SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Building Services Engineering
1.3	Department	Building Services Engineering
1.4	Field of study	Civil Engineering and Building Services
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Building Services for Regenerative Cities / MS Engineer
1.7	Form of education	Full time
1.8	Subject code	11.00

2. Data about the subject

2.1	Subject name			Energy Analysis of a Building / City			
2.2	Course responsible/lecturer			Lecturer Dr. Eng. Andrei CECLAN			
2.3	Teachers in charge of seminars			Lecturer Dr. Eng. Andrei CECLAN			
2.4 Year of study	II	2.5 Semester	I	2.6 Assessment			Exam
2.7 Subject category	Formative category						DS
	Optionality						DI

3. Estimated total time

3.1 Number of hours per week	2	of which	3.2 Course	1	3.3 Seminar	-	3.3 Laboratory	1	3.3 Project	-
3.4 Total hours in the curriculum	28	of which	3.5 Course	14	3.6 Seminar	-	3.6 Laboratory	14	3.6 Project	-

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	10
(b) Supplementary study in the library, online and in the field	10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	18
(d) Tutoring	6
(e) Exams and tests	3
(f) Other activities	-

3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	47
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	General knowledge related to energy, electrotechnics, thermo-technics, civil engineering and renewable energy sources.
4.2	Competence	Electrical, gas, thermal, water and water sewage installations.

5. Requirements (where appropriate)

5.1	For the course	Classroom equipped with blackboard and Video Projector - 21 December 1989 Blvd., no. 128-130

5.2	For the applications project	Classroom equipped with blackboard and Video Projector - 21 December 1989 Blvd., no. 128-130

6. Specific competences

Professional competences	The ability to use specific energy analytics instrumentation and to manage on both energy use and generation at buildings level and local regenerative communities level, on different energy users and energy carriers. The ability to elaborate energy efficiency action plans and programs, energy management actions to be put in practice at buildings, utilities infrastructure and local communities level. The ability to calculate energy consumptions in buildings for different facilities and energy productions for renewable sources.
Cross competences	The ability to have an enhanced understanding of the energy impact on the local public utility services, buildings and their interaction in the regenerative cities. The ability to identify and foster opportunities and detail energy efficiency and energy management solutions. Competences of synthesis and integration of contents from various engineering disciplines, through a holistic approach to the energy of buildings, from an energy perspective.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Evidenced based knowledge transfer and case study-based experiences regarding the energy management in both (non) regenerative cities, to empower the participants to act as local Energy Auditors. Prepare participants with skills similar to those of certified Energy Auditors and certified Energy Managers.
7.2	Specific objectives	Integrative knowledge of the local energy generation and use in the regenerative cities. Knowledge of the legislation and authorities involved in the energy management in local communities, respectively of the role of energy audit and of energy management for local communities. The ability to effectively use energy management tools and implement energy efficiency solutions. Financing, energy performance contracting.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Course 1. Analysis of energy need and real consumption in buildings for heating and for domestic hot water	2	Debates on available for the student's materials and contents. Sessions of questions and answers.	
Course 2. Analysis of energy need and real consumption in buildings for cooling and for mechanical ventilation	2		
Course 3. Analysis of energy production / consumption in buildings provided by solar collectors – thermal and electricity – heat pumps, combined heat and power units, wind-mills	2		

Course 4. Site surveys in energy evaluation of buildings for deep renovation purposes – procedures, steps, instrumentation, case studies and examples	2	Case studies presentations. Use of online interactive instruments – mentimeter – use of power point presentations and board writing Practical examples of energy analytics tools.	
Course 5. Preparation of an energy efficiency action plan for the deep renovation of a building – life cycle cost-benefit assessment, energy savings, cost savings, emissions reduction	2		
Course 6. Technical (energy) and financial due diligence evaluation for buildings for financing purposes, buildings acquisition and energy performance implementation projects	2		
Course 7. Digitalized and distributed energy services for buildings and their interaction with the utilities and mobility – research and innovation demo pilots presentation from several implemented Horizon 2020 projects.	2		

Bibliography

- Guide to Energy Management, Eighth Edition 8th Edition, Barney L. Capehart, Wayne C. Turner, William J. Kennedy, The Fairmont Press, USA, 2016.
- Energy Management Handbook, Wayne C. Turner and Steve Doty (Editors), The Fairmont Press, USA 2006.
- Total Energy Management Handbook, Kazuhiko Yoshida (Editor), Energy Conservation Center Japan, 2005.
- Energy Management in Buildings, Keith Moss, Taylor & Francis, 2006.
- Building Energy Management Systems, Geoff Levermore, Taylor and Francis 2000.
- Managing Indoor Environments and Energy in Buildings with Integrated, Triantafyllia Nikolaou, Dionysia Kolokotsa, George Stavrakakis, Apostolos Apostolou, Corneliu Munteanu, Springer, 2015.

Managementul energiei electrice. Aplicații, Andrei C. Cziker, Mircea Chindriș, Casa Cărții de Știință, Cluj-Napoca, 2004.

8.2. Project	Number of hours	Teaching methods	Notes
Lab 1 Calculation of energy consumption for heating and for domestic hot water in a residential building	2	Debates on available for the student's materials and contents. Sessions of questions and answers. Case studies presentations. Use of online interactive instruments – mentimeter – use of power point	
Lab 2 Calculation of energy consumption for cooling and for mechanical ventilation in an office building	2		
Lab 3 Calculation of energy production for domestic hot water consumption using solar collectors	2		
Lab 4 Instrumentation for site surveys and energy measurements and indoor comfort parameters evaluation in buildings	2		
Lab 5 Description, design and calculation of different energy efficiency and renewable energy sources solutions in buildings	2		
Lab 6	2		

Energy analytics for life cycle cost-benefit assessments for energy savings, cost savings, emissions reduction		presentations and board writing Practical examples of energy analytics tools.	
Lab 7 Results integration in the project, using all the previous tools and programs	2		

Bibliography

- Guide to Energy Management, Eighth Edition 8th Edition, Barney L. Capehart, Wayne C. Turner, William J. Kennedy, The Fairmont Press, USA, 2016.
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Managementul energiei electrice. Aplicații, Andrei C. Cziker, Mircea Chindriș, Casa Cărții de Știință, Cluj-Napoca, 2004.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The preparation and periodical update of the course will take into account the existent curricula at international level, the consultation of relevant professional associations and authorities, the legal frame evolution and national and international implemented projects in energy, energy efficiency and energy audit and management in local communities.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Oral and written evaluation	Individual interviews and quiz	40%
10.5 Seminars /Laboratory/Project	Laboratory evaluation	Written test	60%
10.6 Minimum standard of performance			
Participation at the courses – minimum 80% of the available time and full presence in the laboratory meetings as conditions to enter to the exam. Evaluation grade (G); Course (C); Laboratory (L); Calculation formula of the grade $G = 0.4 \times C + 0.6 \times L$ Condition for obtaining credits: $G > 5.0$; where $C > 5.0$, $L > 5.0$.			

Date of filling in:		**Title Surname Name**	**Signature**
26.06.2023	Lecturer	Lecturer Dr. Eng. Andrei CECLAN	
	Teachers in charge of application	Lecturer Dr. Eng. Andrei CECLAN	

Date of approval in the Department of Building Services Engineering 29.06.2023	Head of department Assoc.Prof.PhD.Eng. Carmen MÂRZA
Date of approval in the Council of the Faculty of Building Services Engineering 29.06.2023	Dean Assoc.Prof.PhD.Eng. Florin DOMNIŢA