

COURSE MODULE OUTLINE

General information

SCHOOL	School of Science and Technology		
PROGRAM COURSE	Cultivation under Cover - Hydroponics		
LEVEL OF STUDY	Postgraduate		
COURSE UNIT CODE	KYK 54	Year	1st
COURSE TITLE	Hydroponic crops under cover		
INDEPENDENT TEACHING ACTIVITIES <i>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</i>	WEEKLY TEACHING HOURS	CREDITS	
Weekly workload hours: 21-22 hours x 13 weeks	280	10 ECTS	
<i>Add rows if necessary. The organization of teaching and the teaching methods used are described in detail under section 4</i>			
COURSE TYPE Compulsory, Optional, Optional mandatory	Compulsory		
PREREQUISITE COURSES:	None		
LANGUAGE OF INSTRUCTION AND EXAMS:	Geek		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://www.eap.gr/en/crops-under-cover-hydroponics/topics/#k54 Each module has its own space in the Learning Management System of EAP (https://courses.eap.gr/login/index.php), with controlled access (use of code) for students and teaching staff.		

(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

<i>Learning and</i>	
APPENDIX B	
<i>Guidelines for writing Learning Outcomes</i>	
<i>After successful completion of this unit, attendees will be able to:</i>	
<ul style="list-style-type: none"> • <i>assess the possibilities of applying soilless culture in a commercial greenhouse and estimate the expected benefits</i> • <i>select the most appropriate soilless cultivation system and growth medium in each specific situation</i> • <i>calculate nutrient solutions for any crop species, cultivation system, and irrigation water source</i> • <i>manage plant nutrition and irrigation in soilless cultivations</i> • <i>contribute to the study and implementation of open or closed-cycle soilless culture projects</i> • <i>disseminate knowledge on soilless culture</i> 	
General Competences	
<i>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?</i>	
<i>Search for, analysis and synthesis of data and information by the use of appropriate technologies,</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for diversity and multiculturalism</i>
<i>Decision-making</i>	<i>Environmental awareness</i>
<i>Individual/Independent work</i>	<i>Social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Group/Team work</i>	<i>Critical thinking</i>
<i>Working in an international environment</i>	<i>Development of free, creative and inductive thinking</i>
<i>Working in an interdisciplinary environment</i>	<i>(Other.....citizenship, spiritual freedom, social awareness, altruism etc.)</i>
<i>Introduction of innovative research</i>	
<ul style="list-style-type: none"> • <i>Search for, analysis and synthesis of data and information by the use of appropriate technologies,</i> • <i>Adapting to new situations</i> • <i>Decision-making</i> • <i>Individual/Independent work</i> • <i>Group/Team work</i> • <i>Project planning and management</i> • <i>Environmental awareness</i> • <i>Development of free, creative and inductive thinking</i> 	

(3) COURSE CONTENT

<ul style="list-style-type: none"> • <u>Hydroponic systems</u>: Systems involving solely water as a substrate (deep water culture, floating hydroponics, NFT, plant plane hydroponics, aeroponics). Systems involving an aggregate as a substrate (bag culture, container culture, trough culture, thin layer systems, various alternative systems). Equipments in hydroponics: Installations used to prepare and deliver nutrient solution, sensors, equipment for the lay-out of the crop, equipment for irrigation and nutrient solution recycling. • <u>Substrates</u>: Physical properties of substrates (bulk density, particle size distribution, porosity, water release curves, hydraulic conductivity, impact of physical properties on irrigation management in hydroponics). Chemical properties of substrates (pH, ion sorption, ion exchange).
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Substrate analysis (determination of water soluble and exchangeable nutrients, CEC, AEC, organic matter content, pH, EC). Description of substrates (sand, gravel, rockwool, expanded minerals, pumice, zeolite, pyroclastic materials, peat, coir, tree bark, sawdust, wood fibres).

