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| **Course title** | **Solid and Liquid Waste Management** | | | | |
| **Course code** | **GALA3602** | | | | |
| **Course type** | **Lectures** | | | | |
| **Level** | Higher Diploma | | | | |
| **Year / Semester** | 3rd Year / 6th Semester | | | | |
| **Teacher's name** | Demetris Tsimouris | | | | |
| **ECTS** | 6 | **Lectures / week** | 2 | **Laboratories / week** | 1 |
| **Course purpose and objectives** | The course introduces the students to the fundamental characteristics of waste, how waste can be a valuable resource, and the key technologies used in the treatment of liquid and solid waste. The goal of the course is to teach the students sustainable management of liquid and solid waste, including waste reduction, various waste treatment methods, and reuse, in order to extend the lifespan of products and resources. The course focuses on waste produced by the horticulture industry and the resources that can be reused. | | | | |
| **Learning outcomes** | Upon completion of the course, students are expected to:<br><br>**Knowledge**<br><br>1. Identify the different types and sources of waste relevant to horticulture and describe appropriate management methods.<br>2. **Explain** the importance of reducing waste generation and adopting sustainable practices .<br>3. **Explain** the significance of treating liquid and solid waste for environmental protection and public health.<br>**Skills**<br><br>**4.** Demonstrate the ability to manage grey water, yellow water, and black water, and apply techniques for the safe reuse of recycled water.<br>**Competencies**<br>5. **Assess**, waste characteristics and determine the most suitable treatment methods or combinations of methods for effective waste management | | | | |
| **Prerequisites** | | **Required** | | | |
| **Course content** | **Week 1 – Introduction to Liquid and Solid Waste Management**<br>• **Content:** Definitions of waste (municipal, industrial, hazardous, liquid, solid, green waste). Categories based on source (domestic, commercial, agricultural, biomedical, e-waste). Global vs EU perspectives.<br>• **Practical:** Case study review - students research different waste categories in Cyprus (or their city) and classify them into liquid/solid/hazardous categories.<br><br>**Week 2 – Solid Waste: Waste Characterisation**<br><br>• Content: Understanding physical (density, moisture content, particle size), chemical (pH, carbon/nitrogen ratio, heavy metals), and biological (biodegradability, pathogens) properties of waste. | | | | |

- Practical: Waste sampling exercise: collect a small sample of municipal solid waste (pre-sorted for safety) and measure: moisture %, density, and approximate biodegradability using observation.

**Week 3 – Solid Waste: Incineration and Sustainable Management**

- Content: Concepts of incineration, pyrolysis, and gasification. The waste hierarchy (reduce, reuse, recycle, recover, dispose). EU Waste List and regulatory framework. Quantitative analysis of waste generation. Recycling markets and challenges. Energy recovery methods (e.g., refuse-derived fuel, biogas). The Concept of Sustainable Management
- Practical: Data analysis: Students calculate per capita solid waste generation in their municipality and identify opportunities for reduction and recycling.

**Weeks 4 - Solid Waste Management**

- Content: Collection, transportation, and disposal methods. Sanitary landfill design and operation. Composting as a sustainable solution for green waste. Policy frameworks for municipal solid waste.
- **Practical- Solid Waste Management**
  - Build a small compost bin with organic waste and record temperature, moisture, and decomposition changes weekly.

**Week 5 – Hazardous Waste Management**

- Content: Types of hazardous waste (chemical, biomedical, electronic, radioactive). Storage, labeling, and disposal methods. EU and international conventions (e.g., Basel Convention). **Recycling of Pesticide Packages in Cyprus.**
- Practical: Case study analysis of **Recycling of Pesticide Packages in a nursery.**

**Week 6- Liquid Waste**

- Content:
  - Definitions, qualitative and quantitative parameters (BOD, COD, TSS, nutrients).
  - Conveyance networks (sewers, stormwater drains).
  - Centralised vs decentralised treatment.
  - Treatment levels: pretreatment, primary (sedimentation), secondary (biological treatment), tertiary (nutrient removal, disinfection).
  - Natural treatment (constructed wetlands, lagoons).
  - Physical & chemical processes (coagulation, chlorination, filtration).

**Week 7- Practical- Liquid Waste**

  - Visit a municipal wastewater treatment plant to observe treatment stages.

