UNIVERSITY OF AGRICULTURAL SCIENCES AND VETERINARY MEDICINE OF CLUJ-NAPOCA
FACULATY OF AGRICULTURE
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No._____of _____ **USAMV form 0107020215 (discipline code)**

SUBJECT OUTLINE

1. Information on the programme

1.1 Higher education institution	**University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca**
1.2. Faculty	**Agriculture**
1.3. Department	Technical and Soil Science
1.4. Field of study	Agronomy
1.5. Cycle studies[1)]	Bachelor
1.6.Specialization/ Study program	ENVIRONMENTAL ENGINEERING
1.7. Form of education	Full time

2. Information on the discipline

2.1. Discipline name	TECHNICAL THERMODYNAMICS							
2.2. Course leader	Assoc. prof. eng. PhD. Ovidiu RANTA							
2.3. Seminar/laboratory/project leader	Assoc. prof. eng. PhD. Ovidiu RANTA							
2.4. Year of study	II	**2.5. Semester**	I	**2.6. Form of evaluation**	Continuous	**2.7. Discipline status**	Content[2]	D
							Compulsoriness[3]	DI

3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time programme	4	out of which: 3.2. course	2	3.3. seminar/ laboratory/ project	1
3.4.Total number of hours in the curriculum	28	out of which: 3.5.course	14	3.6. seminar/laboratory	14
Distribution of the time allotted					
3.4.1. Study after manual, course support, bibliography and notes					ore
3.4.2. Additional documentation in the library, on specialized electronic platforms and on the ground					25
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays					15
3.4.4. Tutorials					10
3.4.5. Examinations					4
3.4.6. Other activities					8
3.4.1. Study after manual, course support, bibliography and notes					
3.7. Total hours of individual study	62				
3.8. Total hours per semester	90				
3.9. Number of credits[4]	3				

4. Prerequisites (if applicable)

4.1. Curriculum related	Mathematics, mechanics, physics
4.2. Skills related	The student must have knowledge of mathematics, mechanics, physics

5. Conditions (if applicable)

5.1. for the course	The course is interactive, students can ask questions about the content of the exhibition. The university discipline requires the observance of the start and end time of the course. No other activities are tolerated during the lecture, mobile phones should be closed The presentation of the course content is done with the help of the blackboard and with the help of the available media
5.2. for the seminar/laboratory/project	In the practical works it is compulsory to consult the reports for the practical works, each student will carry out an individual activity with the laboratory materials made available and described in the existing reports. The academic discipline is required throughout the duration of the works. It is also necessary to respect the labor protection and PSI norms

6. Comulated specific competences

Professional competences	Defining the basic technical and technological concepts necessary for the application of scientific theories and methodology Choosing the principles and establishing the basic methods suitable for designing and adopting technological solutions. Knowing the main processes in the environment and identifying the possibilities for their automation. Writing a specialized study to determine the interactions between natural factors, human activities and the quality of the environment.
Transversal competences	Identifying and observing the rules of professional ethics and deontology, taking responsibility for the decisions taken and the risks involved Carrying out a work / project, carrying out responsibilities specific to the role in a multidisciplinary team

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

7.1 . General objective	Formation of the engineering technical horizon of the future specialists upon their acquaintance with the engineering models of approaching and solving the problems related to the automation of processes, methods of depollution and environmental conservation
7.2. Specific objectives	Creation of skills for the correct choice of the technological stages, the proper setting of the dimensions and type of installations to reduce the specific consumption and for a greater reliability, at high technical parameters. Identification of the types of systems and their adaptability to various possibilities of automation

