



No. \_\_\_\_\_ of \_\_\_\_\_

USAMV form 0124010213

## SUBJECT OUTLINE

## 1. Information on the programme

1.1. Higher education institution	University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca
1.2. Faculty	Agriculture
1.3. Department	Environmental and plant protection
1.4. Field of study	Environment engineering
1.5. Cycle of study <sup>1</sup>	Master
1.6. Specialization/ Study programme	Environment engineering
1.7. Form of education	Full time

## 2. Information on the discipline

2.1. Discipline name	RENEWABLE RESOURCES							
2.2. Course coordinator	Șef lucr. dr.ing. Călin Safirescu							
2.3. Seminar/ laboratory/ project coordinator	Șef lucr. dr. ing. Călin Safirescu							
2.4. Year of study	I	2.5. Semester	I	2.6. Evaluation type	Sumative	2.7. Discipline status	Content <sup>2</sup>	S
							Compulsoriness <sup>3</sup>	DO

## 3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time programme	3	out of which: 3.2. lecture	2	3.3. seminar/ laboratory/ project	1
3.4. Total number of hours in the curriculum	42	out of which: 3.5. lecture	28	3.6. seminar/laboratory	14
Distribution of the time allotted					hours
3.4.1. Study based on books, textbooks, bibliography and notes					36
3.4.2. Additional documentation in the library, electronic platforms and field experiences					20
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays					16
3.4.4. Tutorials					14
3.4.5. Examinations					2
3.4.6. Other activities					
3.7. Total hours of individual study	98				
3.8. Total hours per semester	140				
3.9. Number of credits <sup>4</sup>	5				

## 4. Prerequisites (if applicable)

4.1. curriculum-related	Ecology, Meteorology and Climatology, Hydrology and Hydrogeology, Wind Engineering
4.2. skills-related	Team communications skills, organization, use of internet for research

## 5. Conditions (if applicable)

5.1. for the course	The course is interactive, students can ask questions about the content of the exhibition. Academic discipline is required for the entire time of the lecture. There are not tolerated others activities during the lecture, mobile phones must be switched off. The classroom has video-projector.
5.2. for the seminar/ laboratory/ project	The classroom has video-projector, blackboard. Academic discipline is required throughout the duration of the work. Laboratory room with process specificity.

### 5. Cumulated specific competences

Professional competences	<p><b>1. Knowledge, understanding, explanation and interpretation.</b> Knowledge, understanding of the essential aspects of renewable energies and the principles of their use</p> <p><b>2. Instrumental-applicative</b> - Formation of specific skills to understand the main particular aspects related to renewable energy. Formation of problem analysis capacity.</p> <p><b>3. Aptitudinal</b> - showing positive attitudes that help to investigate aspects related to the aspects of the use of renewable energy in the field of environmental engineering.</p>
Transversal competences	<p>Applying the rules of rigorous and efficient work, manifesting responsible attitudes towards the scientific and didactic field, for the optimal and creative exploitation of its potential in specific situations, respecting the principles and norms of professional ethics.</p> <p>Effective conduct of team activities.</p> <p>Efficient use of information sources and communication and training resources.</p>

### 7. Discipline objectives (based on the cumulated specific competences)

7.1. General objective	Knowledge of the types of renewable energies and their potential, as well as of the existing technologies for exploiting renewable energy resources.
7.2. Specific objectives	<p>Understanding by students of the nature and causes of energy crises.</p> <p>Acquiring knowledge about the potential, management and use of renewable energy, with a lower impact on the environment, for the operation of conventional installations.</p> <p>Acquiring knowledge regarding the impact of renewable energy systems on the environment.</p>

### 3. Content

8.1. COURSE Number of hours - 28	Teaching methods	Observation
1. <b>Getting started.</b> Current and prospective situation of energy sources. The potential of renewable energy resources.	Lecture	2 hours
2. <b>Exhaustible and renewable energy resources.</b>	Lecture	4 hours
3. <b>Solar energy.</b> The characteristics of solar energy. Capture of solar radiation. Flat collectors. Monitoring the intensity of solar radiation.	Lecture	2 hours
4. <b>Air systems.</b> Heating and cooling of buildings (heat pumps). Industrial heating processes. Solar desalination plants. Thermal solar power station. Solar ovens. The solar tower.	Lecture	2 hours
5. <b>Wind energy.</b> Theoretical potential. Capture systems (installations). Specificity of wind energy. Design and execution of wind turbines with horizontal and vertical axis. Uses of wind energy.	Lecture	2 hours
6. <b>Hydraulic energy.</b> Hydropower potential. Types of turbines (impulse, reaction). Technological solutions for micro-hydroelectric plants. Economic, social and environmental problems.	Lecture	2 hours
7. <b>Biomass.</b> Biomass resources. Potential and availability. Conversion of biomass into energy.	Lecture	2 hours
8. <b>Thermochemical processes:</b> combustion (combustible properties of biomass, calorific value, pollutant emissions, problems related to the burning of biomass in boilers, co-burning of biomass with coal, combustion plants), gasification, pyrolysis.	Lecture	2 hours
9. <b>Biochemical processes:</b> fermentation, anaerobic digestion, composting. Mechanical extraction.	Lecture	2 hours
10. <b>Geothermal energy.</b> Types of geothermal resources. Exploration of geothermal resources. Fluid survey, extraction and distribution. Use of geothermal resources. Environmental impact of geothermal energy.	Lecture	2 hours
11. <b>Hydrogen energy.</b> Production of hydrogen from renewable resources. Hydrogen storage, transport and distribution.	Lecture	2 hours
12. <b>Combustion batteries.</b> Applications of fuel cells	Lecture	4 hours

