COURSE OUTLINE

1 GENERAL

SCHOOL	School of Applied Biology and Biotechnology		
ACADEMIC UNIT	Department of Biotechnology		
LEVEL OF STUDIES	Postgraduate (Level 7)		
COURSE CODE	(To be assigned)	**SEMESTER**	1st
COURSE TITLE	Nutrition and Nutraceuticals		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, state the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures & Guided Study (Virtual & Pre-recorded)		3	
Case-study seminars / discussions / Group Projects		1	
TOTAL		4	6 ECTS
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail in section (4).			
COURSE TYPE *general background, special background, specialization, general education, skills development*	Specialization / Special Background		
PREREQUISITE COURSES	Formal prerequisites are not required, but background knowledge in biology, chemistry, human physiology/biochemistry, or nutrition and metabolism is recommended.		
LANGUAGE OF INSTRUCTION AND OF ASSESSMENT	English		
MODE OF TEACHING *in-person (%) synchronous distance learning (%) asynchronous distance learning (%) (In the case of synchronous distance learning, the total weekly duration of teaching is recorded)*	Synchronous distance learning (75%) Asynchronous distance learning (25%)		
AVAILABILITY TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://purdue.brightspace.com		

2 LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Brief Guide for drafting Learning Outcomes*

Upon successful completion of the course, students will be able to:

- Identify and describe the basic and specialized principles of human nutrition and

the physiological roles of macro- and micronutrients.

- Define and categorize nutraceuticals and bioactive compounds, understanding their chemical nature and biological activities.
- Evaluate and apply evidence-based nutrition information to promote health and implement strategies for the prevention of chronic diseases.
- Explain the mechanisms by which specific nutrients and nutraceuticals influence the development and management of metabolic disorders (e.g., obesity, Type 2 diabetes), cardiovascular diseases, and certain types of cancer.
- Analyze the role of dietary bioactive compounds (such as polyphenols, carotenoids, and omega-3 fatty acids) in modulating cellular processes and gene expression (nutrigenomics).
- Assess the safety, efficacy, and regulatory framework surrounding the use of functional foods and dietary supplements in different populations.
- Critically evaluate primary scientific literature and clinical trials related to nutrition and nutraceutical interventions.
- Synthesize complex information to communicate scientific findings effectively to both professional and lay audiences.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and are stated below), at which of the following does the course aim?

Search, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adaptability to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Other…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology (through the analysis of clinical studies and dietary databases).
- Working independently (during the preparation of individual assignments and study of asynchronous modules).
- Team work (through collaborative discussion tasks and peer-to-peer interactions).
- Working in an international environment (as part of a dual-degree framework with international faculty).
- Criticism and self-criticism (developed via the critical appraisal of nutrition claims and scientific papers).
- Production of free, creative and inductive thinking (evidenced by the design of nutritional intervention strategies).

3 COURSE SYLLABUS

The course provides a comprehensive exploration of the role of functional foods and nutraceuticals in human health, focusing on metabolic regulation, disease prevention, and regulatory frameworks. The content is organized into the following thematic units:

- Foundations & Regulatory Frameworks: Introduction to human nutrition and nutraceutical definitions; distinguishing between functional foods, dietary supplements, and nutraceuticals; global market overviews and an introduction to EFSA (European Food Safety Authority) and FDA (Food and Drug Administration) regulatory landscapes.
- Metabolic Health & Assessment: Human metabolism and health indices, including glycemia, blood lipids, inflammation, and oxidative stress; methods for energy balance and nutritional assessment.
- Microbiome-Targeted Bioactives: In-depth study of probiotics, prebiotics, dietary fibers, synbiotics, and postbiotics; focusing on short-chain fatty acid (SCFA) formation, strain specificity, and labeling.
- Phytochemicals & Botanicals: Classes of bioactive compounds including polyphenols, carotenoids, and algae; botanical and herbal bioactives (e.g., green tea, cinnamon) focusing on their absorption, metabolism, safety, and standardization.
- Functional Ingredients & Metabolic Outcomes: Methodology and interpretation of the Glycemic Index (GI) and Glycemic Load (GL); metabolic effects of fermented foods, vinegar, and lipid bioactives (plant sterols, omega-3 fatty acids).
- Nutraceuticals in Chronic Disease Management: Evidence synthesis for the use of nutraceuticals in managing obesity, Type 2 diabetes, metabolic syndrome, and cardiovascular diseases (CVD).
- Clinical Research & Evidence Appraisal: Design of clinical and epidemiological studies; hierarchy of evidence; evaluation of efficacy through CONSORT and STROBE principles; and preparation of EFSA/FDA-compliant ingredient dossiers.

