TOPICS IN AUTOMATION OF CONTROLLED-ENVIRONMENT AGRICULTURE

CÓDIGO	SEM	HT	HP	HA	SCT	REQUISITO	ÁREA DE FORMACIÓN Y TIPO DE ASIGNATURA	UNIDAD RESPONSABLE
AG100536	Otoño Primavera	1	0	2	2	Postgraduate Inscription	Elective	Postgraduate School

Descripción del curso	In the training of professionals in agriculture, it is necessary a basic knowledge of introduction to the automatic control, since they are the ones who will be in contact with the reality of the problem, and must implement the new trends in the sector; not only for the mere advancement of technologies, but because they would improve the competitiveness and security of the agri-food sector. This course develops general aspects of automatic control and its applications in the agricultural sector, specifically in the greenhouse production (climate control and fertirrigation).
Competencias: **B: básica** **G: genérica** **E: específica**	At the conclusion of this class, students will be able to: Acquire a solid knowledge base of automatic control (E). Show the student the agricultural tasks in which the computer can be used, the PLCs and the robots as tools. (G). Offer a vision of the systems that can currently be found in the agriculture sector (G).
Contenidos	**Control system engineering:** The objective is to introduce and motivate the student in the problem of control, as well as both mathematical and practical and operational order necessary for the development of the subject. In this sense, the basic knowledge about control systems are introduced, emphasizing the idea of feedback and the problems of servomechanisms and regulators. **Analysis and modeling of continuous processes:** The design of a control system for a certain process requires knowing its dynamic behavior. To do this, a system model must be designed and implemented that consists of the mathematical description of the existing dynamic relationships between the variables to be controlled and the input variables, both perturbations and control variables. **Continuous controllers design:** In the agrifood sector, there is a wide range of systems in which automatic control techniques are used or can be applied to control a given process. From the control of the temperature and humidity of the seed germination chambers, to the processing of products in the food and beverage manufacturing industries, through the control of the pH and electrical conductivity of irrigation water or the control of the concentration of certain gases in the storage and transport of the conservation of products, it is necessary to use control techniques at each stage of the food chain. **Practice. Process modelling and control:** In order to design a control system for a certain process, it is necessary to know its dynamic behavior. In order to do so, it is necessary to design a model that relates the existing dynamics between the variables to be controlled and the input variables (disturbances as control variables). The terms modeling, simulation and control refer to the set of activities associated with the **Automatic Control in greenhouses:** The growth of a crop is fundamentally determined by the climatic variables of the environment in which it is found and by the amount of water and fertilizers that are applied to it by means of irrigation; therefore, controlling these variables will be able to control the growth of the crop. For this reason, a greenhouse is ideal to cultivate, since being a closed enclosure, these variables can be manipulated to reach an optimal growth of the plants.

Modalidad de evaluación	Case study presentation (50%), Literature review (50%)
Bibliografía	**Básica** Castilla, N. 2007. Invernaderos de plástico: tecnología y manejo. Mundi-Prensa. Hanan, J.J. 1997. Greenhouses: Advanced Technology for Protected Horticulture. CRC Press. Kamp, P.G.H.; Timmerman, G.J. 1996. Computerized environmental control in greenhouses. A step by step approach. IPC Plant. Rodríguez, F.& Berenguel, M. 2004. Control y robótica en agricultura; Monografías de Ciencia y Tecnología. Servicio de publicaciones de la Universidad de Almería. Stanhill G. & H.Z. Enoch. 1999. Ecosystems of the World 20: Greenhouse Ecosystems. Elsevier. **Recomendada** Rodríguez F., M. Berenguel, J.L. Guzmán & A. Ramírez. 2015. Modelling and Control for Greenhouse Crop Growth. Springer van Straten, G., van Willigenburg, G., van Henten, E. & van Ooteghem, R.. 2010. Optimal Control of Greenhouse Cultivation. CRC Press. von Zabeltitz, C. 2011. Integrated Greenhouse Systems for Mild Climates: Climate Conditions, Design, Construction, Maintenance, and Climate Control. Springer.