



COURSE GUIDE

Academic year 2025

FOREWORD

The Master of Science in Vine, Wine and Terroir Management seeks to place emphasis on the fact that the wine sector has three main areas of activity: grape growing, wine making and wine business management. By dedicating one semester to each area of activity, students will be familiar with the various elements throughout the wine supply chain, from soil to consumer. The general objective is to make sure students acquire in-depth scientific knowledge and hands-on technical skills.

Consistent with this framework, the academic content is centred on the terroir concept, which can be defined as a well-defined bounded area where natural and constructed local resources give place to a product with an embedded and local identity. Throughout the

courses, this concept will be expanded and discussed as a productive and localized cultural system, creating economic, ecological and social value within its territorial setting.

The objective of this course guide is to outline the content, objectives and learning outcomes of each module, helping students to understand how each course contributes to their knowledge and skills in the wine sector.

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and Terroir Management
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PROGRAM STRUCTURE

MSc Vintage			ECTS Credits
Semester 1	Wine Quality		30
	Module 1.1	Berry development and ripening	5
	Module 1.2	Winemaking processes and techniques	8
	Module 1.3	Wine microbiology and analysis	5
	Module 1.4	Advanced wine science	5
	Module 1.5	Wine sensory analysis	7
Semester 2	Sustainable Viticulture		30
	Module 2.1	Management of organic viticulture	5
	Module 2.2	Automation and robotics in viticulture	6
	Module 2.3	Grape pest and disease management	5
	Module 2.4	Grapevine eco-physiology	7
	Module 2.5	Grape varieties and wine geography	7
Semester 3	Wine Identity		30
	Module 3.1	Territorial identity of terroir wines	7
	Module 3.2	WSET level 3 award wines	6
	Module 3.3	Applied wine marketing	6
	Module 3.4	Wine economics and business management	6
	Module 3.5	Applied research project	5
Semester 4	Master Thesis		30
	Module 4	Professional research project	30

A photograph of a wine cellar with several large wooden barrels lined up. The barrels are made of light-colored wood with dark metal hoops and have circular metal ports. A red hose runs along the floor in the foreground. The cellar has a vaulted ceiling and warm lighting.

SEMESTER 1

WINE QUALITY

FIRST SEMESTER OVERVIEW

WINE QUALITY

Wine quality is the outcome of a complex interaction between natural, biological and human factors, varying strongly over time and geographical areas. It is therefore the result of many components, ranging from the role of the soil, climate or variety to vineyard or cellar management practices and techniques, all taking place within a specific social and economic background. With increasing global competition, wine quality has become central in retaining consumers and gaining new business, creating a reliable image in the market. Indeed, while wine consumption is growing, especially among non-producing countries, wine production still continues to outpace consumption, resulting in an oversupply of wine and therefore a demand for winegrowers to be committed to quality. Wine quality remains neither easy to define nor measure as it is strongly subjective in nature. In general, a quality wine refers to the absence of perceptible flaws in colour or flavour. Yet, it is likewise assessed with its positives, for example, the presence of desirable characteristics for a particular style, the duration and complexity of aromas, the conformity to a specific place, etc. The first semester focusses on this concept of wine quality, from berry formation to wine conservation, including sensory analysis. The first module is founded on the fundamentals of berry development and ripening. From here, the second and third modules will cover managing wine fermentation and production, as well as wine microbiology and analysis. The courses of these modules are based on the science and technology of winemaking. The modules four and five are based on a comprehensive exploration of the chemical, sensory and practical dimensions of winemaking, including wine statistics to identify, measure and interpret wine quality. Students will not only visit different Portuguese wineries and wine companies, but also spent one week in Spain, exploring famous wine regions like Rioja and Castilla y León.

MSc Vintage		Universidade de Trás-os-Montes e Alto Douro in Vila Real, Portugal.	ECTS Credits
Semester 1	Wine Quality		30
	Module 1.1	Berry development and ripening	5
	Module 1.2	Winemaking processes and techniques	8
	Module 1.3	Wine microbiology and analysis	5
	Module 1.4	Advanced wine science	5
	Module 1.5	Wine sensory analysis	7 ¹

¹ This module includes a study trip to Spain and several daily visits in Portugal.

MODULE 1.1 BERRY DEVELOPMENT AND RIPENING

SCHEDULE & LOCATION

First academic year, first semester at the *Universidade de Trás-os-Montes e Alto Douro* (UTAD) in Vila Real, Portugal.

DESCRIPTION

This module comprises the principles on berry development stages, from insights in grapevine structure and functions to fruit formation and composition. It underpins the importance of closely following the berry ripening process as final wine quality and style are much dependent on grape quality at harvest. Practical classes will allow for performing field and laboratory assessments.