Applied Workshops & Virtual Laboratory Topics:
The course integrates practical modules designed to translate theory into analytical skills:

- Nutritional & Composition Analysis: Evaluation of macro/micronutrient profiles and food database analysis.
- Metabolic Monitoring: Interpretation of Continuous Glucose Monitoring (CGM) data and iAUC (incremental Area Under the Curve) analysis for glycemic response.
- Product Formulation: Design of functional food formulations, such as probiotic-enriched juices or botanical-infused products.
- Clinical Interpretation: Reading DEXA/BOD POD reports for body composition and performing critical appraisals of clinical trials using GRADE and PICO extraction methods.

4 TEACHING AND LEARNING METHODS - ASSESSMENT

MODE OF TEACHING *Face-to-face, distance learning, etc.*	Distance Learning • Synchronous distance learning: 75% (39 hours)

	• Asynchronous distance learning: 25% (13 hours)
MODE AND FREQUENCY OF COMMUNICATION WITH THE STUDENTS	• Weekly Synchronous Sessions: A 3-hour live lecture and a 1-hour interactive workshop are held weekly via video conferencing. These sessions facilitate real-time discussion on metabolic health and nutraceutical efficacy. • LMS Updates: Regular communication through the Brightspace "Announcements" tool (at least twice weekly) regarding upcoming assignments and module highlights. • Discussion Board Monitoring: Faculty and TAs monitor forums daily (Monday–Friday) to provide academic guidance within 24–48 hours. • Virtual Student Consultation: Students may schedule individual virtual meetings as needed for academic advising or content clarification via email request. • Feedback Mechanism: Qualitative and quantitative feedback is provided on all assignments and reports within two weeks of submission. • Email Support: Guaranteed response to university email inquiries within 24 hours during the business week.
ENSURING THE MODE OF COMMUNICATION AMONG STUDENTS *Team assignments and discussions, collaborative learning platforms with the use of AI, video conference, QA sessions, κ.α.*	Student interaction and collaborative learning are facilitated through several integrated academic and technological strategies: • Collaborative Case Studies: Students participate in synchronous workshops and breakout sessions to analyze clinical data and nutritional reports. These activities require students to work together to apply theory to real-world metabolic scenarios. • Structured Discussion Forums: The Brightspace LMS hosts dedicated discussion boards where students engage in academic dialogue regarding current trends in

	nutraceuticals, regulated health claims, and phytochemical research. • Peer-to-Peer Interaction: During synchronous sessions, students are encouraged to participate in Q&A segments and peer-review activities, fostering a sense of an international academic community. • Collaborative Learning Platforms: Students utilize the Brightspace Learning Management System (LMS) and cloud-based productivity tools (e.g., Google Workspace, Microsoft 365) for co-developing reports and sharing research resources. • Integration of AI Tools: Students are permitted to use AI tools for collaborative brainstorming and refining the structure of their assignments, provided they follow the mandatory disclosure and instructor approval guidelines.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, in laboratory training, in the communication with students*	The course extensively utilizes modern Information and Communication Technologies (ICT) to facilitate high-quality distance learning and training and communication with Students: • Learning Management System (LMS): Brightspace serves as the central platform for all course modules, digitized reading materials, and video-based lectures. • Synchronous Delivery is used for real-time lectures, case-study workshops, and guest speaker sessions. • AI Integration: Use of Generative AI tools (e.g., ChatGPT) as collaborative assistants for drafting nutritional intervention outlines and refining scientific communication, under strict disclosure guidelines. • Nutritional Databases: Use of digital food composition databases and specialized software for dietary analysis and macro/micronutrient profiling. • Metabolic Data Analysis: Utilization of digital tools for the interpretation of Continuous

