Course Schedule of MST Program ,TIGP

Semester: Fall, 2013 (102 學年度上學期)

Course(科目): Modern Experimental Techniques-Physics 現代實驗技術-物理
Time(時間): F6F7 Friday (14:20~16:20)
Room(教室): R311 IAMS 中研院原分所 R311(台大校園)
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

Required(必修課), credit(學分): 2
Course No.(科號): TIGP722300, PHT048

Date		lecturer	Date		lecturer
9/27	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	11/29	Friday 14:2 0~16:10	Prof. Jyhpyng Wang
10/4	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	12/6	Friday 14:2 0~16:10	Prof. Jim J. Lin
10/11	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	12/13	Friday 14:2 0~16:10	Prof. Jim J. Lin
10/18	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	12/20	Friday 14:2 0~16:10	Prof. Ker-Jar Song
10/25	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	12/27	Friday 14:2 0~16:10	Prof. Ker-Jar Song
11/1	Friday 14:2 0~16:10	Prof. Juen-Kai Wang	1/3/2014	Friday 14:2 0~16:10	Prof. Jyhpyng Wang
11/8	Friday 14:2 0~16:10	Prof. Jyhpyng Wang	1/10/2014	Friday 14:2 0~16:10	Prof. Jyhpyng Wang
11/15	Friday 14:2 0~16:10	Prof. Jyhpyng Wang	1/17/2014	Friday 14:2 0~16:10	Prof. Jyhpyng Wang
11/22	Friday 14:2 0~16:10	Prof. Jyhpyng Wang			

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, andb(3) Laboratory Electronics taught by Prof. Jyhpyng Wang

Speaker	(2 Weeks) Prof. Jim J. Lin 林志民教授 (2 Weeks) Prof. Ker-Jar Song 宋克嘉教授
Class Outline	(Lin): Vacuum concepts; vacuum generation, measurement, and diagnosis. (Song): Basics of ultrahigh vacuum: adsorption and desorption of chemical species on surface. Murphy's law.

Introduction	(Lin): Gas mean free path, gas flow, outgas, differential pumping, sealing, pumps, pressure measurements, leaks, etc. Practical way to achieve good vacuum. (Song): UHV Option: experimenting with a real ultrahigh vacuum system. This is a very time consuming option for both the student and the teacher. Only those who really need to become an expert in ultrahigh vacuum techniques should take this option. For anyone who takes this option, one has to be able to bring a vacuum system from atmosphere to a pressure in the 10^{-10} torr in order to pass. A UHV chamber with a residual gas analyzer will be made available so that the student gets to know what happens in the chamber for each step of his operation. Students will practice venting the system, replacing components, pumping it down, make leak and/or dirt assessment, baking, e-beam bombardment, and all kind of tricks that can help bring ultra-high vacuum the fastest way.
Grading	(Lin): Exam and Homework. (Song): Home work only.
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	(6 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	(7 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.