Subject Description Form

Subject Code	AP30003
Subject Title	Detectors and Imaging Devices
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This course covers optical detectors and imaging systems from an engineer's point of view. It develops a comprehensive understanding of the engineering application of light, and its uses within detector and imaging systems. It also leads to a review of the instrumentation and techniques involved in imaging and their role in optoelectronics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) outline and explain the basic principles of classical radiometry; (b) apply blackbody radiation theory to solve problems in radiometry of incoherent sources; (c) describe and explain the physical characteristics of commonly used detector and imaging systems; (d) evaluate detector systems on the basis of their published characteristics e.g. signal to noise ratio, sensitivity; (e) develop figures of merit for optical detectors to compare the performance of different detectors; and (f) describe and discuss design issues in the development of an imaging system; solve problems on the design of detectors and imaging devices.
Subject Synopsis/ Indicative Syllabus	**Introduction**: radiometry, blackbody radiation laws, point sources and extended sources, thermal radiation, radiative energy transfer, radiation noise. **Optical detectors**: detection mechanisms (principles of photo detection, intrinsic photovoltaic effect, photoconductive detection, operation and characteristics of photo diodes); introduction to noise; photo detector requirements, responsivity and quantum efficiency, frequency response, figures of merit, detector performance measurement; photomultiplier tubes, multichannels and plates, concepts of charge storage and charge transfer, output readout techniques, charge-coupled device array tests, time delay integration. **Imaging systems***:* materials for optical imaging, films and digital photography, time and frequency analysis using Fourier transformation, sampling, filter and digitizing in imaging systems. **Thermal imaging**: nature of infrared radiation, IR detectors, thermal detectors.

Teaching/Learning Methodology

The methodology includes classroom teaching, laboratory experiments and presentation. The teaching session will focus on basic concepts and principles of detector and imaging devices, which are related to most of the learning outcomes (a–e). The laboratory session will enhance the ability of the students in using various devices for light detection and imaging systems (outcome f). Students will give presentations on the applications and designs of detector and imaging devices (outcome f).

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
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓
Total	100						

Continuous assessment is based on assignments, laboratory reports, presentations, quizzes and test. The test is a one-hour written middle-term test. The examination is a 3-hour written final examination, which covers all of the key issues related to the learning outcomes.

Student Study Effort Expected

Class contact:	
• Lecture	26 h
• Tutorial	6 h
• Laboratory	9 h
Other student study effort:	
• Self-study	79 h
Total student study effort	120 h

Reading List and References

B E A Saleh and M C Teich, Fundamentals of Photonics, 2nd Edition, Wiley, 2007.

R W Boyd, Radiometry and the Detection of Optical Radiation, Wiley, 1983.