LEARNING OUTCOMES

- 1) Describe the anatomy of the grapevine and its growing cycle with knowledge in ampelography.
- 2) Report the physiological processes and environmental needs underlying vine performance for wine production.
- 3) Explain the berry development stages and compositional changes during fruit ripening.
- 4) Execute the principal berry composition analysis and identify potential wine quality and style.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Introduction: Introduction to wine sector and general viticulture; Systematic description of vine anatomy and annual growing cycle; Principals of ampelography; Grapevine cultivars; Different approaches to vine growing, from conventional to biodynamic farming.	Péter Bodor-Pesti and Zsuzsanna Varga (MATE).	15 hours
Grapevine structure and functions: Physiological processes and environmental factors that affect grapevine physiology; Grapevine varieties and heat requirements.	Etienne Neethling (ESA); Lia Dinis and Cátia Brito (UTAD).	10 hours
Fruit formation and composition: Flowering mechanisms; Berry growth and development; Berry composition and parts, principal compounds and changes during ripening.	Lia Dinis and Sara Bernardo (UTAD).	5 hours
Practical training: Field techniques in bio productivity and photosynthesis under field conditions; Performing laboratory berry composition analysis and berry sensory assessments.	Moutinho Pereira, Carlos Manuel Correia and Virgílio Falco (UTAD).	9 hours
Vineyard visits: Experimental vineyards of Symington Family Estates at Quinta do Bomfim. Vineyards of Quinta do Casal da Granja to produce sweet wines.	Fernando Alves (Symington Family Estates); Rui Soares (Real Companhia Velha).	6 hours
Invited masterclasses: Douro Demarcated region, a heritage to preserve, innovate and enhance; Making sense of maturity; Regenerative viticulture; How do soils and climate shape wines?	Helena Pina (UPorto); Antonio Graça (Sogrape); Jamie Goode.	10 hours

PREREQUISITES

None

CREDITS

5 ECTS with 55 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4

The module consists of classroom lectures and discussions completed by vineyard visits and practical training. The teaching and evaluation language is English.

COURSE COORDINATOR

Aureliano Malheiro (UTAD): amalheir@utad.pt

SUGGESTED READINGS

- Creasy GL, Creasy LL (2009) *Grapes*, CABI, Wallingford, Oxfordshire, UK.
- Goode J (2021) *Wine science: The Application of Science in Wine, from Vine to Glass*, 3rd ed., University of California Press, US.
- Iland P, Dry P, Proffitt T, Tyerman S (2012). *The grapevine: from the science to the practice of growing vines for wine*. Campbelltown: Patrick Iland Wine Promotions.
- Jackson RS (2014) *Wine science: principles and applications*, Academic Press, New York, US.
- Keller M (2010) *The science of grapevines: Anatomy and physiology*, Academic Press, New York, US.
- Neethling E, Barbeau G, Coulon-Leroy C, Quénot H (2019). Spatial complexity and temporal dynamics in viticulture: a review of climate-driven scales. *Agric. For. Meteorol.*, 276-277.
- Parker AK, García de Cortázar I, Chuine I, Barbeau G, Bois B, Boursiquot JM, Cahurel JY, Clavierie M, Dufourcq T, Génys L, et al. (2013) Classification of varieties for their timing of flowering and veraison using a modelling approach. A case study for the grapevine species *Vitis vinifera* L. *Agric. For. Meteorol.*, 180, 249–264
- Parker AK, García de Cortázar-Atauri I, Génys L, Spring JL, Destrac A, et al. (2020) Temperature-based grapevine sugar ripeness modelling for a wide range of *Vitis vinifera* L. cultivars. *Agric. For. Meteorol.*, 285–286.
- Ribéreau-Gayon P, Dubourdieu D, Donèche B, Lonvaud A (2000) *Handbook of Enology, The Microbiology of Wine and Vinifications*, Vol. I, Wiley, West Sussex, England
- Van Leeuwen C, Seguin G (2006) The concept of terroir in viticulture. *J. Wine Res*, 17, 1–10.
- White RE (2009) *Understanding Vineyard Soil*, Oxford University Press, New York, USA.

Additional scientific and technical reading references will be set during the course.

MODULE 1.2 WINEMAKING PROCESSES AND TECHNIQUES

SCHEDULE & LOCATION

First academic year, first semester at the *Universidade de Trás-os-Montes e Alto Douro* (UTAD) in Vila Real, Portugal.

DESCRIPTION

This module covers the winemaking processes and techniques for still and special wines. It explores the pre- to post fermentation aspects, carefully considering the various management operations and critical decisions of making commercial wine. The courses place emphasis on alcoholic and malolactic fermentation, phenolic and flavour compounds including sulphur dioxide management and the effects of oxidation. It further provides the opportunity to gain first-hand experience in winemaking from harvest reception to managing fermentation. Students are placed in commercial wineries to work closely with the winemaker, acquiring exposure to the traditional methods shaping Portuguese wine quality and identity.

LEARNING OUTCOMES

- 1) Describe the overall wine making operations and organisational management of a commercial winery.
- 2) Operate with a basic level of competence the winemaking equipment and recognise which type of equipment is most appropriate for a given purpose.
- 3) Implement berry ripening assessments and execute wine analysis during fermentation and post-fermentation operations.
- 4) Discuss how the different winemaking practices and techniques, from harvest reception to bottling, influence final wine quality and style.
- 5) Hold a broad and up-to-date understanding of complex issues in winemaking around the world.

