

# Syllabus

## *Course Description*

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| Course Title                   | Processes and Technologies in Wine Production                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Course Code                    | 44762                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Course Title Additional        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Scientific-Disciplinary Sector |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Language                       | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Degree Course                  | Master in Food Sciences for Innovation and Authenticity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Other Degree Courses (Loaned)  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Lecturers                      | dr. Giovanni Carabin,<br>Giovanni.Carabin@unibz.it<br><a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35346">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35346</a><br>Prof. Andrea Polo,<br>Andrea.Polo@unibz.it<br><a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/36646">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/36646</a> |
| Teaching Assistant             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Semester                       | First semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Course Year/s                  | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| CP                             | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Teaching Hours                 | 36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Lab Hours                      | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Individual Study Hours         | 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Planned Office Hours           | 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Contents Summary               | Wine processing equipment (4CP - module 44762A):<br>The course aims to provide students with the theoretical and practical fundamentals of the wine production chain, focusing on the process engineering, technology, and organizational aspects of winery equipment and plant design. Particular emphasis is placed on the conceptual and analytical tools required to design and optimize an industrial wine production line, including:                                                                                                                    |

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|                      | <ul style="list-style-type: none"> <li>• Basic principles of unit operations, material and energy flows and balancing, heat transfer, and fluid transport in winemaking.</li> <li>• Operating principles and selection criteria for key processing machinery.</li> <li>• Facility layout, hygienic design considerations and cost estimation.</li> </ul> <p>Bridging scientific principles with real-world applications, the course combines lectures with hands-on computational exercises and case studies. Working in groups, students will develop core technical expertise alongside essential skills in scientific reporting and communication.</p> <p>Fermentation Processes for the Production of Mountain Wines (2 CP - module 44762B):</p> <p>Principles of wine microbiology and fermentation. Role of yeasts and lactic acid bacteria in alcoholic and malolactic fermentation. Microbial ecology, starter culture selection, fermentation management, and prevention of spoilage. Case studies on mountain wines. Practical laboratory activities.</p>                                                                                                                                                                               |
| <b>Course Topics</b> | <p>Wine processing equipment (4CP - module 44762A):</p> <ul style="list-style-type: none"> <li>- Introduction and Basics in Wine Process Design: Unit operations, design tools, system configurations and line balancing, plant layout design and sanitary standards, economic evaluation.</li> <li>- Fluid Transportation: Hydraulic components, fundamentals of system sizing.</li> <li>- Fruit Receiving and Processing: Receiving and sorting, destemming and crushing, drainers, presses, clarification.</li> <li>- Fermenters and Heat Transfer: Basics of heat transfer, heat exchangers, fermenter design and operation.</li> <li>- Downstream Processing &amp; Packaging: Filtration technologies, bottling and packaging lines.</li> </ul> <p>Fermentation Processes for the Production of Mountain Wines (2 CP - module 44762B):</p> <p>Ecophysiology and metabolism of wine yeasts. Yeast selection and their use in wine making. Technology and sensory features of selected yeasts. Lactic acid bacteria and malo-lactic acid fermentation. Selection of lactic acid bacteria and their use in wine making. Effects of the mountain environment on the overall quality of wines. Evolution of microbial communities during wine</p> |

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|                                                              | fermentation. Control of wine fermentation. Practical laboratory experiments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Keywords</b>                                              | Winery Equipment, Plant Design, Wine Production, Wine Microbiology, Fermentation Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Recommended Prerequisites</b>                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Propaedeutic Courses</b>                                  | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Teaching Format</b>                                       | The course consists of lectures where the topics are presented by the professor. Course topics are presented by using electronic slides. Presentations, scientific papers and bibliography used during the course are provided to students.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Mandatory Attendance</b>                                  | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Specific Educational Objectives and Learning Outcomes</b> | <p>Deep understanding of the technological, microbiological, biochemical, chemical, and physical principles underlying food transformation processes and responsible for food product degradation, ensuring their stability and prolonging their shelf life. These knowledge areas will be developed through an educational program that integrates theoretical teaching activities with practical activities, such as laboratory exercises, computer simulations, simulations of food processes using pilot plants, and company visits.</p> <p>Ability to manage the technological, microbiological, biochemical, chemical, and physical processes that drive food transformation and the main issues related to the stability and shelf life of food products.</p> <p>Ability to plan and develop analytical techniques, innovative products, and processes using a multidisciplinary approach, with particular attention to local food productions.</p> <p>Independent judgement is developed through a training programme designed to stimulate critical analysis in students. This includes the use of case studies, simulations using spreadsheets and videos, the reading and critical discussion of scientific articles, as well as specialist seminars held by experts in the food sector. The assessment of the independent judgement acquired by students is entrusted to the individual teachers responsible for the training activities, who will assess it through oral and/or written reports on specific topics and/or through exams.</p> <p>Use of the English language, both written and spoken, at a B2 level, with a command of technical and scientific vocabulary related</p> |