**Week 8 - Decentralised Liquid Waste Systems**

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| | • Content: Septic tanks, small-scale anaerobic digesters, greywater reuse, eco-sanitation solutions. Management of grey water, yellow water, and black water, including separation, treatment, and reuse of recycled water for non-potable purposes.<br><br>Week 9: Practical: Design Exercises<br><br>• sketch a septic system or greywater reuse model.<br>• Design a Biological (plant-based) treatment system of wastewater for water reuse<br><br>**Week 10 - Control of Water Pollution**<br><br>• Content: Point vs non-point pollution sources, industrial effluents, agricultural runoff, oil spills. Control measures (legislation, monitoring, best management practices).<br><br>**Weeks 11 – Nitrate Pollution and Organic Waste from Livestock Units**<br><br>• Content: Causes and impacts of nitrate pollution (fertiliser runoff, manure management). EU Nitrates Directive. Waste management strategies in livestock farming (biogas, composting, nutrient recovery).<br><br>**Week 12- Practical- Nitrate Pollution and Organic Waste from Livestock Units**<br><br>○ Simulation: Students design a waste management plan for a small livestock unit (e.g., 50 cows or 200 pigs). |
| **Teaching methodology** | The teaching methodology combines lectures, interactive discussions, case studies, and practical activities to ensure both theoretical understanding and applied learning. Students engage in hands-on exercises such as waste characterisation, composting, and water quality testing, complemented by field visits to treatment facilities and recycling plants. Problem-based learning and group projects are used to encourage critical thinking, teamwork, and the application of concepts to real-world waste management challenges. This blended approach ensures that students develop both technical knowledge and practical skills relevant to sustainable waste and resource management. |
| **Bibliography** | **Greek Bibliography**<br>• Πουλοβασίλης, Α. (2010). *Εισαγωγή στις αρδεύσεις*. Έμβρυο. ISBN 978-960-8002-54-8.<br>• Μπαμπίλης, Δ. (2004). *Αρδευτικά δίκτυα πρασίνου: Εγχειρίδιο αυτο-εκπαίδευσης και τεχνικής εφαρμογής της διαχείρισης νερού σε έργα αρχιτεκτονικής τοπίου*. Σταμούλη Α.Ε.. ISBN: 978-960-351-481-7<br>• Γέμτος, Θ., και Καβαλάρης, Χ. (2015). *Μηχανήματα καλλιεργητικών φροντίδων.* **Kallipos Open Academic Editions**. Ανακτήθηκε από: http://hdl.handle.net/11419/1325. ISBN978-960-603-436-7<br>**English Bibliography**<br>• Laycock, A. (2011). *Irrigation Systems: Design, Planning and Construction*, CABI. ISBN 978-1845938741. |

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| | • Laffan, J. (2016). *Irrigation, Centre Pivot and Lateral Move*. Tocal College, NSW DPI. ISBN:9781742569192. EBSCOHost.<br>• https://greendot.com.cy/en/recycling-of-pesticide-packages/<br>• Khan, Naeem. (2018). Natural Ecological Remediation and Reuse of Sewage Water in Agriculture and Its Effects on Plant Health Natural Ecological Remediation and Reuse of Sewage Water in Agriculture and Its Effects on Plant Health. 10.5772/intechopen.75455. |
| **Assessment** | • Attendance and course participation: 10%<br>• Individual assignment/report based on the content of the practical sessions 40%<br>• Final written examination 50% |
| | Student performance in this course will be evaluated through a combination of continuous and summative assessments. Attendance and active participation in class will contribute **10%** to the final grade, reflecting the importance of consistent engagement. A **portfolio of individual lab reports** compiled from the various practical sessions will account for **40%**, assessing students' ability to document their work systematically, demonstrate applied skills, and reflect on their learning throughout the semester. The **final written examination**, weighted at **50%**, will include both closed-ended questions (e.g., multiple-choice, matching, true/false) and open-ended questions (e.g., short-answer, essay-type, case studies). The examination will have a duration of **two academic periods** and will evaluate students' overall understanding of the course content, their ability to synthesize theoretical and practical knowledge, and their critical thinking skills.<br><br>Student performance is evaluated on a **scale of 0 to 100**, with a **minimum overall passing grade of 60**. The final grade is calculated as a **weighted average** of the assessment components described above. |
| **Language** | Greek or English |