COURSE CONTENT

TOPICS	TEACHERS	TEACHING
Winemaking options and decision making for still wines: Basic principles of white, rosé and red winemaking; Wine stabilization and clarification processes; Wine chemistry, pH and acidity; Alcoholic and malolactic fermentation; Sulphur dioxide management and effects of oxidation; Phenolic compounds, maceration and extraction; Art of blending.	Tiago Alves de Sousa (Quinta da Gaivosa)	20 Hours
Winemaking options and decision making for special wines: Production of sparkling wine, the examples of Champagne, Cava and Prosecco; Production of fortified wines, the example of Port. Production of sweet wines, the examples of Tokaji and Sauternes.	Daniela Fracassetti (UNIMI); Tiago Alves de Sousa (Quinta da Gaivosa); Annamária Sólyom-Leskó (MATE).	9 Hours
Cellar visits: Quinta de Nápoles (Niepoort wines); Aveleda wines; Murganheira sparkling wines.	Luís Pedro (Niepoort); Diogo Campilho (Aveleda); Marta Lourenço (Murganheira).	9 Hours
Work based training: Berry sampling, grape harvest, harvest reception and proceSSION grapes, preparing and cleaning	Portuguese winemakers	2-3 weeks

cellar equipment, making wine (adding yeast, pressing, pumping over, density readings, etc.) and wine analysis.

Invited masterclasses: Flor wines, the example of Sherry with Bodega Tradicion; Extraction and maceration; Whole cluster and carbonic maceration; Evolution of élevage and the art of blending; Comparing the winemaking practices of Tokaji and Sauternes.

Eduardo Davis
(Bodegas Tradicion);
Jamie Goode; László
Mészáros (Disznókő)

12 Hours

PREREQUISITES

None

CREDITS

8 ECTS with 50 teaching hours and 2 to 3 weeks of work-based learning.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	50%	1,4,5
Written assignment	50%	1,2,3,4,5

The module consists of classroom lectures and discussions in addition to a practical working experience in a Portuguese winery. The teaching and evaluation language is English.

COURSE COORDINATORS

Etienne Neethling (ESA): e.neethling@groupe-esa.com

Tiago Alves de Sousa (UTAD): tiago@alvesdesousa.com

SUGGESTED READINGS

- Bird D (2007) Understanding Wine Technology, DBQ Publishing, Great Britain.
- Goode J (2021) Wine science: The Application of Science in Wine, from Vine to Glass, 3rd ed., University of California Press, US.
- Iland P, Grbin P, Grinbergs M, Schmidtke L, Soden A (2007) Microbiological analysis of grape and wine: techniques and concepts. Campbelltown: Patrick Iland Wine Promotions.
- Jackson RS (2014) Wine science: principles and applications, Academic Press, New York, US.
- Moreno-Arribas MV and Polo MC (2008). Wine chemistry and biochemistry. New York, NY: Springer.
- Ribéreau-Gayon P, Dubourdieu D, Donèche B, Lonvaud A (2006) Handbook of Enology, The Microbiology of Wine and Vinifications, Vol. 1, 2nd ed., Wiley, West Sussex, England.
- Ribéreau-Gayon P, Glories Y, Maujean A, Dubourdieu D (2006) Handbook of Enology, The chemistry of wine stabilization and treatments volume, Vol. 2, 2nd ed., Wiley, West Sussex, England.

Additional scientific and technical reading references will be set during the course.

MODULE 1.3 WINE MICROBIOLOGY AND ANALYSIS

SCHEDULE & LOCATION

First academic year, first semester at the *Universidade de Trás-os-Montes e Alto Douro* (UTAD) in Vila Real, Portugal.

DESCRIPTION

This course presents the knowledge of microorganisms of oenological importance, their biodiversity, physiology and metabolism to understand, control and optimize their activity according to the raw material, desired wine characteristics and winemaking procedures. Students acquire scientific knowledge and practical skills that will enable them to identify and solve problems under real winery conditions. This course also includes the methods of wine analysis essential for quality wine production, consisting of practical laboratory lessons to apply different wine analysis methods. Focus will be on equipment and procedures suitable for wineries, including specific spectrophotometric techniques of wine analysis.

LEARNING OUTCOMES

- 1) List and describe the important microorganisms encountered during wine production
- 2) Understand the factors controlling microbial growth during winemaking - fungi (yeast and moulds) and bacteria (lactic acid bacteria – LAB and acetic acid bacteria – AAB)
- 3) Understand the strategies (spontaneous vs inoculated) for conducting wine fermentation
- 4) Explain the role of yeast and LAB in the various stages of the process of wine production.
- 5) Understand and apply the main methods of wine analysis.
- 6) Become familiar with the proper laboratory techniques.

COURSE CONTENT

TOPICS	TEACHERS	TEACHING
Introduction: Microbial groups of interest in oenology (Fungi and Bacteria).	Alexandra Mendes Ferreira (UTAD)	4 Hours
Wine Yeasts: General characteristics of wine yeasts; Ecology and dynamics along fermentation; Spontaneous vs inoculated fermentations; Yeasts traits for use in winemaking industry.	Alexandra Mendes Ferreira (UTAD)	4 Hours
Wine Fermentation: Sugars and nitrogenous compounds metabolism; Factors affecting growth and metabolism and impact on wine quality; Problematic fermentations; Yeast as spoilage agents; Evolution of organic acids during winemaking: the role of yeasts and lactic acid bacteria; Malolactic fermentation: control and management; Spoilage due to bacterial metabolism.	Alexandra Mendes Ferreira (UTAD)	12 Hours
Wine Analysis: Wine density and specific gravity at 20°C; Alcoholic strength by volume - direct measurement by ebulliometry; Alcoholic strength by volume - distillation and measurement of the alcoholic strength of the distillate by pycnometry; Total dry extract; Titrable acidity, volatile acidity, fixed acidity, and pH; Total phenolics by means of	Virgilio Falco (UTAD)	20 Hours

the Folin-Ciocalteu reagent; Total phenolics by spectral analysis; Calcium by atomic absorption spectrophotometry.

