Subject Description Form

Subject Code	AP40009
Subject Title	Advanced Photonics Laboratory
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	AP30013
Objectives	Students will learn some advanced experimental techniques related to laser and photonics. Principles of optical spectroscopy will be conveyed for further characterization of materials. Optics and photonics experiments will be provided to illustrate the fundamentals of modern optics, optoelectronics and their applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) manipulate some advanced instruments commonly used in the area of modern optics and photonics; (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) understand the working mechanism of the fibre optics based sensor; (e) measure the emission and absorption spectrum of various materials; (f) measure the energy band gap of a semiconductor; and (g) investigate the frequency doubled diode pumped solid state laser and laser cavity alignment.
Subject Synopsis/ Indicative Syllabus	**Fiber optics based sensor**: fibre interferometry; fiber Bragg grating, optical isolator; attenuator; structure and fabrication of fiber Bragg grating. Linear photodiode array; scanning Fabry-Pérot interferometer; frequency analyzer. Diode laser pumped solid state laser and frequency doubling; cavity optimizations; and laser characterization. **Laser applications**: Laser Doppler velocimetry; holography.
Teaching/Learning Methodology	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

Walter Koechner, 'Solid-State Laser Engineering', 6th Edition, Springer Berlin/ Heidelberg, 2010.

Yariv, A, 'Optical Electronics', 4th Edition, Saunders College, 1991.

Heinz-Eberhard, A, 'Laser Doppler and Phase Doppler Measurement Techniques', Springer, 2003.