BASIC DETAILS:

Subject:	GREEN AND SUSTAINABLE PHARMACY		
Id.:	31681		
Programme:	GRADUADO EN FARMACIA. PLAN 2013 (BOE 15/07/2013)		
Module:	OPTATIVAS		
Subject type:	OPTATIVA		
Year:	5	**Teaching period:**	Primer Cuatrimestre
Credits:	3	**Total hours:**	75
Classroom activities:	36	**Individual study:**	39
Main teaching language:	Inglés	**Secondary teaching language:**	Castellano
Lecturer:		**Email:**	

PRESENTATION:

This subject deals with the environmental problem that pharmaceuticals and the industry generates. The student will learn to identify several environmental aspects and evaluate the impacts generated during the lifecycle of the pharmaceutical. Furthermore, the student will be able to provide actions that minimize the impacts. Being aware of the problem and being able to provide solutions is important, not only for the formation of the student as pharmacist but also due to the social concern.

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G01	Ability to express opinions and propose arguments effectively both orally and in writing. Effectively use language skills to express views and formulate arguments both orally and in writing.
	G03	Ability for autonomous learning and self-criticism.
	G09	Demonstrate capacity for innovation, creativity and initiative.
Specific programme competences	E02	Select the appropriate techniques and procedures in the design, implementation and evaluation of reagents and analytical techniques and methods.
	E04	Assess the risks associated with the use of chemicals substances and laboratory processes.
	E37	Develop health and hygiene analysis (biochemical, food science, microbiological, parasitological) related to general health and with food and environment in particular.
	E41	Promote the rational use of medication and healthcare products.
	E49	Conocer las técnicas analíticas relacionadas con diagnóstico de laboratorio, tóxicos, alimentos y medioambiente.
Regulated profession competences	P06	Promote rational use of medicines and healthcare products, and acquire basic knowledge in clinical management, health economics and efficient use of healthcare resources.
Learning outcomes	R01	Be aware of the environmental issues that drugs and their industry generate throughout their life-cycle, and assess impacts and propose improvements, from different points of view (industry, consumer, healthcare system).
	R02	Experimentally evaluate the ecotoxicity and biodegradability of drugs, mathematically processing and interpreting the results correctly.
	R03	Apply the methodology of life-cycle assessment to a drug, using appropriate tools and interpreting the results rigorously, being aware of the importance of these techniques for the evaluation of environmental impacts in the pharmaceutical industry.
	R04	Design a research project and develop it fully, communicating the results rigorously.
	R05	Apply the knowledge acquired during their training as a pharmacist to devise, write and defend opinions related to the presence of drugs in the environment with consistency.

PRE-REQUISITES:

The activities of this course are based on the knowledge and skills acquired in previous courses. Students must ensure that executes and delivers the requested work and activities, including laboratory work, applying the skills adquired in previous courses.

SUBJECT PROGRAMME:

Subject contents:

1 - What is Green and Sustainable Pharmacy
1.1 - 1.Introduction
1.2 - Environmental concern
1.3 - Environmental problems caused by drugs and/or pharmaceutical
1.4 - Environmental concepts
1.5 - Green and Sustainable Pharmacy
2 - Framework
2.1 - Introduction
2.2 - Environmental protection agency
2.3 - Chemical regulation in Europe
3 - Pharmaceuticals in the environment
3.1 - Introduction
3.2 - Environmental risk assesment
3.3 - Ecotoxicology
3.4 - Biodergadability
4 - Greener Pharmacy
4.1 - Traditional approach vs Green Pharmacy approach
4.2 - Measuring "greenes" of a pharmaceutical process
4.3 - Green Pharmacy toos
4.4 - Green Chemistry Principles
4.5 - Green Pharmacy in the industry
5 - Life cycle of a pharmaceutical
5.1 - Introduction
5.2 - From public the health perspective
5.3 - From the manufacturing industry perspective
6 - Environmental Management System
6.1 - Environmental Management System
6.2 - Environmental management systems - Requirements with guidance for use (ISO 14001:2004)

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

Theoretical sessions

The theoretical sessions will be based on the active learning methodology. The lecturer will help students learning and progress by orally discussing some of the main theoretical content of the course, using ICTs and providing the needed resources. Collection of student exercises, problems and materials that must be carried out throughout the course as individual work, as well as guidelines and directions to execute them properly will be also provided. On the other hand, students will do a number of activities during the sessionsthat help to create a learning portfolio.

The methodology of the theoretical sessions will be the following:

- Learning outcomes and evaluation criteria will be provided as well as subject content at the beginning of each session/ unit, including vocabulary and communicative language skills that will be practiced thorough the session/ unit.

- Some of the content will be lectured. However, the student will usually have to look for the information elsewhere through a number of projects or activities specifically designed for this aim.

- Finally, some activities, problems, cases or any other task will be completed by the student as the culmination of what he/ she has learned during the session/ unit.

Laboratory experiments

Students will have to design experiments, basing on the guidelines provided by the lecturer. Furthermore, the laboratory notebook will be written and results discussed. Student will have to demonstrate autonomy and self-confidence. After conducting experiments, students will perform the mathematical treatment of the results and set them out in a report thatwill include the discussion and interpretation.

Tutoring sessions

These sessions are designed for the student to solve any doubts that may arise in relation to the subject. In addition the student may request guidelines for learning in these sessions, as well as expanding literature. They may also be useful in performing the proposed activities and projects, since the teacher can monitor the progress of work and orient.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	11
	Other theory activities	10
	Coursework presentations	5
	Laboratory practice	10
Individual study	Tutorials	1
	Individual coursework preparation	7
	Group cousework preparation	10
	Project work	12
	Portfolio	9
	Total hours:	75

ASSESSMENT SCHEME:

Calculation of final mark:

Written tests:	30	%
Individual coursework:	40	%
Trabajo experimental:	30	%
TOTAL	100	%

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

ANASTAS, Paul. WARNER, John. Green Chesmistry. theory and practice. Oxford University Press, 2000
SANGHI, Rashmi. SINGH, Vandana. Green Chemistry for Environmental Remediation.John Wiley
KÜMMERER, Klaus. HEMPEL Maximilian. Green and Sustainable Pharmacy. Springer, 2010
WALKER,C.H. HOPKIN,S.P.Principles of ecotoxicology.Taylor Francis, 2012.
NEWMAN,Michael.UNGER,Michael.Fundamentals od ecotoxicology.Lewis Publisher.3ªEdition

Recommended bibliography:

JORGENSEN,Sven Erik.Ecotoxicology:a derivate of enciclopedia of ecology.Elsevier Academic Press,2010.

Recommended websites:

Norman network	http://www.norman-network.net/index_php.php
Institut Català de Recerca de l'Aigua Recerca i Innovació per a l'ús sostenible de l'aigua	http://www.icra.cat/
Green Chemsitry network	http://www.greenchemistrynetwork.org/
Planta Pilito de Química Fina. Universidad de Alcalá	http://www.ppqf.net/
Center for Green Chemistry at Yale	http://www.greenchemistry.yale.edu/
OECD Guidelines for the testing of Chemicals	http://www.oecd-ilibrary.org

* Guía Docente sujeta a modificaciones