Invited masterclasses: Application of immobilized yeast cells in the winemaking industry; Biological strategies to reduce chemical inputs during winemaking; Wine microbiology in the XXI century: challenges old and new.	Filipe Centeno (Proenol); Ann Dumont and Marion Bastien (Lallemant); Antonio Graça (Sogrape)	12 Hours
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PREREQUISITES

None

CREDITS

5 ECTS with 52 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Written assignment	50%	1,2,3,4
Individual examination	50%	1,2,3,4,5,6

The module consists of face-to-face classroom lectures and discussions, in addition to practical laboratory lessons. The teaching and evaluation language is English.

COURSE COORDINATORS

Alexandra Mendes Ferreira (UTAD): anamf@utad.pt

Virgilio Falco (UTAD): vfalco@utad.pt

SUGGESTED READINGS

- Boulton RB, Singleton VL, Bisson LF, Kunkee RE (1996) Principles and practices of winemaking, Springer, New York.
- Fugelsang KC and Edwards CG (2007). Wine microbiology, practical applications and procedures, 2nd Edition, Springer, New York.
- Harvey D (2016) Analytical Chemistry 2.1. (freely at dpuadweb.depauw.edu/harvey_web/eTextProject/version_2.1.html)
- Iland P, Grbin P, Grinbergs M, Schmidtke L, Soden A (2007) Microbiological analysis of grape and wine: techniques and concepts. Campbelltown: Patrick Iland Wine Promotions.
- Jackson RS (2014) Wine science: principles and applications, Academic Press, New York, US.
- Moreno-Arribas MV and Polo MC (2008). Wine chemistry and biochemistry. New York, NY: Springer.
- Ribéreau-Gayon P, Dubourdieu D, Donèche B, Lonvaud A (2006) Handbook of Enology, The Microbiology of Wine and Vinifications, Vol. 1, 2nd ed., Wiley, West Sussex, England.

Additional scientific and technical reading references will be set during the course.

MODULE 1.4 ADVANCED WINE SCIENCE

SCHEDULE & LOCATION

First academic year, first semester at the *Universidade de Trás-os-Montes e Alto Douro* (UTAD) in Vila Real, Portugal.

DESCRIPTION

This curricular unit is meticulously crafted to provide students with an in-depth understanding of the intricate interactions between wood and wine composition, alongside a critical examination of the indispensable role played by cork in shaping wine quality. Through this course, students will embark on a comprehensive exploration encompassing the chemical, sensory, and practical dimensions inherent in winemaking.

LEARNING OUTCOMES

- 1) Demonstrate a deep understanding of the complex interactions between wood and wine composition, elucidating their effects on wine aging and quality.
- 2) Evaluate the role of cork in preserving wine integrity and its impact on sensory characteristics.
- 3) Apply theoretical knowledge to practical scenarios, such as selecting appropriate wood types for wine aging and mitigating cork-related quality issues.
- 4) Develop critical thinking skills to analyse and interpret scientific literature and experimental data pertaining to wood-wine interactions and cork influence.
- 5) Collaborate effectively in interdisciplinary contexts, integrating insights from chemistry, sensory science, and viticulture to optimize winemaking practices.

COURSE CONTENT

TOPICS	TEACHERS	TEACHING
Introduction to phenolic compounds: Overview of phenolic compounds; Sources of phenolics in grapes and their influence on wine composition; Importance of phenolics for wine quality; Mechanisms of colour formation.	Ana Novo Barros (UTAD)	4 Hours
Understanding enzymatic browning: Oxidation of phenolic compounds; Impact of enzymatic browning on wine quality; Strategies for controlling enzymatic browning.	Ana Novo Barros (UTAD)	4 Hours
Tannin-Protein interactions: Interactions between tannins and wine proteins; Effects of tannin-protein interactions on wine stability and sensory properties.	Ana Novo Barros (UTAD)	2 Hours
Antioxidant activity of phenolic compounds: Antioxidant mechanisms of phenolics; Importance of antioxidants in wine preservation; Evaluation of antioxidant capacity.	Ana Novo Barros (UTAD)	6 Hours
Wood and wine composition interactions: Chemical constituents of wood relevant to winemaking; Influence of wood species, origin, and treatment on wine aging; Extraction kinetics and transformation of wood-derived compounds during wine maturation; Impact of wood contact on wine flavour, aroma, and texture; Analytical techniques for assessing wood-wine interactions.	Ana Novo Barros (UTAD)	12 Hours

Effect of cork on wine quality: Anatomy and chemical composition of cork; Role of cork in wine bottle closures and aging; Positive and negative effects of cork contact on wine sensory attributes; Mechanisms of cork taint and its detection and prevention; Emerging trends in cork alternatives and their implications for wine quality.	Ana Novo Barros (UTAD)	12 Hours
Field visits: Visit to Amorim and Port house	António Mesquita, Catarina Silva and Miguel Cabral (Amorim)	6 Hours

PREREQUISITES

None

CREDITS

5 ECTS with 46 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	50%	1,2,3,4
Group assignment	50%	4,5

The evaluation is performed by conducting a written test. There will also be a group work evaluation from one of the practical classes. The teaching and evaluation language is English.

