28928 - Livestock farming facilities and equipment

Información del Plan Docente

Academic Year	2017/18
Faculty / School	201 - Escuela Politécnica Superior
Degree	437 - Degree in Rural and Agri-Food Engineering
ECTS	6.0
Year	3
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

This subject is offered in the English Friendly form

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

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

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

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.

5.2.Learning tasks

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.

5.3.Syllabus

Syllabus:

- 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.

5.4.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	2	3					2	3

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week								
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.

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Student workload distribution

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

5.5.Bibliography and recommended resources

Bibliography (in Spanish language):

- Callejo Ramos, Antonio. Cow comfort : El bienestar de la vaca lechera / Antonio Callejo Ramos Zaragoza : Servet , D.L. 2009 [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]
- García-Vaquero Vaquero, Emilio. Diseño y construcción de alojamientos ganaderos / Emilio García-Vaquero Vaquero . 3a. ed. rev. y amp. Madrid : Mundi-Prensa, 1987 [BB]
- Ganado porcino : diseño de alojamientos e instalaciones / Fernando Forcada... [et al.] . Zaragoza : Servet, D.L. 2009 [BB]
- Alojamientos e instalaciones. I / Coordinador y director, Carlos Buxadé Carbó ; con la participación de 12 autores . Madrid [etc.] : Mundi-Prensa, 1997 [BC]
- Alojamientos e instalaciones. II / Coordinador y director, Carlos Buxadé Carbó ; con la participación de 12 autores . Madrid [etc.] : Mundi-Prensa, 1998 [BC]
- Forcada Miranda, Fernando. Alojamientos para ganado porcino / Fernando Forcada Miranda. 1ª ed. Zaragoza : Mira, 1997 [BC]

English-friendly (ELF) bibliography:

- Livestock housing. C.M. Wathes and D.R. Charles (Eds.). Wallingford: Cab Internacional, 1994 [BB]
- Livestock housing: Modern management to ensure optimal health and welfare of farm animals. Andres Aland and Thomas Banhazi (Eds.). Wageningen Academic Publishers, 2013, 496 pp. eISBN: 978-90-8686-771-4, ISBN: 978-90-8686-217-7.
- Rural structures in the tropics: Design and development. G.C. Mrema, L.O. Gumbe, H.J. Chepete, J.O. Agullo (Eds). FAO, 2011, 500 pp. ISBN 978-92-5-107047-5. Available at: http://www.fao.org/docrep/015/i2433e/i2433e.pdf.
- C.M. Wathes, D.R. Charles / Livestock housing. CABI, 1994, 448 pp. ISBN-10: 0851987745, ISBN-13: 978-0851987743.
- F. Flanders, J.R. Gillespie / Modern Livestock & Poultry Production, 9th Edition. CENGAGE Learning, 2016, 1152 pp. ISBN-10: 1133283500 | ISBN-13: 9781133283508.
- S. E. Curtis / Environmental management in animal agriculture. Iowa State University Press, 1983. 409 pp. ISBN 0 8138 0556 2.
- 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, 458 pp. ISBN: 978-0-444-42528-7
- FAO Animal Production and Health repository: http://www.fao.org/ag/againfo/resources/en/pubs_aprod.html.

Please note that the books in the ELF bibliography will be provided, upon request, by the instructor (except for the first one, which is available in the Library).

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