8.2. PRACTICAL WORKS Number of hours – 28	Teaching methods	Observation
1. Work instructions and norms of the job security technique and PSI in the profile laboratories.	Exposure and verification of PSI knowledge	1 hour
2. Economic technical calculation for a solar water heating installation	Applying theoretical notions to databases delivered	2 hours
3. Determining the functional characteristics of a planar solar collector	Discussions and debates	2 hours
4. Economic technical calculation for a biomass heating installation	Exposure. Discussions and debates Exposure. Exercise	2 hours
5. Electricity generation using a horizontal axis wind turbine		1 hour
6. Technical-economic calculation for a micro-hydro power plant	Discussions and debates	1 hour
7. Analysis of the organic Rankine cycle of valorisation of geothermal energy	Demonstration. Exercise	1 hour
8. Economic technical calculation for a combustion cell		1 hour
9. Verification of knowledge	Method of verification	1 hour
<i>Compulsory bibliography:</i>		
1.Safirescu Călin, 2018. Ingineria Vântului. Note de curs		
2.Petrecu-Mag V., 2014. Energii neconvenționale. Note de curs		
3. Nițu, V., Pantelimon, L., Ionescu, C., 1985. Energetică generală și conversia energiei, Ed. Didactica și Pedagogica, Bucuresti,		
4. Ilie V., s.a., 1984. Utilizarea energiei vântului, Ed. Tehnica, Bucuresti.		
5. Danescu Al. s.a., 1987Utilizarea energiei solare, Ed. Tehnica.		
6. Iliina M., Bandrabur C., 1987Oancea N., Energii neconventionale utilizate in instalatiile din constructii, Ed. Tehnica.		
<i>Optional bibliography:</i>		
1. Bitir-Istrate I., Minciuc E., 2003.Valorificarea biogazului pentru producerea energiei electrice si termice, Ed. Cartea Universitara, Bucuresti.		
2. Tanasescu, F.T., 1986. Conversia energiei. Tehnici neconventionale, Ed. Tehnica, Bucuresti.		
3. Duffie, J. A., Beckman, W. A., 1991. Solar Engineering of Thermal Processes, 2nd. Ed., J. Wiley & Sons, New York, USA.		
4. :http://www.gvec.net - global wind energy council		
5. :http://www.evea.org - european wind energy association		

### 9. Corroborating the discipline content with the expectations of the epistemic community representatives, of the professional associations and of the relevant employers in the corresponding field

The content of the discipline is in accordance with what is studied in the discipline of renewable energy in other university centers in the country and abroad.

The content and structure of the course are aspects adapted to the needs of the students and the demands of the labor market.

At the same time, the specific knowledge of the course constitutes a starting point towards the higher level of preparation, represented by the doctoral programs.

### 10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation type	10.3. Percentage of the final grade
10.4. Course	It follows the student's ability to make logical connections between concepts, as well as the global vision he has on the subject.	E (sumativ)	70%
10.5. Seminar/Laboratory	The correctness of the answers to the questions. The entire activity carried out at the practical works is quantified.	Check seminar papers	30%
<b>10.6. Minimum performance standards</b>			
<b>Minimum requirements for 5</b>			
Note 5 is awarded following the individual evaluation of each subject, which must obtain note 5 individually; The final average will be a simple arithmetic resulting from the final note at the periodic verification <b>Laboratory.</b> 60% knowledge of the information obtained from the laboratory hours.			

- 1 Ciclul de studii- se alege una din variantele- Licenta/Master/Doctorat
- 2 Regimul disciplinei (continut)- pentru nivelul de licenta se alege una din variantele- **DF** ( disciplina fundamentala), **DD** ( disciplina din domeniu), **DS** ( disciplina de specialitate ), **DC** ( disciplina complementara).
- 3 Regimul disciplinei ( obligativitate)- se alege una din variantele - **DI** ( disciplina obligatorie) **DO** ( disciplina optionala) **DFac** ( disciplina facultativa).
- 4 Un credit este echivalent cu 25-30 de ore de studiu ( activitati didactice si studiu individual).

**Data completării**  
**04.09.2019**

**Data avizării în**  
**departament**  
**05.09.2019**

Titular curs  
Şef lucr. dr Călin SAFIRESCU

Titular lucrari laborator/seminarii  
Şef lucr. dr Călin SAFIRESCU

Director de departament  
Prof. dr. Ioan OROIAN