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|                                                                                 | <p>to food science.</p> <p>Structure and draft scientific and technical documentation describing project activities.</p> <p>Interact and collaborate in the design and development of products and processes with peers and industry experts.</p> <p>The degree course provides graduates with the cognitive skills, logical tools and familiarity with new information technologies necessary to ensure continuous updating of knowledge, both in their specific professional field and in the field of scientific research.</p>                                                                                                                                                                                                                                                                      |
| <b>Specific Educational Objectives and Learning Outcomes (additional info.)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Assessment</b>                                                               | Oral exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Evaluation Criteria</b>                                                      | The assessment consists of an oral exam, evaluating students' theoretical knowledge, practical application, and presentation skills through method discussions, case study analyses, and topic integration. The final score is the weighted average of the two modules.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Required Readings</b>                                                        | Slides of lesson, papers and key notes provided by the lecturer in the E-learning platform of UNIBZ.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Supplementary Readings</b>                                                   | <p>Wine processing equipment (4CP - module 44762A):</p> <ul style="list-style-type: none"> <li>- Block, D.E., &amp; Miller, K.V. (2021). Unit Operations in Winery, Brewery, and Distillery Design (1st ed.). CRC Press.</li> </ul> <p>Fermentation Processes for the Production of Mountain Wines (2 CP - module 44762B):</p> <ul style="list-style-type: none"> <li>- Wine Microbiology: Practical Applications and Procedures, Eds. K.C. Fugelsang and C.G. Edwards, Springer.</li> <li>- Microbiologia del vino, M. Vincenzini, P. Romano, G.A. Farris, Casa Editrice Ambrosiana.</li> <li>- Handbook of Enology, Volume I. Ribéreau-Gayon P., Dubourdieu B., Donéche B., Lonvaud A., Wiley.</li> <li>- The Yeasts, Volume 5: Yeast Technology. Rose A., Harrison J.S., Academic Press.</li> </ul> |

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|                                             | <p>- Biology of Microorganisms on Grapes, in Must and in Wine. König H., Uden G., Frohlich J., Springer.</p> <p>- Brewing Microbiology. Priest F.G., Campbell I., Elsevier Applied Science</p> |
| <b>Further Information</b>                  |                                                                                                                                                                                                |
| <b>Sustainable Development Goals (SDGs)</b> | Good health and well-being, Responsible consumption and production, Industry, innovation and infrastructure, Decent work and economic growth                                                   |

## *Course Module*

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| <b>Course Constituent Title</b>       | Wine processing equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Code</b>                    | 44762A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Scientific-Disciplinary Sector</b> | AGRI-04/B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Language</b>                       | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Lecturers</b>                      | <p>dr. Giovanni Carabin,<br/> Giovanni.Carabin@unibz.it<br/> <a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35346">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/35346</a></p>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Teaching Assistant</b>             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Semester</b>                       | First semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>CP</b>                             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Responsible Lecturer</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Teaching Hours</b>                 | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Lab Hours</b>                      | 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Individual Study Hours</b>         | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Planned Office Hours</b>           | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Contents Summary</b>               | <p>The course aims to provide students with the theoretical and practical fundamentals of the wine production chain, focusing on the process engineering, technology, and organizational aspects of winery equipment and plant design. Particular emphasis is placed on the conceptual and analytical tools required to design and optimize an industrial wine production line, including:</p> <ul style="list-style-type: none"> <li>• Basic principles of unit operations, material and energy flows and balancing, heat transfer, and fluid transport in winemaking.</li> <li>• Operating principles and selection criteria for key processing</li> </ul> |

