

Display Technology Module - 4B20
Cambridge, Engineering Department

Leader:	Prof T D Wilkinson (tdw13@cam.ac.uk)
Timing:	Lent Term
Prerequisites:	None
Structure:	14L + 2 Examples Classes
Assessment:	<i>Material / Format / Timing / Marks/Credits</i> Lecture Syllabus / Written exam (1.5 hours) / Start of Easter Term / 100% / 15

AIMS

The purpose of this module is to cover the technology behind the displays arena and highlight the technological developments that have occurred in this fast moving industry. Due to the vast number of different displays that are in production today, the course will be centred on three main subsections which represent the biggest growth areas in the past few years. The purpose of the module is to describe and analyse the technology behind the displays themselves starting from the fundamentals and leading on to the various sub-components and then the final mass-produced display system.

LECTURE SYLLABUS (Prof TD Wilkinson, 14L)

- **1. Introduction to display optics** (4 lectures)

In order to understand display technology in general some fundamental properties of optics must be covered that are common to most display systems. This includes the basics of ray tracing and physical topics, reflection, TIR, polarisation and birefringence. This will be covered in these two opening lectures.

- **2. Liquid crystal displays** (4 lectures)

LCDs have become a very dominant force in the modern display market from simple calculator displays right through to large area (>50 inch diagonal) flat panels. This section will start with the fundamental properties of liquid crystal materials and then develop the optics of these materials through to the latest generation of displays technologies such as VAN, IPS and ACS as well as more novel effects such as blue phases, chiral systems and scattering displays.

- **3. Emissive display technology** (3 lectures)

Emissive displays are a well established technology with electro-optics such as CRTs, vacuum fluorescents and electroluminescent displays being in production. Displays such as plasma panes are also well established and new technologies such as OLED and PLEDs are now starting to make a serious impact in the displays market. This section will outline how these displays function and are fabricated as well as the enhancements that can be done to improve their overall performance.

- **4. Projection displays** (3 lectures)

The final section will describe a wide range of displays loosely based on projection from classical image based devices using LCD to DLP based pixel engines to pico projectors. Also included in this will be some of the emerging display technologies such as those used in 3D cinema (both Real D and Dolby) as well novel displays such as Actuality and the Wedge.

OBJECTIVES

On completion of the module students should:

- Have a basic understanding of optics for use in displays
- Understand the basics of raytracing
- Understand the role of polarisation and birefringence
- Know the basic structure of key LC display modes, TN, STN, VAN, IPS
- Understand the principles of addressing fboth passive and active and the importance the TFTs
- The basic physics of LC materials, especially nematics and chiral nematics
- The fundamentals of emissive technologies from CRLs, to EL to OLEDs
- Know the role of the backplane in emissives, especially OLEDs and PLEDs
- Understand the basic optical structures of rear and from projection
- Understand the concept of etendu and how its limits are interpreted
- Build up a picture of how key display elements fit both manufacture and the environment

REFERENCES

Please see the **Booklist for Group B Courses** for references for this module.

<http://to.eng.cam.ac.uk/teaching/courses/y4/Booklist-IIB-GrpB.pdf>
