



## COURSE MODULE – RADIOMETRY, SOURCES & DETECTORS

COURSE CODE	COSI RSD
COURSE LEVEL	Master
ECTS CREDITS	5
COURSE INSTRUCTOR/S	Prof. Ana Carrasco Sanz (UGR) and Prof. Antonio Manuel Pozo Molina (UGR)
EDUCATION PERIOD	SEMESTER 2
EXPECTED PRIOR-KNOWLEDGE	Fundamentals of Optics and Colour Vision
LANGUAGE OF INSTRUCTION	English

**AIM** 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, and imaging systems.

On completion of this course the student will be able to understand:

- How the radiant energy is emitted and detected.
- How to use the methodology in quantifying electromagnetic radiation, from ultraviolet to infrared.
- How to characterize light sources, materials, and imaging systems.
- How to characterize photodetectors with different properties and responsivities.
- How to evaluate the image quality of imaging sensors.

<b>COURSE OUTLINE</b>	<i>(topic 1)</i>	Fundamentals of Radiometry and Photometry. Radiometric and photometric quantities and laws.
	<i>(topic 2)</i>	Spectral properties of light sources.
	<i>(topic 3)</i>	Fundamentals of lasers.
	<i>(topic 4)</i>	Devices and instrumentation to measure optical radiation.
	<i>(topic 5)</i>	Photodetectors.
	<i>(topic 6)</i>	Matrix detectors in electronic cameras.
	<i>(topic 7)</i>	MTF in Optical and Electro-optical systems.
	<i>(topic 8)</i>	MTF evaluation of detector arrays.

<b>PRACTICAL ACTIVITIES</b>	<ul style="list-style-type: none"> <li>• Radiometric and photometric laws</li> <li>• Spectroradiometric measurements of light sources</li> <li>• Optical characterization of displays.</li> <li>• MTF evaluation of array detectors.</li> </ul>
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<b>LEARNING OUTCOMES<sup>1</sup></b>	<ul style="list-style-type: none"> <li>• Knowledge and Comprehension of the fundamentals, principles, applications, limits, relationships, of all concepts and topics covered by this course.</li> <li>• Application, Analysis, Synthesis and Evaluation skills of the main concepts and topics covered by this course.</li> <li>• Ability to apply/implement concepts and principles introduced in the lectures on practical tasks.</li> <li>• Ability to self-learn, to understand some problems and to suggest/find solutions to solve these problems.</li> </ul>
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<b>FORM/S OF ASSESSMENT</b>	written exam (60%), exercises (20%), lab sessions and reports (20%)
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<sup>1</sup> The meaning of *keywords* in italic used to define Learning Outcomes are detailed in Annex.



ASSESSMENT  
CRITERION

Written exam lab sessions and Homework/seminar presentations

Excellent - outstanding performance	A
Very Good - above the average standard but with some errors	B
Good - generally sound work with a number of notable errors	C
Satisfactory - fair but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required before the credit can be awarded	FX
Fail - considerable further work is required	F

Detail of criteria used to assess acquired skills :

- Activities and questionnaires giving evidence of knowing (5%)
- Activities and questionnaires giving evidence of comprehension/understanding (5%)
- Activities and questionnaires giving evidence of analysis (5%)
- Activities and questionnaires giving evidence of synthesis (5%)
- Activities and questionnaires giving evidence of evaluation (5%)

The evaluation of informal learning outcomes will be based on questionnaires and laboratory notebook (self-evaluation, learning diary).

LITERATURE AND  
STUDY MATERIALS

*Reference books:*

- Wolf, W. L., "Introduction to Radiometry", Ed. by SPIE-The International Society for Optical Engineering, 1998.
- Palmer, J.M., "The Art of Radiometry", Ed. by SPIE-The International Society for Optical Engineering, 2010.
- Flesh, P., "Light and light sources", Ed. By Springer, 2006.
- Saleh, B. E. A., Teich, M. C., "Fundamentals of Photonics", 2nd Ed., John Wiley & Sons, Inc., 2007.
- Holst, G. C., "CCD Arrays, Cameras and Displays", JCD Publishing and SPIE Optical Engineering Press, 1996.
- Boreman, G. D., "Modulation Transfer Function in Optical and Electro-Optical Systems", SPIE PRESS, 2001.

*Additional books:*

- Bass, M., "Handbook of Optics, Vol. 1 Fundamentals, Techniques and Design", 2nd Ed. Optical Society of America, 1995.
- Parr, A.C. "Optical Radiometry", Elsevier Academic Press, 2005.
- Chirigov, V. G., "Liquid Crystal Devices. Physics and Applications", Artech House, 1999.
- 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.
- Wyszecki, G., Stiles, W.S., "Color Science: Concepts and Methods, Quantitative Data and Formulae", 2nd Ed. John Wiley & Sons, 2000.
- 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.

CONTACT DETAILS

Prof. Ana Carrasco Sanz  
University of Granada, Spain.  
E-mail: [acarrasco@ugr.es](mailto:acarrasco@ugr.es)  
Office hours: 10:00 to 13:00 (Tuesday and Thursday)

Prof. Antonio Manuel Pozo Molina  
University of Granada, Spain.  
E-mail: [ampmolin@ugr.es](mailto:ampmolin@ugr.es)  
Office hours: 10:00 to 12:00 (from Tuesday to Thursday)