COURSE COORDINATORS

Ana Novo Barros (UTAD): abarros@utad.pt

SUGGESTED READINGS

- Boulton RB, Singleton VL, Bisson LF and Kunkel RE (1996) Principles and practices of winemaking
- Goode J (2021) Wine science: The Application of Science in Wine, from Vine to Glass, 3rd ed., University of California Press, US.
- Jackson RS (2014) Wine science: principles and applications, Academic Press, New York, US.
- Ribéreau-Gayon P, Dubourdieu D, Donèche B, Lonvaud A (2006) Handbook of Enology, The Microbiology of Wine and Vinifications, Vol. 1, 2nd ed., Wiley, West Sussex, England.
- Ribéreau-Gayon P, Glories Y, Maujean A, Dubourdieu D (2006) Handbook of Enology, The chemistry of wine stabilization and treatments volume, Vol. 2, 2nd ed., Wiley, West Sussex, England.

Additional scientific and technical reading references will be set during the course.

MODULE 1.5 WINE SENSORY ANALYSIS

SCHEDULE & LOCATION

First academic year, first semester at the *Universidade de Trás-os-Montes e Alto Douro* (UTAD) in Vila Real, Portugal.

DESCRIPTION

This module first explores the sensory evaluation of wines, from introducing the common wine aromas and flavours to the subject of wine scoring and description, including the recognition of the major wine faults. The courses then focus on the science of sensory analysis, developing students' skills to select appropriate sensory evaluation methods and train a tasting panel, in addition to the understanding of statistical methods and analysis. The module also includes a 5-day study trip in Spain.

LEARNING OUTCOMES

- 1) Able to distinguish wine aromas and key wine components through a blind wine tasting.
- 2) Understand the viticultural and oenology practices defining the final wine quality and style.
- 3) Describe faults in wine and how to identify them.
- 4) Develop skills for the application and interpretation of sensory methodologies presented.
- 5) Apply the theoretical and practical knowledge of multivariate statistics.
- 6) Acquire skills in the use of statistical software to illustrate the application of the methods studied, and interpret the outputs obtained.

COURSE CONTENT

TOPICS	TEACHERS	TEACHING
Introduction: Sensory analysis fundamentals; Physiology of the senses and threshold limits; 3-AFC Tests (ISO approved) for detection threshold determination of primary tastes.	Alice Vilela (UTAD)	4 Hours
Biochemical formation and perception of aromas perception: Wine aromas and correlation between sensorial analysis and instrumental analysis; Influence of technology during the processing of the grapes, wine, and wine-aging on wine sensory characteristics. Aroma perception training.	Alice Vilela (UTAD)	4 Hours
Sensory evaluation techniques: Selection and training of a tasting panel; Discriminative sensory evaluation methods (triangular, duo-trio, differentiation tests, ranking tests); Single point techniques (scoring tests, descriptive analysis, sensory profile); Temporal techniques (TDS, TI) and Hedonic tests (descriptive hedonic scales, facial scales, projective mapping, and elicited emotions). Practical training.	Alice Vilela (UTAD)	4 Hours
Multivariate statistical analysis: Factorial analysis (PCA and CATPCA), MANOVA and Multiple Linear Regression using the SPSS software.	Elisete Correia Mourão (UTAD)	18 Hours
Spanish study trip: 5-day study trip to Spanish wine regions in Rias Baixas, Ribeira Sacra, Bierzo, Ribera del Duero, Rioja, Rueda and Toro.	José Luís Aleixandre-Tudo (UPV)	35 Hours

Invited masterclasses: Portugal's indigenous varieties; Understand the principles of wine tasting and evaluation of wine quality and style; Varieties and wines of Portugal; Distinctive characteristics of the Douro region and the uniqueness of Port style wines; Role of the Port and Douro Wines Institute to guarantee the quality; Wine faults and wine flavour chemistry.	Tiago Alves de Sousa (Quinta da Gaivosa); Christine Marsiglio (Master of Wine); Sofia Salvador (ViniPortugal); Manuel Lima Ferreira (IVDP, IP); Jamie Goode.	20 Hours
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PREREQUISITES

None

CREDITS

7 ECTS with 85 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual tasting examination	10%	1,2,3
Individual sensory examination	45%	1,2,3,4
Individual statistic examination	45%	5,6

The module consists of practical sensory lessons where the student applies different methods of wine tasting and sensory analysis. The teaching and evaluation language is English.

COURSE COORDINATORS

Alice Vilela (UTAD): avimoura@utad.pt

Elisete Correia (UTAD): ecorreia@utad.pt

SUGGESTED READINGS

- Goode J (2021) Wine science: The Application of Science in Wine, from Vine to Glass, 3rd ed., University of California Press, US
- Jackson R (2002) Wine Tasting: A Professional Handbook (A Volume in the Food Science and Technology International Series). Academic Press. 291 p.
- Lawless HT and Heymann H (2010) Sensory Evaluation of Food: Principles and Practices. Aspen Publishing, New York, US.
- Pozo-Bayón MA and Muñoz González C (2024) Wine Analysis and Testing Techniques. Springer, New York, US.
- Wine & Spirit Education Trust (WSET) Level 3 Award in Wine. Understanding Wines: Explaining Style and Quality. 200p.