	Glucose Monitoring (CGM) data and the calculation of metabolic indices (iAUC). • Scientific Research Tools: Access to online clinical trial registries and academic databases (PubMed, Scopus) for evidence-based analysis. • Digital Hub: Continuous use of Brightspace Announcements and Discussion Boards for academic support and peer interaction. • Virtual Collaboration: Use of cloud-based productivity suites (Microsoft 365, Google Workspace) for collaborative project development and report writing.
TECHNOLOGICAL EQUIPMENT REQUIREMENTS	To successfully participate in this distance-learning course, students are required to have access to the following technological equipment and infrastructure: • Personal Computer / Laptop: A modern computer capable of running data analysis software and supporting high-definition video streaming. • High-Speed Internet Connection: Reliable broadband access to support synchronous video conferencing and the streaming of asynchronous video content. • Peripherals: A functional webcam and a high-quality microphone/headset for participation in live discussions and workshops. Software & Tools: • LMS Access: Standard web browser for the Brightspace platform. • Data Analysis & Productivity: Access to Microsoft Excel for metabolic data calculations (e.g., iAUC) and software for creating scientific reports and presentations. • Communication: Installation of Zoom or other approved video conferencing platform for synchronous sessions. • Institutional Infrastructure: Students are provided with institutional accounts for the University's LMS and access to digital library resources (PubMed, Scopus) for primary research.
PLAGIARISM POLICY/ PLAGIARISM DETECTION TOOLS	The program maintains a zero-tolerance policy towards academic dishonesty and plagiarism,

	ensuring that all submitted work reflects the student's original research and critical thinking. • Plagiarism Policy: Plagiarism is defined as using the words, ideas, results, or images of others without proper attribution, as well as self-plagiarism (resubmitting prior work). • Students are required to follow the Purdue Honor Pledge ("As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. I will neither give nor receive aid unless the instructor authorizes it"). • In alignment with the Agricultural University of Athens (AUA) regulations, all postgraduate assignments and the final thesis must comply with the institutional standards for originality. Plagiarism Detection Tools: • Turnitin: All written assignments (Manuscript Reports, Discussion Board posts, and the final Thesis) are systematically screened through the Turnitin plagiarism detection software. • Originality Reports: Instructors review detailed similarity reports generated by Turnitin to identify improperly cited content or excessive overlap with existing literature. • AI Writing Detection: The program utilizes Turnitin's AI writing detection feature to identify instances where generative AI tools may have been used outside the permitted guidelines. • Consequences: Instances of academic dishonesty are handled according to the procedures of the Office of Student Rights and Responsibilities (OSRR) at Purdue and the Assembly of the Department of Biotechnology at AUA. Sanctions may range from failure of the assignment to dismissal from the dual-degree program.
ARTIFICIAL INTELLIGENCE POLICY *(1) The use of Artificial Intelligence is prohibited in all circumstances* *(2) The use of Artificial Intelligence is allowed only with the permission of the instructor*	(2) The use of Artificial Intelligence is allowed only with the permission of the instructor (3) The use of Artificial Intelligence is allowed only with an explicit reference to the literature

(3) The use of Artificial Intelligence is allowed only with an explicit reference to the literature *(4) Students are free to use Artificial Intelligence*	Description & Implementation: In this course, a constructive but regulated approach to Generative AI (e.g., ChatGPT, Gemini) is adopted: • Permitted Use: Students are allowed to use AI tools primarily as "collaborative partners" for brainstorming, structuring outlines, or refining the linguistic clarity of their written reports (e.g., the final manuscript report). • Instructor Approval: Use of AI for specific assignments must be discussed with and approved by the instructor during the initial stages of the project. • Mandatory Disclosure: If AI tools are used, students must include a dedicated "AI Disclosure Statement" in their work, explicitly describing which tool was used and for which part of the assignment. • Academic Integrity: Students remain 100% responsible for the accuracy and scientific validity of the final output. AI-generated text must be critically verified against primary peer-reviewed literature. • Prohibited Use: Using AI to generate entire assignments, perform primary data analysis without disclosure, or bypass critical thinking components of the course is strictly prohibited and constitutes academic dishonesty.
ORGANISATION OF TEACHING *The mode and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, work placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artworks, etc.* *The student's study hours for each learning activity are stated, as well as the hours of independent study, according to the principles of the ECTS.*	

