Universidad Zaragoza

Year : 2018/19

28928 - Livestock farming facilities and equipment

Syllabus Information

Academic Year:	2018/19
Subject:	28928 - Livestock farming facilities and equipment
Faculty / School:	201 -
Degree:	437 - Degree in Rural and Agri-Food Engineering
ECTS:	6.0
Year:	3
Semester:	Second semester
Subject Type:	Compulsory
Module:	---

General information

Aims of the course

This course and its expected outcomes meet the following goals:

- Acquire criteria to establish the bases for the design of livestock housing.
- Determine the environmental, physiological and available space requirements of the main livestock species.
- Establish the different aspects of environmental control in livestock housing.
- Technically describe and gauge the necessary facilities for ventilation, heating and cooling in livestock housing.
- Technically describe and gauge the necessary equipment for milking and for the distribution of food and water.

Context and importance of this course in the degree

This is an eminently applied course, with a physiological basis, but with a technical orientation closely linked to the proper functioning of livestock facilities.

The design and sizing of the different systems of environmental control and equipment in different livestock facilities is an aspect of crucial importance in this Degree, complementing in a precise manner the knowledge acquired in other courses of the Degree in the basic engineering and animal production areas. The knowledge that is taught in this course can be deemed as almost essential for the engineer to know how to properly identify the different existing air conditioning systems, in order to solve problems and to perform the appropriate calculations. In this sense, a very high percentage of the pathological problems or of the productive problems detected at the exploitation level can be avoided or solved with an adequate environmental control.

On the other hand, the knowledge and sizing of the most suitable equipment for the distribution of food and water as well as for milking is an essential basis for any engineer who develops his/her professional activity in the agricultural sector.

Undoubtedly, the importance of the objectives and competences provided by the subject will increase over time, as future graduates should know how to assess the suitability of different environmental control systems, both to design and to

build them, and to evaluate their effectiveness and possible improvements and relate them to animal welfare aspects, with a view to achieving an adequate profitability of farms on the basis of efficiency and energy savings.

Recommendations to take this course

This course is also offered in the *English Friendly* format.

Having pursued the Mathematics I and II; Physics I and II; Graphic expression; Electrotechnics and rural electrification; Animal Science I and II; and Projects courses is strongly recommended. Attending class regularly is also advised so as to make the most of this course.

Learning goals

Competences

The students who pass this course will have developed the following competences:

- Know, understand and use the engineering principles of agricultural farms: facilities for animal health and welfare.
- Apply their knowledge to their work or vocation in a professional manner and equip themselves with the skills that are typically demonstrated through the devise and defense of arguments and the solving of problems within their field of study.
- Be able to gather and interpret relevant data (usually within their field of study) that would allow them to make judgments that include reflections on relevant social, scientific or ethical issues.

Learning goals

The student, in order to pass this course, should be able to:

- Quantify the ventilation and air conditioning needs of a livestock housing.
- Select and gauge the components of the ventilation installation of a livestock housing.
- Select and gauge the components of the heating/cooling installation of a livestock housing.
- Select and gauge the components of the feeding and water supply installation of a livestock housing.
- Technically describe other facilities of livestock housing: lighting, milking, sanitation and waste management.
- Interpret the usefulness of the data provided by temperature sensors, air velocity and air pressure to assess the ventilation and heating needs of a livestock housing.

Importance of learning goals

The achievement of the learning results planned for this course will partly facilitate the acquisition by the students of a specific competence of the specialty. This competence (CE24) is of obligatory fulfillment when dealing with a Degree with professional attributions.

On the other hand, the strengthening of certain generic or transversal competences (capacity for analysis and synthesis, oral and written communication, information management skills, teamwork, autonomous learning capacity and personal commitment skills) will contribute, together with the rest of the courses, to the integral formation of future graduates in Rural and Agri-Food Engineering.

Assessment (1st and 2nd call)

Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he/she has achieved the intended learning outcomes through the following evaluation activities:

The global test, similar in the two official calls, will consist of the following evaluation activities:

- A written test on theoretical concepts. This written test will consist of several short or multiple choice questions

related to all the contents taught during the semester. It will account for be 50% of the final grade of the course.
- Problem-solving written test. It will consist in the resolution of several problems (according to the guidelines and formats followed in the problem sessions during the semester). Its will account for 40% of the final grade of the course. In this test the student will be able to use the supporting material that he/she deems appropriate.
- Assignments, in which the student will have to elaborate on topics related to the subject (to be defined). The grade obtained in this activity will account for 10% of the final grade of the course. The reports may be presented on the date prior to the official date of the first call, or on the date of the official call established in the Center's examination calendar. Once submitted and passed (with a grade of >= 5 points out of 10), these assignments will remain valid for all the calls that the student may need to pass the subject.