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|                               | <p>machinery.</p> <ul style="list-style-type: none"> <li>• Facility layout, hygienic design considerations and cost estimation.</li> </ul> <p>Bridging scientific principles with real-world applications, the course combines lectures with hands-on computational exercises and case studies. Working in groups, students will develop core technical expertise alongside essential skills in scientific reporting and communication.</p>                                                                                                                                                                                                                                                  |
| <b>Course Topics</b>          | <ul style="list-style-type: none"> <li>- Introduction and Basics in Wine Process Design: Unit operations, design tools, system configurations and line balancing, plant layout design and sanitary standards, economic evaluation.</li> <li>- Fluid Transportation: Hydraulic components, fundamentals of system sizing.</li> <li>- Fruit Receiving and Processing: Receiving and sorting, destemming and crushing, drainers, presses, clarification.</li> <li>- Fermenters and Heat Transfer: Basics of heat transfer, heat exchangers, fermenter design and operation.</li> <li>- Downstream Processing &amp; Packaging: Filtration technologies, bottling and packaging lines.</li> </ul> |
| <b>Teaching Format</b>        | <p>The course consists of lectures where the topics are presented by the professor. Course topics are presented by using electronic slides. Presentations, scientific papers and bibliography used during the course are provided to students.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Required Readings</b>      | <p>Slides of lesson, papers and key notes provided by the lecturer in the E-learning platform of UNIBZ.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Supplementary Readings</b> | <p>Block, D.E., &amp; Miller, K.V. (2021). Unit Operations in Winery, Brewery, and Distillery Design (1st ed.). CRC Press.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## *Course Module*

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| <b>Course Constituent Title</b>       | Fermentation processes for the production of mountain wines                                                                                                                                                   |
| <b>Course Code</b>                    | 44762B                                                                                                                                                                                                        |
| <b>Scientific-Disciplinary Sector</b> | AGRI-08/A                                                                                                                                                                                                     |
| <b>Language</b>                       | English                                                                                                                                                                                                       |
| <b>Lecturers</b>                      | <p>Prof. Andrea Polo,<br/> Andrea.Polo@unibz.it<br/> <a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-">https://www.unibz.it/en/faculties/agricultural-environmental-food-</a> </p> |

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|                               | sciences/academic-staff/person/36646                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Teaching Assistant</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Semester</b>               | First semester                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>CP</b>                     | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Responsible Lecturer</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Teaching Hours</b>         | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Lab Hours</b>              | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Individual Study Hours</b> | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Planned Office Hours</b>   | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Contents Summary</b>       | Principles of wine microbiology and fermentation. Role of yeasts and lactic acid bacteria in alcoholic and malolactic fermentation. Microbial ecology, starter culture selection, fermentation management, and prevention of spoilage. Case studies on mountain wines. Practical laboratory activities.                                                                                                                                                                  |
| <b>Course Topics</b>          | Ecophysiology and metabolism of wine yeasts. Yeast selection and their use in wine making. Technology and sensory features of selected yeasts. Lactic acid bacteria and malo-lactic acid fermentation. Selection of lactic acid bacteria and their use in wine making. Effects of the mountain environment on the overall quality of wines. Evolution of microbial communities during wine fermentation. Control of wine fermentation. Practical laboratory experiments. |
| <b>Teaching Format</b>        | The course consists of lectures where the topics are presented by the professor. Course topics are presented by using electronic slides. Presentations, scientific papers and bibliography used during the course are provided to students.                                                                                                                                                                                                                              |
| <b>Required Readings</b>      | Slides of lesson, papers and key notes provided by the lecturer in the E-learning platform of UNIBZ.                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Supplementary Readings</b> | <p>Wine Microbiology: Practical Applications and Procedures, Eds. K.C. Fugelsang and C.G. Edwards, Springer.</p> <p>Microbiologia del vino, M. Vincenzini, P. Romano, G.A. Farris, Casa Editrice Ambrosiana.</p> <p>Handbook of Enology, Volume I. Ribéreau-Gayon P., Dubourdieu B., Donéche B., Lonvaud A., Wiley.</p>                                                                                                                                                  |

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|  | <p>The Yeasts, Volume 5: Yeast Technology. Rose A., Harrison J.S., Academic Press.</p> <p>Biology of Microorganisms on Grapes, in Must and in Wine. König H., Uden G., Frohlich J., Springer.</p> <p>Brewing Microbiology. Priest F.G., Campbell I., Elsevier Applied Science</p> |
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