

Syllabus

Course description

Course title	Special Issues of Building Physics
Course code	45529
Scientific sector	ING-IND/11
Degree	Master Energy Engineering
Semester	1
Year	2 (Curriculum Technologies for Energy Efficiency)
Academic Year	2017-2018
Credits	6
Modular	No

Total lecturing hours	40
Total lab hours	
Total exercise hours	20
Attendance	Not mandatory
Prerequisites	Advanced Applications of Building Physics (preferably)
Course page	

Specific educational objectives	<p>The course deals with the topic of indoor lighting and visual comfort in the built environment, presenting requirements and methodologies for the design of lighting systems able to ensure proper levels of visual comfort while minimizing the energy uses. The students attending this course are expected to learn how to specify system requirements, design a building lighting system integrating electrical and natural lighting and assess its impact with respect to the building total energy performance.</p>
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Lecturer	Dr. Giovanni Pernigotto, Dr Anna Maria Atzeri
Scientific sector of the lecturer	ING-IND/11
Teaching language	English
Office hours	Appointment by email
Teaching assistant	Eng. Luca Zaniboni
Office hours	Appointment by email

<p>List of topics covered</p>	<p>(1) <u>Light and vision</u>:</p> <ul style="list-style-type: none"> • Human perception of electromagnetic waves; the human eye and the light; lighting quantities. <p>(2) <u>Solar radiation</u>:</p> <ul style="list-style-type: none"> • Radiation and light, solar radiation and daylight; radiation components (direct and diffuse) and distribution; lighting effectiveness. <p>(3) <u>Daylighting modelling</u>:</p> <ul style="list-style-type: none"> • From external to internal daylight illuminance; daylighting modelling approaches and practical examples <p>(4) <u>Daylighting and artificial lighting control and systems</u>:</p> <ul style="list-style-type: none"> • Envelope components for passive and active daylight and solar control; artificial lighting systems; control strategies and energy performance. <p>(5) <u>Technical standards currently in force about lighting and daylighting</u></p>
<p>Teaching format</p>	<p>Class lectures (blackboard and/or slides) and design exercises using spreadsheets and lighting, daylighting and/or energy simulation software. Some of the lecture material (slides) will be available for download by the students</p>
<p>Learning outcomes (ILOs)</p>	<p>The learning outcomes need to refer to the Dublin Descriptors:</p> <p><u>Knowledge and understanding</u></p> <p>1. Knowledge of light, vision, solar radiation, daylight models and artificial lighting systems and controls, as well as the content of the main technical standards on the topics currently in force.</p> <p><u>Applying knowledge and understanding</u></p> <p>2. Capability of defining the requirements for visual comfort in the built environment, daylight modelling, designing of artificial lighting systems, with controls aimed at optimizing energy and visual comfort performances. Furthermore, students will be able to understand how the lighting system interacts with the rest of the building systems in the framework of total energy efficiency.</p> <p><u>Making judgements</u></p> <p>3. The student will be able to assess the quality of existing lighting systems, identify critical aspects and suggest redesign solutions and improvements on both visual comfort and energy efficiency.</p>

	<p><u>Communication skills</u></p> <p>4. The student will be able to discuss the learned knowledge with vocabulary and technical terms of the discipline, describing efficiently the outcome of the design activity and the features of different solutions.</p> <p><u>Ability to learn</u></p> <p>5. Lifelong learning capability through the acquisition of critical tools and critical evaluation of product and systems specifications.</p>
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Assessment	<p>Oral examination with questions aimed at verifying the knowledge and the capability to understand the topics of the course and the mastery of the technical language. The capability to transfer these competences to applicative cases and the developed autonomy of judgment will be evaluated through the discussion of the design work assigned during the course.</p> <p>Formative assessment</p> <table border="1"> <thead> <tr> <th>Form</th> <th>Length /duration</th> <th>ILOs assessed</th> </tr> </thead> <tbody> <tr> <td>Development of the assigned design work</td> <td>During the course</td> <td>(2), (3), (5)</td> </tr> </tbody> </table> <p>Summative assessment</p> <table border="1"> <thead> <tr> <th>Form</th> <th>%</th> <th>Length /duration</th> <th>ILOs assessed</th> </tr> </thead> <tbody> <tr> <td>Oral examination, including discussion of the design work</td> <td>100</td> <td>About 1 hour</td> <td>All except (5).</td> </tr> </tbody> </table>	Form	Length /duration	ILOs assessed	Development of the assigned design work	During the course	(2), (3), (5)	Form	%	Length /duration	ILOs assessed	Oral examination, including discussion of the design work	100	About 1 hour	All except (5).
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Assessment language	English														
Evaluation criteria and criteria for awarding marks	A single final vote will take into account of knowledge of the topics presented during the course, ability to synthesize information, correctness of the technical terms and clarity (50 %). With reference to the developed design work, the capability to analyze the proposed problem and to formulate a cost-effective and technically advantageous solution will be taken into account (50 %).														

Required readings	Lessons and slides of the course
Supplementary readings	<p>European and Italian technical standards and laws:</p> <ul style="list-style-type: none"> EN 12464/1-2011: Lighting of work places - Indoor work places;

- EN 15251-2008: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics;
- EN 15193-2008: Energy performance of buildings. Energy requirements for lighting;
- D.P.R. n. 303 del 19/3/56 – “Norme generali per l’igiene del lavoro”
- Circ. Min. LL. PP. n. 3151 del 22/5/67 – “Criteri di valutazione delle grandezze atte a rappresentare le proprietà termiche, igrometriche, di ventilazione e di illuminazione delle costruzioni edilizie”
- Circ. Min. LL. PP. n. 13011 del 22/12/74 – “Requisiti fisico-tecnici per le costruzioni edilizie ospedaliere. Proprietà termiche, igrometriche, di ventilazione e di illuminazione”
- D.M. 5/7/75 – “Modificazioni alle istruzioni ministeriali del 20/6/1896 relative altezza minima dei locali ed ai requisiti igienico sanitari principali dei locali di abitazione”
- D.M. 18/12/75 – “Norme tecniche aggiornate relative all’edilizia scolastica, ivi compresi gli indici minimi di funzionalità didattica, edilizia e urbanistica da osservarsi nella esecuzione di opere di edilizia scolastica”.
- Norma UNI 10840/2007, Locali scolastici–Criteri generali per l’illuminazione artificiale e naturale.

Books

- Illuminotecnica, Gino Moncada Lo Giudice, Andrea De Lieto Vollaro, CEA, 2007;
- Daylighting Handbook I, Christoph Reinhart, Paperback – 2014

Documents

- Tutorial on the Use of Daysim Simulations for Sustainable Design, Christoph F. Reinhart

Scientific papers

- Carlucci, S. et al., 2015. A review of indices for assessing visual comfort with a view to their use in optimization processes to support building integrated design. *Renewable and Sustainable Energy Reviews*, 47, pp.1016–1033.
- Galatioto, A. & Beccali, M., 2016. Aspects and issues of daylighting assessment: A review study. *Renewable and Sustainable Energy Reviews*, 66, pp.852–860.
- Wienold, J., 2009. Dynamic daylight glare evaluation. In *Eleventh International IBPSA Conference: Building Simulation*. pp. 944–951.
- Wienold, J. & Christoffersen, J., 2006. Evaluation methods

and development of a new glare prediction model for daylight environments with the use of CCD cameras. *Energy and Buildings*, 38(7), pp.743–757.

Wienold, J. & Christoffersen, J., 2005. Towards a new daylight glare rating. *Lux Europa, Berlin*, pp.1–8.