Additional scientific and technical reading references will be set during the course.



SEMESTER 2

SUSTAINABLE VITICULTURE

SECOND SEMESTER OVERVIEW

SUSTAINABLE VITICULTURE

The grapevine is cultivated over a wide range of environmental conditions. As a perennial specie, it requires a few years to reach reproductive maturity, remaining then economically productive for many years. Prior to planting, choices in terms of perennial practices are very important. At this level, natural conditions inevitably play an important role, yet decision-making is also strongly driven by other factors, such as market trends. Indeed, quality-orientated wine production is achieved by considering both environmental and socio-economic conditions. From here, annual practices, e.g. soil and canopy management, are constantly required to manage, among other factors, seasonal climate variability. Today, vine growers are facing many environmental issues (in particular, a global changing climate), requiring them to reconsider their management practices and strategies to promote sustainable viticulture. Hence, vineyard practices and strategies should focus on producing grapes with high quality and correct yields, while having minimal effects on the environment for future generations. The second semester seeks to promote the principles of sustainable viticulture. The first module will present the knowledge on the management of organic viticulture, while the second addresses automation and robotics in viticulture. The third module provides students guidance relevant to grape pest and disease management. The fourth module is focused on vine physiology, teaching students the advanced understanding of managing grapevines, especially within the context of a global changing environment. The last module is based on wine geography, allowing students to gain exposure and knowledge to the wine sector and activities of local actors from different regions around the world. Students will visit different Italian wineries and wine companies in regions such as Piemonte and Tuscany, and spent one week in Hungary, exploring famous wine regions like Tokaj and Villány.

MSc Vintage		Università Cattolica del Sacro Cuore (UCSC) in Piacenza, Italy	ECTS Credits
Semester 2	Sustainable Viticulture		30
	Module 2.1	Management of organic viticulture	5
	Module 2.2	Automation and robotics in viticulture	6
	Module 2.3	Grape pest and disease management	5
	Module 2.4	Grapevine eco-physiology	7
	Module 2.5	Grape varieties and wine geography	7 ²

² This module includes a study trip to Hungary and several daily visits in Italy.

MODULE 2.1 MANAGEMENT OF ORGANIC VITICULTURE

SCHEDULE & LOCATION

First academic year, second semester at the *Università Cattolica del Sacro Cuore* (UCSC) in Piacenza, Italy.

DESCRIPTION

The aim of the course is to provide in-depth knowledge on the management of viticulture using the organic management method, according to the environmental variables and modern problems of the wine sector. A wider part of the course will address differences in choices for the establishment of an organic vineyard, including informed decisions on weed communities and balance management due to weed-plant competition.

LEARNING OUTCOMES

- 1) Understand limiting factors for yield and quality in organic viticulture and have knowledge of vineyard management techniques specific to organic viticulture.
- 2) Recognise the most effective organic vineyard management systems.
- 3) Know the solutions to address the main problems of organic viticulture and identify the most suitable ones according to the site-specific limiting factors.
- 4) Produce objective and independent analyses of factors affecting organic management.
- 5) Discuss the scientific and technical knowledge of organic viticulture to clearly communicate the concepts learnt.
- 6) Engage with different stakeholders in the wine value chain and organic farming.
- 7) Formulate concepts, make decisions, and critically argue the main aspects concerning organic management of the vineyard.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Introduction: Numbers and diffusion of organic viticulture. Organic certification in the world. New trends and perspectives. Conversion of a vineyard to organic.	Tommaso Frioni (UCSC)	4 Hours
Organic vineyard design: Choice of site and exposure. Rootstocks for organic viticulture and role of grape variety. Planting layouts and weed management. Training systems for organic viticulture.	Tommaso Frioni (UCSC)	10 Hours
Soil management in organic vineyards: Fertilisers and soil improvers allowed in organic viticulture. Nutrition of organic vineyard. Managing inter-rows and sub-rows with tools of organic farming. Controlling the vigour of organic vineyard.	Tommaso Frioni (UCSC)	11 Hours
Managing the foliage and ripening of organic grapes: Maintenance and adjustment of vegetative-productive balance with tools allowed in organic farming. Biostimulants and vegetative and reproductive activity.	Tommaso Frioni (UCSC)	7 Hours
Good agronomic practices: Agroecology, trophic networks and ecological interactions; Managing organic vineyards using an overall approach. Sustainability of organic viticulture. Organic Viticulture 4.0.	Tommaso Frioni (UCSC)	3 Hours

Practical classes: Managing vine diseases in the organic vineyard. Defence practices and Plant Protection Products (PPPs) allowed in organic viticulture. Use of resistant varieties in organic viticulture.	Irene Salotti (UCSC)	6 Hours
Field visit: Discussing organic vineyard management and cultivation choices in different sites.	Tommaso Frioni (UCSC)	6 Hours

PREREQUISITES

None

CREDITS

5 ECTS with 47 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4,5,6,7

The module consists of classroom lectures and discussions completed by practical activities, seminars and a field visit. The teaching and evaluation language is English.

