Course title	**Introduction to Chemistry**				
Course code	**GALA1103**				
Course type	**Compulsory**				
Level	Higher Diploma				
Year / Semester	1st Year / 1st Semester				
Teacher's name	Chrysi Tomouzou				
ECTS	6	**Lectures / week**	2	**Laboratories / week**	1
Course purpose and objectives	The purpose of this course is to introduce students to the basic principles of chemistry and demonstrate their direct application to gardening and horticulture. Students will explore the structure and behavior of matter, chemical reactions, soil and water chemistry, and the safe use of fertilizers and pesticides. By linking scientific theory with practical garden-based experiments, the course equips students with the knowledge and skills to make informed decisions about soil management, plant nutrition, and sustainable gardening practices.				
Learning outcomes	Upon completion of the course, students are expected to: **Theoretical Learning Outcomes:** 1. Explain the basic structure of atoms, molecules, and ions, and their role in matter. 2. Describe chemical bonding, reactions, soil chemistry, and pH in relation to plant growth and gardening practices. 3. Understand the properties and uses of fertilizers, pesticides, and soil amendments, including their environmental impact. **Practical Learning Outcomes:** 4. Perform simple experiments to test soil, water, and fertilizers, and observe basic chemical changes. 5. Apply safe laboratory and field practices, record results accurately, and make basic recommendations for soil and plant management.				
Prerequisites		**Required**			
Course content	**Week 1 – The Atom and Matter** • **Lecture:** ○ Structure of the atom: protons, neutrons, electrons. ○ Definition of element, compound, and mixture. ○ How matter is classified (solid, liquid, gas). ○ Why chemistry is important in gardening: understanding fertilizers, pesticides, and soil components. • **Practical 1:** ○ Laboratory rules and safety – Short test on health and safety rules				

- Familiarity with laboratory equipment (utensils, chemical reagents and their safe handling)
- *Separation of Mixtures* – sand, salt, iron filings → physical separation using magnet, filtration, evaporation.

Week 2 – Atomic Models & Elements in the Garden

- **Lecture:**
  - Historical models: Dalton, Thomson, Rutherford, Bohr → leading to the modern atomic model.
  - Periodic table basics: groups, periods, metals, non-metals.
  - Essential plant nutrients as chemical elements (N, P, K, Mg, Fe, Zn).
  - Link to horticulture: fertilizers are combinations of elements (compounds) designed for plant uptake.
- **Practical 2:** *Paper Chromatography* – separate plant pigments or ink colors, demonstrating mixtures vs. pure substances.

Week 3 – Chemical Bonding & Ions in Gardening

- **Lecture:**
  - Ionic vs. covalent bonds with examples.
  - Formation of ions (Na^+, Cl^-, etc.) and their role in fertilizers and soil minerals.
  - Water as a polar covalent molecule → why it dissolves salts but not oils.
  - Garden link: salts in soil (good = nutrients, bad = salinity).
- **Practical 3:** *Conductivity Test* – test saltwater, sugar water, fertilizer solution, vinegar, showing that ionic solutions conduct electricity.

Week 4 – States of Matter & Solutions

- **Lecture:**
  - Solids, liquids, gases and their particle arrangement.
  - Melting, evaporation, condensation in the garden (e.g., dew, evaporation from soil).
  - Solutions, solubility, and concentration — why fertilizers are applied dissolved in water.
  - Saturated solutions and crystallization.
- **Practical 4:** *Crystal Growth* – grow salt or alum crystals to visualize ionic lattice formation.

Week 5 – Soil Chemistry & Soil Components

- **Lecture:**
  - Soil as a chemical system: minerals, organic matter, water, air.
  - Sand, silt, clay — their role in water retention and nutrient holding.
  - Cation exchange capacity (CEC) simplified: clay and humus "hold" nutrients for plants.
  - Organic matter decomposition = chemical cycling of nutrients.
- **Practical 5:** *Soil Texture Test* – sedimentation jar method to identify % of sand, silt, clay.

Week 6 – Acids, Bases, and Soil pH

- **Lecture:**
  - Definition of acids and bases; pH scale.

- Soil pH and nutrient availability: e.g., iron deficiency in alkaline soils.
- Amending soil pH: lime to raise, sulfur/organic matter to lower.
- Importance of buffering capacity.

- **Practical 6:** *Soil pH Testing* – test garden soil with universal indicator strips and pH meter; test effect of adding lime or vinegar.

Week 7 – Chemical Reactions in Gardening

- **Lecture:**
  - Types of reactions: neutralization, oxidation-reduction, decomposition, combustion.
  - Examples in gardening:
    - Neutralization → liming acidic soil.
    - Oxidation → rusting of tools.
    - Decomposition → composting organic waste.
  - Energy in chemical reactions and its role in metabolism.
- **Practical 7:** *Neutralisation Reaction* – add lime ($CaCO_3$) to vinegar to show neutralisation and CO_2 release.

Week 8 – Fertilizers and Plant Nutrition

- **Lecture:**
  - Macronutrients: N, P, K.
  - Secondary and micronutrients: Ca, Mg, Fe, Zn.
  - Organic vs. synthetic fertilizers: pros and cons.
  - Environmental impacts: leaching, eutrophication.
- **Practical 8:** *Fertilizer Solution Prep* – dissolve fertilizer granules; calculate concentrations; test nitrate or phosphate with strips or reagents.

