou 鄒德里教授
Class Outline	核磁共振技術 NMR Technology
Introduction	1. NMR basics and fundamental principles NMR phenomena, relaxation behavior, spin-spin interaction and NOE 2. 1D and 2D NMR experiments 1D (1H, 13C, 15N, 31P …) & 2D (COSY, NOESY, HSQC, HMBC) 3. A brief about multi-dimensional NMR for Macromolecules. 4. Experimental sections
Grading	75% in quiz and 25% in experimental sections
Textbook	1. Ivano Bertini, Claudio Luchinat and Giacomo Parigi, “Solution nmr of paramagnetic molecules” 2001. 2. Kenssal E. van Holde, W. Curtis Johnson and P. Shing Ho, “Principles of Physical Biochemistry” (2nd edition 2006) pp535-578