

COURSE ID SHEET



Course No.	5292	NTUA			
Semester:	8,10	Core		Elective	Specialization X

Title: **CHEMISTRY, MICROBIOLOGY & FOOD PRESERVATION PRINCIPLES**

Aim: The course provides Chemical Engineers knowledge in advanced Food Chemistry, Food Microbiology and Food Preservation topics. It covers the study of food composition and ingredients and their physicochemical, nutritional and bio-functional properties, chemical and microbiological actions in food, food quality and safety, and the effects and behavior of food systems under the conditions of production and preservation processes, packaging and shelf life. Overall objective is the knowledge of food as a complex and active biological system. This knowledge is prerequisite for the optimal design of food products, processes and preservation throughout the food chain from production to the final use in a farm to fork approach. Topics discussed include food product innovation, sustainability, energy and environmental impact optimization, circular economy.

CONTENT

- **Food Composition.** Main components, physicochemical properties, sensory characteristics, nutritional and bio-functional value. Food legislation principles. Food Proteins- Food carbohydrates. Food lipids: Chemistry-functionality-nutrition-bioactivity. Role in the design and processing of main food categories. Water – Vitamins – Enzymes – Minor components – Additives – Flavor and coloring compounds – Special ingredients: hydrocolloids, fiber, antioxidants, probiotics and prebiotics, alternative sweeteners, beta glucans, $\omega 3$. GMOs. Allergens.
- **Food material science.** Rheology- Viscoelasticity. Texture. Structure at macro, micro and nano scale.
- **Food Microbiology.** Pathogen and spoilage factors – Standard, rapid and molecular techniques. Parameters and control of microbial activity- Hurdle technology - Predictive microbiology – New computational tools- Risk analysis and food safety management.
- **Design and preservation of food products.** Chemical, physicochemical, enzymatic and microbiological reactions in foods- Kinetics and control- Shelf life testing and evaluation – Food labelling – Management of the food chain from production to consumption- Principles of food product design and preservation-. Effect of composition and processing - New trends: Innovation, sustainability, energy and environmental impact optimization, circular economy.
- **Laboratory exercises:**
 1. Food composition determination and study of the effect of processing conditions
 2. Proteins: Functionality and interactions in food systems
 3. Carbohydrates: Study of physicochemical and functional properties. Gelatinization. Glycemic index.
 4. Study of rheological properties. Texture analysis.
 5. Study of action of antioxidant compounds in lipid systems and food products.
 6. Laboratory techniques of microbial analysis of foods. Computational tools and determination of shelf life in real food chain conditions
 7. Kinetics of main reactions in foods – Study and modelling of the Maillard reaction in model systems and food products- Development and application of software tool.
 8. Design of a novel food product.

Field trip to an industrial food production plant. Case study.

Hours per
semester:

LECTURES	16	EXERCISES	8	LABORA- TORY	16	HOME- WORK	135	TOTAL HOURS: 175
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Student
performance/
evaluation:

The evaluation of the students will be done through:

- A Final (written) Examination (FE), and
- Laboratory Exercises and oral examination (LE).

The Final Grade results as follows: Final Grade = 0.5 x (FE) + 0.5 x (average grade of LE)