**COURSE OF STUDY:** *Master's degree in Innovation DEvelopment In Agrifood Systems (IDEAS) (LM69)*

**ACADEMIC YEAR***: 2023/24*

**ACADEMIC SUBJECT:** *Waste biorefinery (Module of I.C. "Eco-friendly technologies for biomass recycling" - 9 ECTS)*

| **General information** | |
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| Year of the course | *2nd year* |
| Academic calendar (starting and ending date) | *1st semester (from 16/10/2023 to 26/01/2024)*<br>*(interruption from 11/12/2023 to 20/12/2023 for intermediate assessment test)* |
| Credits (CFU/ETCS): | 3 |
| SSD | *Agricultural chemistry (AGR/13)* |
| Language | *English* |
| Mode of attendance | *Not compulsory, but recommended* |

| **Professor/ Lecturer** | |
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| Name and Surname | Concetta Eliana Gattullo |
| E-mail | concettaeliana.gattullo@uniba.it |
| Telephone | 0805442852 |
| Department and address | *DIP. DISSPA – University of Bari "Aldo Moro"* |
| Virtual room | *Microsoft Teams class code: 5yshcjf* |
| Office Hours (and modalities: e.g., by appointment, on line, etc.) | From Monday to Friday, by appointment |

| **Work schedule** | | | |
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| **Hours** | | | |
| Total | Lectures | Hands-on (laboratory, workshops, working groups, seminars, field trips) | Out-of-class study hours/ Self-study hours |
| *75* | *16* | *14* | *45* |
| **CFU/ETC** | | | |
| *3* | *2* | *1* | |

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| **Learning Objectives** | *The aim of the course is the search for new experimental approaches capable of sustainably transforming waste biomass deriving from different agro-food activities into products with high added value. The skills acquired by students will allow them to respond to specific technical needs and socio-economic issues of private and public operators in the biorefinery sector.* |
| **Course prerequisites** | *Knowledges requested for the admission to the Master course.* |

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| **Teaching strategies** | Course topics will be covered with the aid of Power Point presentations, didactic visits to local biorefineries, and seminars. The didactic material used for lectures will be available for students on Microsoft Teams. |
| **Expected learning outcomes in terms of** | The expected learning outcomes in terms of knowledge, skills and abilities are indicated for each Dublin Descriptor (DD) in accordance with the didactic regulation of the study course. |

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| **Knowledge and understanding on** | **DD1: Knowledge and understanding**<br>○ Knowledge and understanding of the main transformation processes able to sustainably convert side-products into added value products. |
| **Applying knowledge and understanding on:** | **DD2: Applying knowledge and understanding**<br>○ Ability to select the most suitable transformation processes on the bases of the feedstocks available and of the products to be obtained, in accordance with the principles of sustainability.<br>○ Capacity of design biorefinery systems able to produce chemicals and materials useful for the agricultural and environmental field. |
| **Soft skills** | **DD3: Critical and judgmental skills**<br>○ Ability to analyse and overcome the potential drawbacks occurring during the searching of suitable feedstocks and their processing.<br>○ Ability to identify the most useful and easily marketable end-products.<br><br>**DD4: Ability to communicate the knowledge acquired**<br>○ At the end of the course, the student should be able to communicate the knowledge acquired during the course with a technical and scientific language.<br><br>**DD5: Ability to continue learning autonomously during the life**<br>○ At the end of the course, the student should be able to understand and critically elaborate the course contents, and to relate the knowledge acquired to the educational background gained during the university path. |
| ***Syllabus*** | |
| **Content knowledge** | • The framework of biorefinery: sustainable development, circular economy, European Green Deal, goals of Agenda 2030.<br>• Definition of biorefinery; classification of biorefineries of different generations, definition of advanced biorefinery; distribution and typology of biorefineries in Europe and all over the World.<br>• Types of feedstocks, focusing especially on residues and side-products of agricultural, agro-industrial, and municipal activities.<br>• Overview of the main transformation processes: biochemical, chemical, thermochemical, and mechanical transformation processes.<br>• The products of biorefineries: fine chemicals, food and feed, bioplastics and polymers, energy, biofuels, fertilizers.<br>• Examples of biorefineries producing biostimulants, bioactive molecules against plant pathogens and parasites, food and feed components, preservatives and molecules for the synthesis of biofilms. |
| **Texts and readings** | • *Handbook of Waste Biorefinery (2022). E. Jacob-Lopes, L. Queiroz Zepka, M. Costa Deprà Eds. Springer.*<br>• *Biorefineries – Industrial Processes and Products, I volume (2006). Edited by B. Kamm, P. R. Gruber, and M. Kamm. Wiley.* |
| **Notes, additional materials** | Notes of lectures, as well as slides and other bibliographic materials will be provided by the Professor during the course. |
| **Repository** | All teaching material will be available to students on Microsoft Teams (code *5yshcjf*). |

| Assessment | |
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| Assessment methods | For students enrolled in the course year in which the course is taught, an intermediate oral test is scheduled. The result of this test contributes to the evaluation of the profitability examination and is valid for one academic year. The examination consists of an oral test on the topics developed during the theoretical and theoretical-practical lessons, as set out in the Degree Course Regulations (Article 4). |
| Assessment criteria | • *Knowledge and understanding*<br>  ○ To demonstrate a critical and in-depth understanding of the main transformation processes able to sustainably convert side-products into added value products.<br>• *Applying knowledge and understanding*<br>  ○ Ability to select the most suitable and sustainable transformation processes on the bases of the feedstocks available, in order to obtain chemicals and materials useful for the agricultural and environmental field.<br>• *Autonomy of judgment*<br>  ○ To demonstrate conscious autonomy of judgement with reference to the evaluation and interpretation of the potential drawbacks occurring during the biorefinery process, in order to overcome them.<br>• *Communicating knowledge and understanding*<br>  ○ Ability to use a technical-scientific language adequate for communicating the information related to the knowledge acquired.<br>• *Capacities to continue learning*<br>  ○ Ability to understand and critically elaborate the course contents, and to relate the knowledge acquired to the educational background gained during the university path. |
| Final exam and grading criteria | Assessment of the student's preparation is based on pre-established criteria, as detailed in the Didactic Regulation of IDEAS degree course.<br>For students who have taken the intermediate test, the assessment of the final examination is expressed considering the mark obtained in the intermediate test, not as an arithmetic mean but as a weighted weighting in relation to the syllabus covered by the exoneration test. In awarding the final mark, account will be taken of the theoretical and practical knowledge acquired, the ability to apply this knowledge, independent judgement, communication skills and the ability to integrate the knowledge acquired into a work project. |
| **Further information** | |