COURSE OUTLINE

1. GENERAL INFORMATION

FACULTY/SCHOOL	SCHOOL OF PLANT SCIENCES		
DEPARTMENT	DEPARTMENT OF CROP SCIENCE (DFC)		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	247	**Semester:**	9th DFC
COURSE TITLE	SOILLESS CULTURE		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHNG HOURS**	**ECTS**
	Lectures	3	5
	Practical Exercises	2	
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail under section 4			
COURSE TYPE *Background knowledge, Scientific expertise, General Knowledge, Skills Development*	Scientific expertise		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION:	Greek		
LANGUAGE OF EXAMINATION/ASSESSMENT:			
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://www.aua.gr/ekk/archives/334		

2. LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:

APPENDIX A

- *Description of the level of learning outcomes for each level of study, in accordance with the European Higher Education Qualifications' Framework.*
- *Descriptive indicators for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and*

APPENDIX B

- *Guidelines for writing Learning Outcomes*

The objectives of the course "Soilless Culture" are the following.

• To introduce the techniques of growing plants without soil and to the relevant terminology

• To outline the prerequisites and methods of applying soilless cultivation systems in commercial greenhouse production and explain their advantages and disadvantages with special emphasis on the environmental impacts.
• To provide a sufficient background on a) the physical and chemical properties of horticultural substrates and b) the specific characteristics of the most important substrates.
• To provide the necessary knowledge on the chemistry of nutrient solutions to the students and to enable them to calculate nutrient solutions of any desirable composition.
• To provide sufficient knowledge background on the management of plant nutrition and irrigation in commercial soilless cropping systems.
• To provide advanced knowledge on modern methods of nutrient and water recycling in closed-cycle soilless cultivation systems.
• To provide the necessary knowledge on irrigation control and practices in soilless cropping systems.

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Group/Team work
Working in an international environment
Working in an interdisciplinary environment
Introduction of innovative research
Project planning and management
Respect for diversity and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical thinking
Development of free, creative and inductive thinking
……
(Other…….citizenship, spiritual freedom, social awareness, altruism etc.)
…….

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous work
- Teamwork
- Work in an international environment
- Work in an interdisciplinary environment
- Generation of new research ideas
- Respect for the natural environment
- Promotion of free, creative and inductive thinking

3. COURSE CONTENT

- Terminology, introductory concepts and definitions. Historical review. Prospects of soilless cropping production in greenhouses.
- Soilless culture systems (closed or open soilless cropping systems, growing on substrates or in water culture systems, growing on bags, pots, containers, channels, NFT, floating hydroponic system, aeroponics, other soilless growing systems).
- Equipment for hydroponic crops (systems for preparation - supply of nutrient solution and collection of the drainage solution, substrate containers, automatic control systems for fertigation of soilless crops).
- Substrates for hydroponic crops (definitions, physical and chemical properties of substrates, water retention curves of substrates, impact of substrate hydraulic conductivity on water availability in substrate-grown crops
- Special description of substrates: sand, perlite, rockwool, pumice, vermiculite, expanded clay, other volcanic materials, synthetic porous materials, peat, coconut compost, tree bark, sawdust, by-products of agricultural industries, etc.).
- Preparation of nutrient solution. Properties of nutrient solutions, composition of nutrient solutions, required fertilizers, difficulties in preparing a nutrient solution with a desired composition, achieving desired values of electrical conductivity, pH and ratios of nutrients, automation of the process of preparing nutrient solutions.
- Control & adjustments of nutrient solution in open soilless cropping systems (regulation of total concentration of salts and pH in the root environment, adjustment of nutrient ratios, impact of nutrient solution on the quality of horticultural crops grown in soilless production systems, impact of environmental conditions on plant nutrition in soilless cropping systems.
- Management of plant nutrition, and readjustment of nutrient solution composition in closed soilless cropping systems. Accumulation of salts in closed soilless cropping systems and concepts to deal with the problem towards minimizing its impact on crop performance.
- Irrigation of soilless crops (irrigation systems, adjustment of irrigation frequency and duration in soilless crops, uniformity of water supply, automation of irrigation in soilless crops, irrigation and O_2 supply to plant roots in soilless crops).
- Special description of the cultivation techniques and nutritional needs of the main greenhouse vegetables and cut flowers grown in soilless cropping systems.

4. TEACHING METHODS--ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	**Theory:** Face-to-face lectures in a classroom for three hours once a week **Laboratory:** A) Practical training in the Laboratory's hydroponic greenhouse. B) Training in the preparation and adjustment of the composition of nutrient solutions using a special computer program accessible via the internet.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *Use of ICT in teaching, Laboratory Education, Communication with students*	Using Powerpoint presentations. Communication with students via e-mail. Support learning process through access to e-class and on-line databases. Use of a special computer program to prepare and adjust the composition of nutrient solutions based on data obtained from hydroponic cultures
COURSE DESIGN *Description of teaching techniques, practices and methods:* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc.* *The study hours for each learning activity as well as the hours of self-directed study are given following the principles of the ECTS.*	

Activity/ Method	Semester workload
Lectures	39
Laboratory exercises	26
Individual laboratory work (results of laboratory exercises)	12
Personal study	48
Total Course (25 workload hours per credit unit)	**125**

STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS *Detailed description of the evaluation procedures:* *Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.* *Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students.*	**I. Theory.** Written final exam in the theory of the course which includes: 1. One final exam (written) The exam includes: a) Multiple choice questions, b) True-false questions and c) all correct answers to a question, d) short answer questions. **II. Laboratory.** The examination in the laboratory part of the course is based on the evaluation of three exercises using the special computer program for the calculation and recycling of nutrient solutions in hydroponic cultures. Students, after being provided with data (different for each one), are asked to solve the exercises at home and submit the assignments to the teacher for evaluation.

5. SUGGESTED BIBLIOGRAPHY:

Suggested bibliography:

1. Savvas, D., Gianquinto, G.P., Tüzel, Y., Gruda, N., 2013. Soilless Culture. In: Good Agricultural Practices for Greenhouse Vegetable Crops. Principles for Mediterranean Climate Areas. Food and Agriculture Organization of the United Nations, Plant Production and Protection Paper 217, Rome, pp. 303-354, (http://www.fao.org/3/a-i3284e.pdf).
2. Savvas, D., Gruda, N., 2018. Application of soilless culture technologies in the modern greenhouse industry - A review. European Journal of Horticultural Science 83, 280-293.
3. Raviv, M., Lieth, H.J., Bar-Tal., A. (eds). Soilless Culture: Theory and Practice. 2nd Edn. Academic Press, UK. 712 pp.

Related scientific journals:

1. Scientia Horticulturae
2. European Journal of Horticultural Science
3. Journal of Horticultural Science and Biotechnology
4. Journal of the American Society for Horticultural Science
5. Journal of Plant Nutrition and Soil Science
6. Agricultural Water Management

6. TEACHERS:

Theory:

1) Dimitrios Savvas, Professor,
2) Ntatsi Georgia, Assistant Professor

Laboratory:

1) Dimitrios Savvas, Professor,
2) Andreas Ropokis, Teaching and Research Associate