

Subject Description Form

Subject Code	AP40001
Subject Title	Advanced Physics Laboratory
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	AP20004
Objectives	Students will learn some advanced solid-state physics experimental techniques to reveal the physics of materials. Principles of optical spectroscopy will be conveyed for further characterization of materials. Optical experiments will be provided to illustrate the fundamentals of modern optics, optoelectronics and their applications.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) manipulate some advanced instruments commonly used in the area of modern optics and solid-state physics; (b) utilize the characteristics of a gas laser for practical applications; (c) use laser to make holograms and to measure the velocity of an object; (d) process the captured images by optical as well as digital methods; (e) measure the transition temperature of a high T_c ceramic superconductor and the temperature dependence of resistance of metal and semiconductor; (f) measure the energy band gap of a semiconductor; and (g) investigate the nuclear magnetic resonance signals of some materials containing hydrogen or fluorine nuclei.
Subject Synopsis/ Indicative Syllabus	<p>Solid-state physics experiments and techniques: high T_c ceramic superconductor; direct and indirect band gap of semiconductor; X-ray diffraction of crystalline materials; NMR of hydrogen and fluorine nuclei.</p> <p>Optical spectroscopy and image processing: emission and absorption spectra; optical multichannel analyzer; Fourier optics and imaging processing.</p> <p>Laser characteristics: linear photodiode array; scanning Fabry-Pérot interferometer; frequency analyzer.</p> <p>Laser applications: laser Doppler velocimetry; holography.</p>
Teaching/Learning Methodology	The data process methods and the principles of the laboratory experiments are introduced in lectures in parallel with the laboratory sessions. This would help students to develop better understandings of the physical principles and to build up their capability to write high-quality experimental reports. The working principles of the equipment are presented in the laboratory manuals and the key points and precautions are highlighted at the beginning of the laboratory class. During the laboratory session, technician and teaching assistant will assist students to solve unexpected problems and lead them through the difficult parts. In addition, a presentation session will be arranged for students to form groups to present on any topics related to the experiments. This

	encourages students to go for in-depth self-study, broadens their knowledge and improves their communication skills in technical discussions.								
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
			a	b	c	d	e	f	g
	(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓
	(2) Practical examination	20	✓	✓	✓	✓	✓	✓	✓
	(3) Written test	40	✓	✓	✓	✓	✓	✓	✓
	Total	100							
	Students are expected to excel in physical understanding and practical operation. The continuous assessment includes the lab reports and log books. Written test and practical examination can evaluate the capabilities of the students in problem solving and practical operation.								
Student Study Effort Expected	Class contact:								
	• Lecture		13 h						
	• Laboratory		39 h						
	Other student study effort:								
	• Laboratory report preparation		36 h						
	• Laboratory manual reading, assignment preparation and lecture notes review		32 h						
	Total student study effort		120 h						
Reading List and References	<p>Yariv, A, Optical Electronics, 4th Edition, Saunders College, 1991.</p> <p>Kittel, C, Introduction to Solid State Physics, 7th Edition, Wiley, 1996.</p> <p>Hennel, J W, Fundamentals of Nuclear Magnetic Resonance, Wiley, 1993.</p> <p>Heinz-Eberhard, A, Laser Doppler and Phase Doppler Measurement Techniques, Springer, 2003.</p>								