Activity	***Semester workload***
Lectures (Synchronous distance learning - 3h/week)	39
Case-study seminars / Q&A (Synchronous distance learning - 1h/week)	13
Independent study of asynchronous modules & digital content	30
Study and analysis of bibliography	28
Preparation and completion of Online Quizzes (3)	12

	Case Study Assignments (2)	14
	Final Project Development (Clinical trial design / Dossier)	14
	Course total	**150**

STUDENT ASSESSMENT

Description of the assessment method

Language of assessment, methods of assessment, formative or summative assessment, multiple choice questions test, short answer questions, essay questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory assignment, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

Language of assessment: English

Methods of assessment:
The assessment is summative and aims to evaluate the student's ability to integrate nutritional biochemistry with clinical and regulatory applications:

- Online Quizzes (30%): Three scheduled quizzes throughout the semester consisting of multiple-choice and short-answer questions. These assess the comprehension of core concepts in human metabolism and bioactive compounds.
- Case Study Assignments (20%): Two practical assignments (10% each) where students analyze real-world data, such as metabolic indices (CGM data) or body composition reports, to provide evidence-based nutritional recommendations.
- Final Project (35%): A comprehensive project where students either design a clinical trial for a specific nutraceutical ingredient or prepare a health claim dossier following EFSA/FDA guidelines. This evaluates advanced research synthesis and regulatory knowledge.
- Discussion Board Participation (15%): Ongoing evaluation of contributions to asynchronous forum prompts, focusing on the critical appraisal of current nutrition trends and primary literature.

Evaluation Criteria:

- Specifically defined criteria**:** Scoring rubrics are provided for the Case Studies and the Final Project, emphasizing scientific accuracy, methodology, and adherence to regulatory standards.

	• Accessibility: The grading scale, assessment dates, and rubrics are available on the Brightspace LMS from the start of the term. • Feedback: Students receive immediate automated feedback on quizzes and detailed instructor comments on written assignments and projects within two weeks.

5 RECOMMENDED BIBLIOGRAPHY

Suggested Textbooks:
Gropper, S.S., & Smith, J.L. Advanced Nutrition and Human Metabolism, Cengage, 2020.

- Wildman, R. Handbook of Nutraceuticals and Functional Foods, CRC Press, 2016.
- Holban, A.M., & Grumezescu, A.M. Nutraceuticals: Efficacy, Safety and Toxicity, Elsevier, 2018.
- Gibson, G.R. & Roberfroid, M. Handbook of Prebiotics, CRC Press, 2008.
- Kaur, C. & Kapoor, H.C. Antioxidants in Fruits and Vegetables: The Millennium's Health, CRC Press, 2001.

Related Scientific Journals

• Journal of Functional Foods
• Nutrients
• Food & Function
• Nutrition Research
• Phytotherapy Research

Reading List (key sources):
Core regulatory / guidance

- EFSA (2025). Botanicals. https://www.efsa.europa.eu/en/topics/topic/botanicals.
- EFSA (2021). *General scientific guidance for stakeholders on health claim applications.* (EFSA Journal 19:e06553).
- EFSA (2021). *Scientific & technical guidance for the preparation of applications for authorisation of health claims.*
- EFSA (2009). Guidance on Safety assessment of botanicals* and botanical preparations** intended for use as ingredients in food supplements. https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2009.1249
- FDA (2009; web last updated 2018). *Guidance for Industry: Evidence-Based Review System for the Scientific Evaluation of Health Claims (SSA & Qualified Health Claims).*
- FDA (2024). *Authorized Health Claims (SSA standard).* and *Qualified Health Claims* pages.
- FDA (2024). *Structure/Function Claims* page and *Small Entity Compliance Guide.*

Additional Readings:
- Selected papers from peer-reviewed scientific journals (posted on Brightspace/e-Class). A list of papers includes:

