

CIMET Devices and Instrumentation

Course name: Device and Instrumentation
Course level: Master

Course code: CIMET DI
ECTS Credits: 5.00

Course instructors: Manuel Rubiño (University of Granada), Antonio Pozo (University of Granada)

Education period (Dates): 2nd semester

Language of instruction: English

Prerequisite(s): Module “Photonics and Optics Fundamentals” (1st semester)

Expected prior-knowledge: Fundamentals of Optics and colour vision

Aim and learning outcomes:

This course develops an understanding of emission and detection of the radiant energy. The course covers the study of photometric and colorimetric instrumentation, including the study of measurement methods and systems for the characterization of light sources, materials, displays and imaging systems.

On completion of this course the student will be able to understand (i.e. to describe, analyse and reason about)

- How the radiant energy is emitted and detected.
- How to design a measurement system using different light sources, optical components and physical detectors.
- How to characterize light sources, materials, displays and imaging systems.

Topics to be taught (may be modified):

- Fundamentals of Radiometry and Photometry. Radiometric and photometric quantities and laws.
- Fundamentals of Colorimetry. Colour terminology, standards and calculations.
- Light sources. Spectral properties and laboratory sources.
- Photodetectors. Applications in photometric and colorimetric instrumentation.
- Colour printing and scanners.
- Displays.
- Scientific electronic cameras.
- Digital still cameras and video cameras.

Lab classes:

- Spectroradiometric measurements of light sources.
- Spectrophotometric evaluation of materials.
- Colorimetric characterization of displays.
- MTF evaluation of array detectors.
- Optical-quality evaluation of multispectral imaging systems in terms of the MTF.
- Optical characterization of scanners in terms of the MTF.

Teaching methods: Lectures, lab classes, and homework exercises.

Form(s) of Assessment: Written exam (75%), exercises (25%).

Literature and study materials: Handouts of the material covered in the lectures will be distributed.

Reference book:

- Hunt, R.W.G., "The Reproduction of Colour ", 6th Ed. John Wiley & Sons, 2004.

Additional books:

- Bass, M., "Handbook of Optics, Vol. 1 Fundamentals, Techniques and Design", 2nd Ed. Optical Society of America, 1995.
- Berns, R.S., "Billmeyer and Saltman's Principles of Color Technology", 3rd Ed. John Wiley & Sons, 2000.
- Chirigov, V. G., "Liquid Crystal Devices. Physics and Applications", Artech House, 1999.
- Holst, G. C., "Electro-Optical Imaging System Performance", 4th Ed. JCD Publishing and SPIE Optical Engineering Press, 2006.
- Holst, G. C., Lomheim, T. S., "CMOS/CCD Sensors and Camera Systems", JCD Publishing and SPIE Press, 2007.
- Keller, P.A., "Electronic Display Measurement: Concepts, Techniques and Instrumentation", John Wiley & Sons, 1997.
- McDonald, L. W., Luo M. R. (Eds.), "Colour Imaging. Vision and Technology", John Wiley & Sons, 1999.
- Sproson, W. N., "Colour Science in Television and Display Systems", Ed. Adam Hilger, 1983.
- Wolfe, W.L., "Introduction to Radiometry", Ed. SPIE – The International Society for Optical Engineering, 1998.
- Wyszecki, G., Stiles, W.S., "Color Science: Concepts and Methods, Quantitative Data and Formulae", 2nd Ed. John Wiley & Sons, 2000.
- Yadid-Pecht, O., Etienne-Cummings, R. (Eds.), "CMOS Imagers: From Phototransduction to Image Processing", Kluwer Academic Publishers, 2004.

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