COURSE COORDINATORS

Tommaso Frioni (UCSC): tommaso.frioni@unicatt.it

SUGGESTED READINGS

- Döring J, Frisch M, Tittmann S, Stoll M, Kauer R (2015) Growth, yield and fruit quality of grapevines under organic and biodynamic management PLoS One, 10 (10).
- Döring J, Collins C, Frisch M, Kauer R (2019) Organic and biodynamic viticulture affect biodiversity and properties of vine and wine: a systematic quantitative review. American Journal of Enology and Viticulture, 70(3), 221-242.
- Frioni T, Bertoloni G, Squeri C, et al. (2020) Biodiversity of Local Vitis vinifera L. Germplasm: a Powerful Tool Toward Adaptation to Global Warming and Desired Grape Com-position, Frontiers in Plant Science 11 (2020): 608.
- Frioni T, Romanini E, Pagani S., et al. (2023) Reintroducing Autochthonous Minor Grapevine Varieties to Improve WineQuality and Viticulture Sustainability in a Climate Change Scenario, Australian Journal of Grape and Wine Research, no. 1: 1–16.
- Poni S, Frioni T, Gatti M (2025) Vineyard “Naturalness”: Principles and Challenges. Australian Journal of Grape and Wine Research. Volume 2025, Article ID 3247228, 22 pages.
- Rombough, Lon (2002) The grape grower: A guide to organic viticulture. Chelsea Green Publishing.

Additional scientific and technical reading references will be set during the course.

MODULE 2.2 AUTOMATION AND ROBOTICS IN VITICULTURE

SCHEDULE & LOCATION

First academic year, second semester at the *Università Cattolica del Sacro Cuore* (UCSC) in Piacenza, Italy.

DESCRIPTION

This module will allow students to acquire the fundamental knowledge on automation and robotics, therefore smart farming practices applied to vineyard management. Based on a multidisciplinary approach, principles and techniques being part of the digitalization process of agricultural systems will be analysed with specific emphasis on engineering concepts and applications used in viticulture.

LEARNING OUTCOMES

- 1) Identify the needs of automation in viticulture.
- 2) Know the digitalization process in viticulture based on implementation of automation and robotic solutions.
- 3) Know the most recent technical solutions already available at commercial scale.
- 4) Assess the opportunity to introduce mechanical and/or robotic solutions to perform different vineyard management operations.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Introduction: Rural development and agricultural systems. Automation in viticulture, state of the art, needs and vineyard mechanization.	Matteo Gatti (UCSC)	12 Hours
Automation and enabling technologies: Basics of Artificial Intelligence, Machine Learning, Deep Learning. Computer vision technology in agricultural automation. Automated systems for crop monitoring.	Matteo Gatti (UCSC)	10 Hours
Robotic platforms: Autonomous vehicles, wheel-type and crawler-type systems, quadrupeds.	Matteo Gatti (UCSC)	6 Hours
Vineyard management: Fruit crop architecture, plan material, growing sites and commercial target; Vine performance in open field and under controlled conditions; Robotic applications for automation of vineyard practices (harvest, pruning, irrigation, crop protection, weed control, etc.)	Matteo Gatti (UCSC)	14 Hours
Practical classes: Field observations and lectures.	Matteo Gatti (UCSC)	12 Hours

PREREQUISITES

None

CREDITS

6 ECTS with 54 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4

The module consists of classroom lectures, tutorials, and discussions. The teaching and evaluation language is English.

COURSE COORDINATOR

Matteo Gatti (UCSC): matteo.gatti@unicatt.it

SUGGESTED READINGS

- Avital Bechar (Ed.). Innovation in Agricultural Robotics for Precision Agriculture. 1st edition (2021). Springer Nature Switzerland AG
- Bramley RGV (2005) Understanding variability in wine grape production systems. 2. Within vineyard variation in quality over several vintages. Australian Journal of Grape and Wine Research 11, 33–42.
- Bramley RGV (2010) Precision viticulture: Managing vineyard variability for improved quality outcomes. Chapter 12. In: Managing wine quality. Volume 1. Viticulture and wine quality. Ed. A.G. Reynolds (Woodhead Publishing: Cambridge, UK) pp. 445–480.
- Bramley RGV, Hamilton RP (2004) Understanding variability in winegrape production systems. 1. Within vineyard variation in yield over several vintages. Australian Journal of Grape and Wine Research 10, 32–45.
- Gatti M, Garavani A, Squeri C, et al. (2022) Effects of intra-vineyard variability and soil heterogeneity on vine performance, dry matter and nutrient partitioning. Precision Agric 23, 150–177
- Manoj Karkee and Qin Zhang (Eds.). Fundamentals of Agricultural and Field Robotics. 1st edition (2021). Springer Nature Switzerland AG
- OIV definition and general principles on Precision Viticulture <https://www.oiv.int/public/medias/2074/cst-1-2004-en.pdf>
- Vaudour E, Costantini E, Jones GV, Mocali S (2015) An overview of the recent approaches to terroir functional modelling, footprinting and zoning. Soil, 1, 287–312.

Additional scientific and technical reading references will be set during the course.

