

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Code: UBPJO-104 Module name: Energy and environment

Academic year: 2013/2014 Semester: Spring, Fall ECTS credits: 5

Programme: University Base of Courses in English

Course homepage: <https://intcourses.agh.edu.pl/> Lecture language: English

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Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K001	understands the need for further training and upgrading of skills and personal	Involvement in teamwork, Test results, Participation in a discussion, Activity during classes
M_K002	is aware of the importance and understanding Non-technical aspects and impacts of engineering, including its impact on the environment and related the responsibility for decisions	Participation in a discussion, Activity during classes
Skills		
M_U001	The student can independently perform presentations in English	Presentation, Activity during classes
M_U002	able to acquire, evaluate critically and creatively process information from the scientific literature, databases and other carefully selected sources in English	Execution of laboratory classes, Presentation, Activity during classes
M_U003	can make a preliminary economic analysis of engineering activities undertaken and can carry out a multi-faceted	Execution of exercises, Project

M_U004	is aware of the importance and understanding Non-technical aspects and impacts of engineering, including its impact on the environment and related the responsibility for decisions;	Test results, Execution of laboratory classes, Participation in a discussion
Knowledge		
M_W001	has extensive and deepend knowledge of the chemistry necessary to perform chemical analyses to understand chemical reactions and processes and associated physicochemical phenomena in chemical technologies	Examination, Activity during classes
M_W002	advanced knowledge in the field on the implementation of typical technological processes, principles of their design and evaluation of technical and economic factor	Examination, Activity during classes
M_W003	has advanced knowledge of technology of processing and use of raw materials/fuels	Examination, Activity during classes
M_W004	has advanced knowledge of the use of specialized hardware and software	Completion of laboratory classes, Execution of laboratory classes, Activity during classes

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	Fieldwork classes	Workshops	E-learning
Social competence												
M_K001	understands the need for further training and upgrading of skills and personal	-	-	+	-	-	-	-	-	-	-	-
M_K002	is aware of the importance and understanding Non-technical aspects and impacts of engineering, including its impact on the environment and related the responsibility for decisions	-	-	+	-	-	-	-	-	-	-	-
Skills												
M_U001	The student can independently perform presentations in English	-	-	+	-	-	-	-	-	-	-	-

M_U002	able to acquire, evaluate critically and creatively process information from the scientific literature, databases and other carefully selected sources in English	-	-	+	-	-	-	-	-	-	-	-
M_U003	can make a preliminary economic analysis of engineering activities undertaken and can carry out a multi-faceted	-	-	+	-	-	-	-	-	-	-	-
M_U004	is aware of the importance and understanding Non-technical aspects and impacts of engineering, including its impact on the environment and related the responsibility for decisions;	-	-	-	-	-	-	-	-	-	-	-
Knowledge												
M_W001	has extensive and deepend knowledge of the chemistry necessary to perform chemical analyses to understand chemical reactions and processes and associated physicochemical phenomena in chemical technologies	-	-	-	-	-	-	-	-	-	-	-
M_W002	advanced knowledge in the field on the implementation of typical technological processes, principles of their design and evaluation of technical and economic factor	+	-	-	-	-	-	-	-	-	-	-
M_W003	has advanced knowledge of technology of processing and use of raw materials/fuels	+	-	-	-	-	-	-	-	-	-	-
M_W004	has advanced knowledge of the use of specialized hardware and software	+	-	-	-	-	-	-	-	-	-	-

Module content

Lectures

Energy and Enviroment

Lecture 1 - Clean energy technologies

Modern fossil-fuel power systems. Combined heat and power units – purpose and practical applications. Next generation combustion engines and gas turbines. Low and near zero-emission power technologies. Oxy-fuel combustion and chemical looping technologies.

Micro and nanotechnology power systems. Renewable energy and hybrid systems in domestic use and transportation systems.

Lecture 2 - Pollutant emission control

GHG emissions. Energy policy and legislation. Sustainable development dilemmas. Anthropogenic pollutions and wastes. Air pollution monitoring and emissions control. Lecture 3- Advanced technological options for coal conversion
Advanced clean coal technologies. Gasification of the coal. Coal conversion to liquid and gaseous fuels. Integrated gasification combined cycles. Synergy of nuclear energy and fossil fuels.

Lecture 4 – Fuel cells and hydrogen technologies

Advanced distributed energy systems. Fuel cells for stationary and mobile applications. Hydrogen production and storage. Future hybrid systems.

Lecture 5 – CO₂ mitigation technologies

Trends in carbon emissions. Efficiency improvement. Energy save and storage. Carbon removal technologies. Post-combustion carbon capture and sequestration. Fuel refining. Renewable energy technologies.

Lecture 6 Decarbonization of urban space

Energy and buildings. Improvement of household energy use. Green transportation systems. Intelligent buildings. Recycling, reuse and municipal waste disposal. District heating and cooling.

Laboratory classes

Practical exercises and laboratory tests

- 1.Simulation of advanced power generation cycles (Lab. – WEiP, GATECycle software)
- 2.Environmental pollution – monitoring, control and waste treatment (Lab. – WEiP)
- 3.Coal cleaning and conversion technologies (Lab. – WEiP)
- 4.PEM fuel cell testing and performance characteristics (Lab. – WEiP)
- 5.Testing of small hybrid PV/wind system (Lab. – WEiP)
- 6.Biofuels and CNG use in the internal combustion engines (Lab. – WEiP)

Method of calculating the final grade

Mark from seminars/laboratory (L) and test (exam)(T) Final mark (FM)

$$FM = 0.6 \cdot w + T + 0.4 \cdot L$$

Prerequisites and additional requirements

The basic knowledge about chemistry, physics, mechanics,

Recommended literature and teaching resources

- 1.F. Kreith, D.Y. Goswami: Handbook of Energy Efficiency and Renewable Energy, CRC Press, 2007
- 2.B. Everett, J.Ramage: Energy Systems and, Sustainability, Oxford 2003
- 3.M.F. Hordoski: Hydrogen & Fuel Cells: Advances in Transportation and Power, CRC Press, 2009
- 4.S.A. Roosa, A.G. Jhaveri: Carbon Reduction: Policies, Strategies and Technologies, CRC, 2009
- 5.J. J. Peirce, P.A. Vesilind, R.Weiner: Environmental Pollution and Control, 4-th Ed., Butterworth-Heinemann, 1998
- 6.D.A. Bell, B.F. Towler: Coal Gasification and Its Applications, Elsevier, 2010
7. Fuel cells (each book)

Scientific publications of module course instructors related to the topic of the module

Additional scientific publications not specified

Additional information

None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	20 h
Contact hours	30 h
Examination or Final test	30 h
Preparation of a report, presentation, written work, etc.	20 h
Participation in laboratory classes	22 h
Preparation for classes	25 h
Summary student workload	147 h
Module ECTS credits	5 ECTS