Subject Description Form

Subject Code	AP40002
Subject Title	Display Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The aim of this subject is to provide a fundamental understanding of the physics and operation principles of both inorganic and organic display materials and devices, and to illustrate the application and fabrication of various types of display technology.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) describe the human visual system and apply display specification to understand the characteristics of display systems; (b) apply the theory of energy transfer to elucidate the optical emission and describe different types of luminescence in display phosphors; (c) explain the operation principles and fabrications of various inorganic display devices; analyze advantages and disadvantages of various display panel; (d) describe the different phases and optical properties of liquid crystal materials; explain the working principles of twisted nematic cell used in displays; (e) describe the structure of thin film transistors (TFT) and formulate the TFT characteristics; (f) explain the operating principles of active matrix liquid crystal displays (AMLCD) and the addressing methods of pixels; describe the fabrication process of AMLCD; (g) describe the structure and the working principles of organic light emission diodes (OLED) and display; and (h) differentiate various modern display technologies and elaborate on their advantages and disadvantages.
Subject Synopsis/ Indicative Syllabus	**Fundamentals of display technology**: human vision and perception for display; Red-Blue-Green (RGB) color gamut; chromaticity; energy transfer; energy absorption**;** optical emission; photoluminescence (PL); cathodoluminescence (CL) and electroluminescence (EL); phosphors. **Inorganic display technology**: cathode-ray tube (CRT) display; flat-panel display; field emission display (FED); plasma display panel (PDP); semiconductor light-emitting diode (LED) display; microdisplay and others. **Display measurements**: photometric and colorimetric measurements; display measurement system. **Liquid crystal**: isotropic; nematic and smectic phases; twisted nematic cell. **Thin film transistors (TFT)**: device structure and performance; amorphous silicon TFT; polycrystalline silicon TFT; organic TFT. **Active matrix liquid crystal display (AMLCD)**: structure of AMLCD; drive circuit;

addressing method; fabrication of AMLCD.

Organic light emission diode (OLED): organic semiconductor; device structure and performance; OLED display.

Teaching/Learning Methodology

Lecture: the fundamentals of display physics and various display technologies will be described. The students are free to request help. The students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance.

Tutorial: a set of problems and group discussion topics will be arranged in the tutorial classes. Students are encouraged to solve problems before having solutions.

Laboratory: a set of laboratories/demonstrations will provide students opportunities to apply the fundamental knowledge gained from the lecture into display technologies and hence develop a deeper understanding of the subject.

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

Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students' understanding of basic concepts and principles in materials science. Examination will be conducted to make a comprehensive assessment of students' intended learning outcomes as stated above.

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

Jiun-Haw Lee, David N. Liu and Shin-Tson Wu, "Introduction to Flat Panel Displays", John Wiley & sons Ltd., 2008.
Ernst Lueder, "Liquid Crystal Displays: Addressing Schemes and Electro-Optical

	Effects", 2nd Edition, Wiley, 2010. Robert L. Myers, "Display Interfaces: Fundamentals and Standards", John Wiley & Sons Ltd., 2002. Hari Singh Nalwa and Lauren Shea Rohwer Edition, Handbook of Luminescence, Display Materials, and Devices; American Scientific Publishers, 2003.