The final grade of the course (FG) will be determined by the following equation:

CF = (0.5 * theoretical test score) + (0.4 * problem-solving test score) + (0.1 * assignments score)

The student must pass the written test (i.e., (0.5 * theoretical test score) + (0.4 * problem-solving test score) >= 5 points out of 10) so that the other aspects of the final evaluation (assignments) can be considered.

In the event that the above requirements are not met, the final grade will be obtained as follows:

- If FG >= 4.0, the final grade will be: fail (4.0)
- If FG < 4.0, the final grade will be: fail (FG)

Methodology, learning tasks, syllabus and resources

Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented. The learning process designed for this course is based on the following teaching modalities:

- *Theoretical sessions*. Face-to-face modality in which the contents of the course syllabus will be covered. This modality comprises the lectures (master classes) and debates.
- *Practical sessions focused on engineering problems solving*. Modality in which problems related to the contents of the course will be solved, applying the fundamental concepts learnt in the theoretical classes.
- *Guided and individual self-study*. Non-contact modality focused on the autonomous work of the student so as to complete various learning activities.
- *Technical visits*. In this modality students will acquire a practical and realistic view of the theoretical and practical contents covered throughout the course.
- *Office hours*. Meetings with the teacher, either in the teacher's office or virtually, for those students struggling with classes.

Learning tasks

This is a 6 ECTS course. The program that the student is offered to help him/her achieve the expected results includes the following activities:

- *Theoretical sessions*: at the beginning of each session, the theoretical content that the teacher will cover in the class will be described. So as to develop reasoning abilities and in order to extend the study conditions, during these classes the students will also participate in the resolution of the issues raised and not explained by the teacher.
- *Problem-solving sessions*: a collection of exercises and problems will be provided for each of the topics covered in the syllabus. Some of those engineering problems will be solved in the classroom, leaving the rest for the autonomous work of the student. The proposed problems will address issues aimed at facilitating the learning of the theoretical foundations explained in the theoretical sessions and also different aspects representative of the engineering problems that occur during the development of a real project.
- *Lab sessions*: students will interpret the theoretical and real operation of different livestock farm facilities, learning how to justify them by numerical calculations and through the use of instruments and specific software.
- *Collaborative work sessions*: groups of 3 students will autonomously complete an assignment (project) proposed by the teacher, focused on the justification and implementation of facilities for livestock farms.

Syllabus

The course will address the following topics:

- European, national and regional rules on livestock buildings.
- Design and dimensioning of buildings for ruminants.
- Design and dimensioning of buildings for monogastric animals.
- Design and dimensioning of buildings for poultry, rabbits and other animals.
- Importance of the livestock farms in the general context of animal science. Adequacy of requirements of stockmen and animals. Importance of well-being in livestock farms.
- Comfort in livestock farms. Optimum temperatures. Thermoneutral zone. Lower critical temperature. Higher critical and evaporation temperature. Factors modifying critical temperatures
- Environmental requirements in the main livestock species - ruminants, monogastric animals and poultry. Space requirements, temperature and relative humidity in the different stages of production and their practical implications. Acceptable gas concentrations
- Main methods of heat exchange between the animal and its environment. Heat losses by convection, conduction and radiation. Sensible heat. Heat losses by evaporation. Latent heat. Implication of different types of losses in buildings and tools
- Gains and losses of heat in livestock farms. Thermal equilibrium. Concept and importance of thermal insulation
- Concept and objectives of ventilation in livestock farms. Static or natural ventilation. Advantages and disadvantages. Types of static ventilation - horizontal and vertical. Calculation of the air inlet and outlet sections and their relation with speed. Factors on which both parameters depend.
- Forced ventilation. Advantages and disadvantages. Types. Ventilation by depression or extraction. Characteristics. Different possibilities, with natural or pre-treated air intake. Designs. Calculation of the air inlet section. Ventilation by overpressure. Calculation of the air speed at the level of animals.
- Bases for the calculation of the needs of air renewal in winter and in summer for the different animal species. Types of fans. Automation of ventilation. Continuous or proportional regulation of ventilation.
- Refrigeration in livestock farms. Foundations of evaporative refrigeration. Refrigeration by panel or by nozzles. Bases for the calculation and the expected reduction of temperature. Tunnel ventilation. Bases for calculation.
- Milking machine. Vacuum system - vacuum pump, bucket, regulator, manometer and vacuum line. Milking system - milk line, collector, flow meters, teat-cups. Bases of pulsing. Push-buttons. Electronic pulsing. Description of pushing cycle.
- Milking parlours for cattle. Milking in a fixed place. Individual milking parlours - tandem. Group milking parlours - in herring bone or parallel. Milking parlours in continuous series - carousels. Automated milking - robots.
- Machine milking in sheep and goat livestock. Bases. Suitability for machine milking. Casse System. Linear systems. Carousels. Technical characteristics of milking machine in small ruminants.
- Psychrometrics.
- Heating. Calculation of the needs of heating. Types of heating for livestock farms. Selection criteria of heating systems .
- Equipment in livestock farms. Concepts and definitions. Needs and justifications of mechanisation and automation. Terminology. Criteria and classification of equipment and material.
- Equipment for the distribution of food and water. Fixed systems for the transport of solid feed. Systems for the distribution of solid feed. Transport and distribution of moist and liquid feed. Transport and distribution of fodder and straw. Distribution of water. Unifeed systems.
- Equipment for the elimination of livestock excrement. Systems for the evacuation of slurry. Systems for the evacuation of semi-solid dejections. Systems for the evaluation of manures, dejections and poultry manures.
- Complementary and auxiliary material. Cattle holdings (beef and milk production). Pig farms. Poultry farms. Farms of small ruminants.