8. Content

8.1. COURSE Number of hours – 14	Teaching methods	Observation
1. Basic elements of thermodynamics. Systems and units measure. Thermal balance. Temperature Temperature stairs.	Lecture	2 hours
2 Mechanical work. The heat.		
3. Principle I of thermodynamics Calorie coefficients	Lecture	2 hours
4. .Perfect gas Boyle-Mariotte Law, Gay-Lussac Mayer's Relationship to Ideal Gas Phase transformations .	Lecture	2 hours
5. The II principle of thermodynamics. Cycles Carnot cycle. Yield. Characteristic functions.	Lecture	2 hours
6. Entropy. The third principle of thermodynamics	Lecture	2 hours
7. Cycles of cars and thermal installations with gas. Internal combustion piston engines, theoretical cycles of	Lecture	2 hours
internal combustion engines. Gas turbine installations,	Lecture	4 hours
operating cycles. Gas exchange process, distribution phases.		
8. Criteria for appreciation and comparison of internal combustion engines. Pollution rules.	Lecture	2 hours
9. Compressors and fans. Theoretical, technical, step compressor. Construction of compressors.		
10. Heating systems. Heat loss. Local heating. Central heating system.	Lecture	2 hours
11. Refrigeration installations. Obtaining low temperatures Steam refrigeration systems, with mechanical compression	Lecture	2 hours
12. Physico-chemical basis of combustion. Elements of thermodynamics of combustion	Lecture	2 hours
.13. Combating environmental pollution produced by thermal machines. Pollutants produced by internal combustion engines.	Lecture	2 hours
Methods and technical solutions to reduce pollution	Lecture	2 hours

8.2. PRACTICAL WORKS **Number of hours – 14**		
1. Measures and norms of labor protection. Units of measurement in thermodynamics	Practical works	2 hours/work
2. Measurement of temperatures	Practical works	2 hours/work
3. Pressure measurement	Practical works	2 hours/work
4. Applications of principle I of thermodynamics to heating	Practical works	2 hours/work
5. Applications of principle I of thermodynamics to the production of mechanical energy		2 hours/work
6. Determination of the heat of combustion of gaseous fuels.	Practical works	2 hours/work
7. Construction and operation of internal combustion engines - Fixed and mobile parts	Practical works	2 hours/work
8. Internal combustion engine systems	Practical works	2 hours/work
9. Testing and adjusting the injection pumps		
10. The thermal balance of the MAI	Practical works	2 hours/work
11. Analysis of pollution reduction systems produced by MAI	Practical works	2 hours/work
12. Draw the characteristic curves on a centrifugal fan	Practical works	2 hours/work
13. Testing and adjusting the injectors	Practical works	2 hours/work
14. Analysis of the functioning of a cold cell	Practical works	2 hours/work

Compulsory bibliography:

1. Ranta O. Curs predat
2. Adler O. Vezeanu P., Instalatii si echipamente termotehnice, Editura Tehnica, Bucuresti, 1970
3. Danescu, A., Nicolescu T., Termotehnica si instalatii termice in agricultura EDP, Bucuresti 1967
4. Marinescu M., Baran N., Radcenco V., Termodinamica tehnica, Editura Matrix Rom 2014
5. Negrea V. D. Procese in motoare cu ardere interna, Vol I, II, Editura Politehnica, Timisoara 2003

Observation bibliography:

1. Mihaiu I., Sopa S., Motoare si tractoare horticole, Casa de editura Albastra, 2003

9. Corroborating the discipline contents with the expectations of the epistemic community representatives, of the professional association and of the relevant employers in the corresponding field

In order to identify ways of modernizing and continuously improving the teaching and the content of the courses, with the most current topics and practical problems, the teachers participate in the meetings and symposiums where they meet with teachers from other universities and with representatives from the economic activity. Also the teachers participate in exhibitions and forums organized at these events.

10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation type	10.3. Percentage of the final grade
10.4. Course	The ability to analyze thermodynamic systems Knowledge in the medium ; Knowing the types of internal combustion engines interaction with the environment Use of compressors and refrigeration systems	Colloquy	80%

10.5. Seminar/Laboratory	The ability to identify and apply thermodynamic systems Recognition and identification of the main types of engines Carrying out dimensioning, checking and execution calculations for compressing, ventilating, heating, cooling installations	Colloquy	20%
10.6. Minimum performance standard			
Mastery of scientific information transmitted through lectures and practical papers at an acceptable level.			

[1] Cycle of studies - choose one of the three options: Bachelor/Master/Ph.D.
[2]according to the educational plan
[3]Discipline status (compulsoriness) - choose one of the options – **DI** (compulsory discipline) **DO** (optional discipline) **DFac** (facultative discipline).
[4] One credit is equivalent to 25-30 hours of study (teaching activities and individual study).

Filled in on
04.09.2019

Course coordinator
Assoc. prof. eng. PhD. Ovidiu RANTA

Laboratory works/ seminars coordinator
Lect. eng. PhD. Ovidiu MARIAN

Approved by the
department on
05.09.2019

Head of the Department
Assoc. prof. eng. PhD. Ovidiu RANTA