Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 4007 ADVANCES IN DISPLAYS AND LIGHTING (3,3,1)**

Course Aims: This course provides students an insight on understanding the principles of displays and lighting that are widely used for application in mobile appliances, traffic signals, signage, advanced flat panel displays and energy efficient lighting.

Pre-requisite: Year 4 standing or consent of instructor.

Course reviewed by: Prof. Fu-rong Zhu, Prof. Kok-wai Cheah and Prof. Shu-kong So

Course Intended Learning Outcomes (CILOs):

No.	**Upon successful completion of this course, students should be able to:**
1	Explain the basic principles, measurements and applications of various display and lighting technologies outlined in the course content.
2	Explain the fundamentals of light generation, measurement of light and quantitative description of the effect of radiation.
3	Describe the basic operation principles and applications of flat panel displays, LEDs and OLEDs for lighting, relating to the electroluminescent processes, light extraction, choice of materials and device design.
4	Illustrate the differences between LEDs and OLEDs, ways to produce the white light from LEDs and OLEDs, and applications in displays and lighting.

Teaching and Learning Activities (TLAs):

CILOs	**TLAs will include the following:**
1-4	Students will learn from lectures on the concept/theory and related issues of the topics outlined in the course content.
1-4	Emphasis is placed on understanding the principles of flat panel displays and lighting, device physics of LEDs and OLEDs, and production of white light.
1-4	Advances in flat panel displays and lighting will be reviewed and discussed to highlight the unique capabilities of each technology.
1-4	Students will have a good background to the advanced flat panel displays and lighting techniques, understanding the advantages and limitations of each.

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Assessment Methods (AMs):

Type of Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
Continuous Assessment (problem and reading assignments)	25%	1-4	Problem and reading assignments are designed to measure how well the students have learned the basic principles, measurements and applications of LEDs and OLEDs in displays and lighting.
Mini-projects and presentations	25%	1-4	Mini-project presentations are graded based on students' understanding on the technologies and critical discussions by giving actual examples of advanced displays and lighting.
2-hour Final Examination	50%	1-4	Final Examination questions are designed to see how far students have achieved their intended learning outcomes.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
I. Introduction	1-4	1
II. Light Sources	1-4	3
III. Colorimetry	1-4	6
IV. Introduction to Flat Panel Displays	1-4	12
V. Lighting Basics	1-4	6
VI. LED for Lighting	1-4	6
VII. White OLED for Lighting	1-4	6

Textbook: None.

References:

1. Rolf R. Hainich and Oliver Bimber, Displays: Fundamentals and Applications, CRC Press, 2011.
2. Günther Wyszecki and W. S. Stiles, Color Science: Concepts and Methods, Quantitative Data and Formulae (Pure & Applied Optics Series), John Wiley & Sons, 1982.
3. Jiun-Haw Lee, David N. Liu and Shin-Tson Wu, Introduction to Flat Panel Displays, John Wiley & Sons, 2008.
4. Gregory P. Crawford, Flexible Flat Panel Displays (Wiley SID Series in Display Technology), John Wiley & Sons, 2005.
5. Zhigang Li and Hong Meng, Organic Light-emitting Materials and Devices, Taylor & Francis, 2007.
6. Patrick Mottier, LEDs for Lighting Applications, John Wiley & Sons, 2009.
7. Zakya H. Kafafi, Organic Electroluminescence, Taylor & Francis, 2005.

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Course Contents in Outline:

	Topic	**Hours**
I.	Introduction	1
II.	Light Sources	3
	A. Fundamentals of light	
	B. The Sun and daylight	
	C. Different lighting technologies	
III.	Colorimetry	6
	A. Basics of visual vision	
	B. The CIE colorimetric system	
	C. Photometry and radiometry	
IV.	Introduction to Flat Panel Displays	12
	A. Non-emissive and emissive displays	
	B. Fundamentals of flat panel displays	
	C. Flat panel displays	
V.	Lighting Basics	6
	A. Traditional lighting technologies	
	B. Color temperature and color rendering index	
	C. Smart and energy efficient lighting	
VI.	LEDs for Lighting	6
	A. Physics of p-n junctions	
	B. White light generation	
	C. Challenges in LED solid state lighting	
VII.	White OLEDs for Lighting	6
	A. Development of OLEDs	
	B. Principles and characteristics of white OLEDs	
	C. WOLEDs: the next generation lighting	