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	18.00

2. Data about the subject

2.1	Subject name			Renewable Energy Sources			
2.2	Course responsible/lecturer			*Lect.phd.eng. Roxana Mare – roxana.mare@insta.utcluj.ro*			
2.3	Teachers in charge of seminars			*Lect.phd.eng. Georgiana CORSIUC – georgiana.corsiuc@insta.utcluj.ro*			
2.4 Year of study	II	2.5 Semester	I	2.6 Assessment		E	
2.7 Subject category						DA	
						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	24
(b) Supplementary study in the library, online and in the field	7
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	-
(e) Exams and tests	2
(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	
4.2	Competence	Technical drawings, electrical, thermal, and mechanical engineering

5. Requirements (where appropriate)

5.1	For the course	Microsoft Teams platform/ amphitheater, 21 December 1989 Blvd. Nr.128-130, Cluj-Napoca

5.2	For the applications Laboratory	Microsoft Teams platform/ laboratory room, 21 December 1989 Blvd. Nr.128-130, Cluj-Napoca

6. Specific competences

Professional competences	✓ Identify the types and amount of energy supply necessary in a regenerative building or city, in order to provide the most beneficial, sustainable and cost-effective energy services as regards the renewable energies. ✓ To design renewable energy plants and systems integrated in nZeB buildings and regenerative cities, that match the latest findings regarding the renewable energy sources and leads to improvement, optimisation and modernisation of the building services; all focused on energy sustainability and efficiency. ✓ Designing, analysing and choosing the best solution for building services and systems focused on renewable energy sources with the help of special data programmes and software.
Cross competences	✓ Teamwork – the ability to synthesise and clearly define every team worker's job, ensuring an efficient exchange of information, knowledge and proofing good interpersonal and networking skills. ✓ Use of the IT&C technology. ✓ Adjustment to new technologies, personal and professional development by using specialized documents and software, and electronic resources written in an international language.

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

7.1	General objective	Developing competences in the field of renewable energy sources for nZeB buildings and regenerative cities.
7.2	Specific objectives	✓ Identify the renewable energy sources from the area of interest. ✓ The use of the latest technologies of the renewable energies in building services from regenerative cities after determining the energy demand of buildings and/or city. ✓ Design new building services, optimise and upgrade the existing building services and systems based on renewable energies. ✓ The integration of the building services and systems that use the renewable energies in the architecture of the nZeB buildings and regenerative cities. ✓ The use of theoretical knowledge in practice: dimensioning, analysis and choice of the optimum solution through specific software.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Overview. Renewable energy policy and statistics	1 hour	On line or	Video system
Solar energy – thermal plants	2 hours		

Solar energy – photovoltaic systems	2 hours	Presentation and discussions	
Wind energy	2 hours		
Hydropower	1 hour		
Biomass and biofuels	2 hours		
Geothermal energy	1 hour		
Hydrogen and fuel cells	1 hour		
Hybrid renewable systems for thermal and electrical energies	2 hours		
Total	14 hours		

Bibliography

1. RES LEGAL Europe – Legal Sources on Renewable Energy - https://www.res-legal.eu/home/
2. ***, Renewable Energy Policies in a Time of Transition, April 2018, IRENA
3. https://www.ecohz.com/facts/european-renewable-policy-framework/
4. ***, Renewable Energy Statistics Report, IRENA – International Renewable Energy Agency, 2020
5. ***, Eurostat, Renewable Energy Statistics https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics
6. Mârza C., Hoțupan A., Moldovan R., Corsiuc G., Surse neconvenționale de energie (Renewable energy sources), Ed. U.T.PRESS Cluj-Napoca, 2013.
7. Boyle, G., Renewable Energy. Power for a Sustainable Future, Third Edition, Oxford University Press, 2012.
8. Shere J., Renewable., St. Martin's Press, 2013
9. Sorensen B., Renewable energy. Its physics, engineering, use, environmental impacts, economy and planning aspects, Third Ed., Elsevier Science, 2004.
10. Yergin D., The New Map. Energy, Climate, and the Clash of Nations, The Penguin Press, 2020

8.2. Laboratory	Number of hours	Teaching methods	Notes
Solar systems for heating and hot water. Domestic hot water and heating demand. Selecting and sizing components.	4	On line or Discussions, case study, team work.	
Determining electricity demand. Selecting components and sizing the solar-photovoltaic system.	4		
Wind power generation system.	2		
Heat pumps for heating and domestic hot water supply.	2		
Evaluation	2		

Bibliography

1. Mârza C., Hoțupan A., Moldovan R., Corsiuc G., Surse neconvenționale de energie (Renewable energy sources), Ed. U.T.PRESS Cluj-Napoca, 2013.
2. Bandoc, G., Degeratu M., Instalaţii şi echipamante pentru utilizarea energiei mecanice nepoluante,Utilizarea energiei vântului, Matrix Rom, Bucureşti, 2007.
3. Boyle, G., Renewable Energy. Power for a Sustainable Future, Third Edition, Oxford University Press, 2012.
4. Degeratu, M., Bandoc G., Instalaţii şi echipamante pentru utilizarea energiei mecanice nepoluante- Utilizarea energiei valurilor, Matrix Rom, Bucureşti, 2007.
5. Fanchi, J. R.: Energy: technology and directions for the future. 2004, Elsevier.

6. ***Gex 13-2015 Ghidul privind utilizarea surselor regenerabile de energie la cladirile noi si existente, Ed. Matrix Rom. Bucuresti, 2016.
7. Lucian Victor, Surse nepoluante de producere a energiei electrice, Editura AGIR, Bucureşti 2005.
8. Kemp, W., Renewable Energy Handbook, Aztext Press, Canada, 2009.
9. Popescu, M.,O, Popescu, C.,L, Surse regenerabile de energie, Vol.1: Principii şi aplicaţii, Ed. Electra, Bucuresti 2010.

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

The competences achieved by the alumni are necessary in the field of design, production, consulting and marketing. Thus, the demands of the employees are being satisfied.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Written exam	Test – 2 hours	50%
10.5 Laboratory	Verification of knowledge and abilities acquired as a result of class activities.	Oral examination	50%
10.6 Minimum standard of performance			
Students must pass the Laboratory test for the final exam. The components of the final grade are Exam (E) and Laboratory (L). Thus, the formula for the final grade of this subject is N = 0.5xE + 0.5xL. The 3 credits are obtained only if N≥5, where both E≥5 and L≥5.			

Date of filling in: 26.06.2023		**Title Surname Name**	**Signature**
	Lecturer	Lect.phd.eng. Roxana MARE	
	Teachers in charge of application	Lect.phd.eng. Georgiana CORSIUC	

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