1. Puri V, Nagpal M, Singh I, Singh M, Dhingra GA, Huanbutta K, Dheer D, Sharma A, Sangnim T. A Comprehensive Review on Nutraceuticals: Therapy Support and Formulation Challenges. Nutrients. 2022; 14(21):4637. https://doi.org/10.3390/nu14214637
2. Vamanu E, Dinu LD. In Vitro Modulation Processes, Prebiotic vs. Postbiotic, of Microbiota Pattern: A Preliminary Study. Nutraceuticals. 2025; 5(4):30. https://doi.org/10.3390/nutraceuticals5040030
3. Mendoza-Barajas UA, Vázquez-Ontiveros ME, Félix-Medina JV, Velarde-Barraza R, Grimaldi-Olivas JC, Badilla-Medina CN, Amillano-Cisneros JM, Quintero-Soto MF. Systematic Purification of Peptides with In Vitro Antioxidant, Antihyperglycemic, Anti-Obesity, and Antidiabetic Potential Released from Sesame Byproduct Proteins. Nutraceuticals. 2025; 5(3):23. https://doi.org/10.3390/nutraceuticals5030023
4. Crupi P, Faienza MF, Naeem MY, Corbo F, Clodoveo ML, Muraglia M. Overview of the Potential Beneficial Effects of Carotenoids on Consumer Health and Well-Being. Antioxidants (Basel). 2023;12(5):1069. https://doi.org/10.3390/antiox12051069
5. Rathod NB, Elabed N, Punia S, Ozogul F, Kim S-K, Rocha JM. Recent Developments in Polyphenol Applications on Human Health: A Review with Current Knowledge. Plants. 2023; 12(6):1217. https://doi.org/10.3390/plants12061217
6. Fekete M, Lehoczki A, Kryczyk-Poprawa A, Zábó V, Varga JT, Bálint M, Fazekas-Pongor V, Csípő T, Rząsa-Duran E, Varga P. Functional Foods in Modern Nutrition Science: Mechanisms, Evidence, and Public Health Implications. Nutrients. 2025; 17(13):2153. https://doi.org/10.3390/nu17132153
7. Brouns F, Bjorck I, Frayn KN, Gibbs AL, Lang V, Slama G, Wolever TM. Glycaemic index methodology. Nutr Res Rev. 2005;18(1):145-71. https://doi.org/10.1079/NRR2005100
8. Jenkins DJA, Dehghan M, Mante A, et al. Glycemic Index, Glycemic Load, and Cardiovascular Disease and Mortality. N Eng J Med. 2021; 384(14):1312-1322. https://doi.org/10.1056/NEJMoa2007123
9. Nasser A, Maha A, Syed AH, Nada AA, Cid RG, Sheikha AH, Saud MJ. Herbs and spices as functional food ingredients: A comprehensive review of their therapeutic properties, antioxidant and antimicrobial activities, and applications in food preservation. Journal of Functional Foods. 2025; 129:106882. https://doi.org/10.1016/j.jff.2025.106882
10. Hasler CM. Functional Foods: Benefits, Concerns and Challenges—A Position Paper from the American Council on Science and Health. The Journal of Nutrition. 2002; 132(12):3772 – 3781. https://doi.org/10.1093/jn/132.12.3772
11. Pirro M, Vetrani C, Bianchi C, Mannarino MR, Bernini F, Rivellese AA. Joint position statement on "Nutraceuticals for the treatment of hypercholesterolemia" of the Italian Society of Diabetology (SID) and of the Italian Society for the Study of Arteriosclerosis (SISA). Nutr Metab Cardiovasc Dis. 2017;27(1):2-17. https://doi.org/10.1016/j.numecd.2016.11.122
12. Papakonstantinou E, Oikonomou C, Nychas G, Dimitriadis GD. Effects of Diet, Lifestyle, Chrononutrition and Alternative Dietary Interventions on Postprandial Glycemia and Insulin Resistance. Nutrients. 2022;14(4):823. https://doi.org/10.3390/nu14040823
13. Cadar E, Popescu A, Dragan A-M-L, Pesterau A-M, Pascale C, Anuta V, Prasacu I, Velescu BS, Tomescu CL, Bogdan-Andreescu CF, et al. Bioactive Compounds of Marine Algae and Their Potential Health and Nutraceutical Applications: A Review. *Marine Drugs*. 2025; 23(4):152. https://doi.org/10.3390/md23040152