Contents of the practical sessions:

- Calculation of thermal insulation of walls and coverings in livestock farms using different building and insulating materials.
- Calculation of the needs to renew air in summer and in winter for different animal species.
- Calculation of heating needs. Calculation of the needs to renew air in a livestock building with tunnel ventilation.
- Description and use of the equipment used for assessing the environmental control in livestock farms.
- Practical assessment of ventilation systems in farms.
- Practical assessment of installations for fattening lambs in farms.
- Practical study of the functioning of a milking machine.

Course planning and calendar

Schedule of face-to-face sessions and submission dates for assignments:

2nd semester	Theoretical sessions		Problem-solving sessions		Lab sessions		Assignments	
	F2F	AW	F2F	AW	F2F	AW	F2F	AW
1st week	2	3	2	3				
2nd week	2	3	2	3				
3rd week	2	3	2	3				
4th week	2	3					2	3
5th week	2	3					2	3
6th week	2,5	3,75	1,5	2,25				
7th week					4	6		
8th week			1+1	3			1+1	3
9th week	2	3	2	3				
10th week	2	3	2	3				
11th week	2	3	2	3				
12th week					4	6		
13th week	2	3					2	3
14th week	2	3					2	3
15th week	2,5	3,75	1,5	2,25				
Total (hours)	25	37,5	17	25,5	8	12	10	15
Total (ECTS)	2,5		1,7		0,8		1	

F2F: face-to-face sessions

AW: Non-contact hours in which the student will conduct autonomous work and study.

Student workload distribution:

Face-to-face			
Theory sessions	Problem-solving sessions	Lab sessions	Assignments
25	17	8	10

The final exam will be conducted on the date appointed by Higher Technical School of Huesca Board, according to the official examination schedule.

Further information concerning the timetable, classroom, office hours, and other details regarding this course will be provided on the first day of class.

Bibliography and recommended resources

The bibliographical references for the English Friendly, version of this course wil be provided by the instructor.

BB	Callejo Ramos, Antonio. Cow comfort : El bienestar de la vaca lechera / Antonio Callejo Ramos Zaragoza : Servet , D.L. 2009
BB	Curtis, S.E. (1983). Environmental management in animal agriculture. Iowa State University Press [english friendly]
BB	Fuentes Yagüe, José Luis. Climatización de alojamientos ganaderos. José Luis Fuentes Yagüe . Madrid : Ministerio de Agricultura, Pesca y Alimentación, Publicaciones de Extensión Agraria, 1985
BB	Ganado porcino : diseño de alojamientos e instalaciones / Fernando Forcada... [et al.] . Zaragoza : Servet, D.L. 2009
BB	García-Vaquero Vaquero, Emilio. Diseño y construcción de alojamientos ganaderos / Emilio García-Vaquero Vaquero . 3a. ed. rev. y amp. Madrid : Mundi-Prensa, 1987
BB	Livestock housing / edited by C.M. Wathes and D.R. Charles . Wallingford : Cab Internacional, cop.1994
BC	Aland, A., Banhazi, T. (2013). Livestock housing: Modern management to ensure optimal health and welfare of farm animals. Wageningen Academic Publishers [english friendly]
BC	Alojamientos e instalaciones. I / Coordinador y director, Carlos Buxadé Carbó ; con la participación de 12 autores .

BC	Madrid [etc.] : Mundi-Prensa, 1997 Alojamientos e instalaciones. II / Coordinador y director, Carlos Buxadé Carbó ; con la participación de 12 autores . Madrid [etc.] : Mundi-Prensa, 1998
BC	Flanders, F., Gillespie, J.R. (2016). Modern Livestock & Poultry Production, 9th Edition. Cengage Learning [english friendly]
BC	Forcada Miranda, Fernando. Alojamientos para ganado porcino / Fernando Forcada Miranda . 1ª ed. Zaragoza : Mira, 1997
BC	Housing of Animals Construction and Equipment of Animal Houses. In: Developments in Agricultural Engineering, Volume 6. A. Maton, J. Daelemans, J. Lambrecht (Eds.) Elsevier, 1985 [english friendly]

The updated recommended bibliography can be consulted in:
http://psfunizar7.unizar.es/br13/egAsignaturas.php?id=8089