- Composition of nutrient solution: Calculation of nutrient solutions for open systems. Calculation of nutrient solutions for closed systems: concept of drainage solution plus fresh water, concept of uptake concentrations or uptake ratios.
- Nutrient management in hydroponics: Effects of pH, EC and nutrient ratios on plant growth, yield and quality. Management of nutrient solution in open systems. Monitoring and adjusting the nutrient supply. Introduction to nutrient solution recycling. Methods of nutrient solution recycling.
- Disinfection in closed hydroponic systems: Nutrient solution disinfection (heating, UV-irradiation, chemical treatments by means of ozone, hydrogen peroxide, chlorine, iodine, etc., membrane filtration, slow sand filtration)..
- Irrigation control in hydroponics: Characteristics of irrigation systems (capacity, uniformity). Delivery Systems (overhead systems, drip irrigation, subirrigation). Irrigation scheduling (preset schedule, sensor-based schedule, transpiration-based schedule).

(4) TEACHING METHODS--ASSESSMENT

<p>MODES OF DELIVERY <i>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</i></p>	<p>Distance learning using the HOU's E-Learning Platform and conducting Group Consultative Meetings (tele-GCM) during weekends. The duration of every tele-GCM is 4 hours.</p>	
<p>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY <i>Use of ICT in teaching, Laboratory Education, Communication with students</i></p>	<p>A platform (cisco webex) is used for the tele-GCMs. Communication with students is done via e-mail and forum posts. Submission of assignments, participation in quizzes and exams are carried out through the HOU's platform. Free access to the platform NUTRISENSE is provided (https://nutrisense.online/), which will be used to perform the two relevant educational activities, particularly the compilation of nutrient solution compositions, either in standard form, or readjusted, Students have on-line access to the HOU's library collections and online databases. In addition, students use office automation software tools, web browsers as well as e-reader for digital books.</p>	
<p>COURSE DESIGN <i>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.</i></p>	<p>Activity/Method</p>	<p>Semester workload</p>
	<p>3 meetings (4hrs)</p>	<p>12 hrs</p>
	<p>2 educational activities</p>	<p>30 hrs</p>
	<p>1 written assignment (semester essay)</p>	<p>60 hrs</p>
	<p>Final examinations</p>	<p>3 hrs</p>
	<p>Individual study</p>	<p>168-181 hrs</p>
	<p>Total course work load</p>	<p>273-286 hrs</p>

<p><i>The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.</i></p>	
<p>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS</p> <p><i>Detailed description of the evaluation procedures:</i></p> <p><i>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.</i></p> <p><i>Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students.</i></p>	<p>Undertake two educational activities (EA), each contributing 10% to the final grade of the TU and one written assignment (WA) contributing 20% to the final grade of the TU. The grade acquired from each of the educational activities and the written assignment needs to be equal to or above the pass grade (≥ 5) to enter the final or repeated exams. The final or repeated written exams contributes 60% to the final grade of the TU.</p> <p>There are all the criteria posted, both in each written assignment (in the study) and in the general regulation: https://www.eap.gr/wp-content/uploads/2022/03/kanonismos-spoudwn-isxys-apo-to-didaktiko-etos-2022-2023.pdf</p>

(5) SUGGESTED BIBLIOGRAPHY:

Σάββας, Δ., 2012. Καλλιέργειες εκτός εδάφους. Υδροπονία, Υποστρώματα. Εκδόσεις Αγροτύπος, Αθήνα. (ISBN 9789607667441), σελ. 525. (in greek)

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>).

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.

Raviv, M., Lieth, H.J., Bar-Tal., A. (eds), 2019. Soilless Culture: Theory and Practice. 2nd Edn, Academic Press, UK. 712 pp.

-related scientific journals:

Agricultural Water Management Scientia Horticulturae

European Journal of Horticultural Science

Horticulturae

Journal of Horticultural Science & Biotechnology

Journal of Plant Nutrition and Soil Science

Journal of the American Society of Horticultural Science