Week 9 – Organic Chemistry in Gardening

- **Lecture:**
  - Carbon compounds: carbohydrates, proteins, fats.
  - Organic matter in soil: compost, humus, biochar.
  - Activated charcoal/biochar as a soil amendment: adsorption of chemicals, improved soil aeration.
  - Compost teas as a source of soluble organic nutrients.
- **Practical 9:** *Activated Charcoal Distillation* – small-scale biochar preparation using a metal tin with plant matter heated on a sand bath; demonstrate adsorption of colored solutions.

Week 10 – Water Chemistry in Horticulture

- **Lecture:**
  - Properties of water: cohesion, adhesion, high heat capacity.
  - Solvent power of water for nutrient uptake.
  - Hard vs. soft water and its effect on irrigation.
  - Salinity and waterlogging as chemical problems in soil.
- **Practical 10:** *Water Quality Testing* – measure pH, TDS (total dissolved solids), hardness (soap test or kit).

Week 11 – Pesticides & Safe Chemical Use

- **Lecture:**

	○ Chemistry of pesticides, herbicides, fungicides. ○ Risks: bioaccumulation, groundwater contamination. ○ Safe handling, PPE, and environmental alternatives. ○ Reading chemical labels and hazard symbols. • **Practical 11:** *Dilution Exercise* – read a fertilizer/pesticide label; calculate correct dilution; practice safe mixing with water only (no active chemicals). **Week 12 – Integration: Chemistry in the Garden** • **Lecture:** ○ Sustainability and the chemical cycle in gardening. ○ Linking soil, water, fertilizers, compost, and pH management. ○ Review of core chemical concepts in practical gardening. • **Practical 12 (Capstone):** *Garden Chemistry Investigation* – students test a soil/compost sample for pH and composition, then recommend a pH adjustment or fertilization plan.
Teaching methodology	**Theoretical Instruction:** The theoretical component will be delivered through interactive lectures supported by visual aids, demonstrations, and horticultural case studies. Core chemistry concepts such as atomic structure, bonding, chemical reactions, and soil chemistry will be explained using examples directly related to gardening, including fertilizer use, soil pH adjustment, and composting. Short problem-solving exercises, quizzes, and guided discussions will be incorporated to reinforce understanding and encourage student participation. **Practical Instruction:** The practical component will focus on hands-on laboratory and field activities designed to link theory with real gardening applications. Students will conduct simple, safe experiments such as separating mixtures, growing crystals, testing soil pH, and analyzing water quality. Soil and fertilizer experiments will emphasize applied skills relevant to horticulture. Practical sessions will follow a structured format: introduction and safety briefing, step-by-step experimentation, data recording, and group discussion of results. Emphasis will be placed on safe handling of equipment and materials, accurate observation, and applying findings to practical garden management decisions.
Bibliography	**Greek Bibliography** • Μανουσάκης, Γ. (2016). Γενική και Ανόργανη Χημεία. [*General and organic Chemistry*]. Εκδόσεις Κυριακίδη. ISBN: 9789605990091 • Θεοχάρους, Σ. (2014). Ανόργανη χημεία. [*Inorganic Chemistry*]. KES College. • Ebbing, D. D.(2014). Σύγχρονη Γενική Χημεία: Αρχές και Εφαρμογές. [*Contemporary General Chemistry: Principles and Applications*]. 10η Έκδοση. Ν. Δ. Κλούρας μετ. Εκδόσεις Τραυλός. ISBN 978-618-5061-02-9. • Μαυρομούστακος, Θ., Τσέλιος, Θ., και Παπακωνσταντίνου, Κ. (2014). Θεμελιώδεις αρχές οργανικής χημείας. [*Fundamental Principles of organic Chemistry*]. Εκδόσεις Συμμετρία. ISBN: 9789602663875 • Λαλία-Κανούρη, Μ., και Παπαστεφάνου, Σ. (2012). Γενική και ανόργανη χημεία: Αρχές και εργαστηριακές ασκήσεις. [*General and inorganic chemistry: Principles and laboratory exercises*]. Ζήτη. ISBN 978-960-456-335-7 • Καλογιάννης, Σ.(2018). Εισαγωγή στη βιοχημεία. [*Introduction to biochemistry*]. 2η Έκδοση. Τζιόλα. ISBN: 9789604187225. **English Bibliography**

	• Peter B. Moore (2020). An Introduction to Chemistry. Newcastle upon Tyne : Cambridge Scholars Publishing. 2020. ISBN: 9781527545519 **EBSCOHost** • Timberlake, K. (2015) *Chemistry: an introduction to general, organic and biological chemistry*. 12th Edition. Pearson. ISBN: 1292061324. • Jeyashanti, N. (2017). *Textbook of Biochemistry*. 1st Edition. Bengaluru: Laxmi Publications Pvt Ltd. ISBN: 9789386202437. **EBSCOHost**
Assessment	• Attendance and course participation: 10% • Individual assignments/reports related to the nature of the Practical/Lab training: 40% • 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. 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