MODULE 2.3 GRAPE PEST AND DISEASE MANAGEMENT

SCHEDULE & LOCATION

First academic year, second semester at the *Università Cattolica del Sacro Cuore* (UCSC) in Piacenza, Italy.

DESCRIPTION

Students will acquire the necessary elements to understand the development of grapevine plant diseases and for applying this knowledge in the sustainable vineyard management. Different aspects will be addressed: i) epidemiological aspects of diseases; ii) interaction between plant disease epidemics, the environment, and crop management; iii) mathematical models and decision support system for crop protection; iv) crop protection in integrated and organic viticulture.

LEARNING OUTCOMES

- 1) List the epidemiological aspects of diseases in grapevines.
- 2) Explain the interaction between disease epidemics, the environment, and vine management.
- 3) Report the mathematical models and decision support system for grapevine protection.
- 4) Discuss grapevine protection in integrated and organic viticulture.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Plant-pathogen-environment interactions: Life cycle of pathogens; infection chains and epidemiological parameters; influence of the host plant on epidemiological parameters of plant diseases; the vineyard's environment (biotic and abiotic components and their measurement).	Vittorio Rossi (UCSC)	5 Hours
Biology and epidemiology of grape pathogens: Overview of the recent findings on biology, epidemiology and population dynamics of the main pathogens, including oomycetes, fungi, phytoplasmas, fastidious bacteria and viruses.	Vittorio Rossi (UCSC)	7 Hours
Sustainable grape protection: concepts in sustainable grape protection; principles of Integrated Pest Management according to Directive 128/2009 EC; a framework for IPM implementation; new tools and methods for IPM, including resistant varieties, sanitation, vineyard monitoring and scouting, modelling, monitoring of resistant populations and anti-resistance strategies, biocontrol agents and other non-chemical methods for disease control; precision crop-protection.	Vittorio Rossi (UCSC)	10 Hours
Mathematical models for grape disease and protection: Insights on plant disease modelling; empirical versus mechanistic models; principles of model validation and use in scheduling fungicide applications; strengths and weaknesses of model's use. Practical examples of models for downy and powdery mildews, Botrytis bunch rot and Black rot.	Vittorio Rossi (UCSC)	15 Hours

Decision support tools for sustainable grape protection:	Vittorio Rossi (UCSC)	10 Hours
Tools for supporting grape growers in practical implementation of IPM; on-site devices, warning systems, and decision support systems (DSSs); strengths and weaknesses of the different tools; the DSS vite.net as a successful case-study.		

PREREQUISITES

None

CREDITS

6 ECTS with 47 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4

The module consists of classroom lectures and discussions completed by practical field work. The teaching and evaluation language is English.

COURSE COORDINATOR

Vittorio Rossi (UCSC): vittorio.rossi@unicatt.it

SUGGESTED READINGS

- Bettiga LJ (2013) Grape Pest Management. 3rd Edition. University of California, 609 pp.
- Caffi T, Legler SE, Bugiani R, Rossi V (2013) Combining sanitation and disease modelling for control of grapevine powdery mildew. *Eur. J. Plant Pathol.* 135, 817–829
- Caffi T, Rossi V (2018) Fungicide models are key components of multiple modelling approaches for decision-making in crop protection. *Phytopathol. Mediterr.* 57, 153–169.
- Caffi T, Rossi V, Legler SE, Bugiani R (2011) A mechanistic model simulating ascospore infections by *Erysiphe necator*, the powdery mildew fungus of grapevine. *Plant Pathol.* 60, 522–531.
- Rossi V, Caffi T, Giosuè S, Bugiani R (2008) A mechanistic model simulating primary infections of downy mildew in grapevine. *Ecol. Modell.* 212, 480–491.
- Rossi V, Caffi T, Salinari F (2012) Helping farmers face the increasing complexity of decision-making for crop protection. *Phytopathol. Mediterr.* 51, 457–479.
- Rossi V, Onesti G, Legler SE, Caffi T (2015) Use of systems analysis to develop plant disease models based on literature data: Grape black-rot as a case-study. *Eur. J. Plant Pathol.* 141, 427–444
- Rossi V, Salinari F, Poni S, Caffi T, Bettati T (2014) Addressing the implementation problem in agricultural decision support systems: The example of vite.net®. *Comput. Electron. Agric.* 100, 88–99

Additional scientific and technical reading references will be set during the course.

MODULE 2.4 GRAPEVINE ECO-PHYSIOLOGY

SCHEDULE & LOCATION

First academic year, second semester at the *Università Cattolica del Sacro Cuore* (UCSC) in Piacenza, Italy.

DESCRIPTION

Students will deepen knowledge related to grapevine ecophysiology to master solutions suitable to solve practical issues in the vineyard. The course will include new perspectives bound to climate change and to a more efficient use of water and nutrient resources.

LEARNING OUTCOMES

- 1) Report the physiological processes and environmental constraints underlying vine performance.
- 2) Explain the issues of a global changing climate and its effects on viticulture.
- 3) List the main climate change adaptation and mitigation techniques.
- 4) Describe the physiology of winter pruning and canopy management.
- 5) Discuss the water relations and water use efficiency of grapevines.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Bases of environmental physiology: yield formation, yield potential and its realization. Grape composition and fruit quality: water, sugar, acids, nitrogen compounds and mineral nutrients, phenolics, lipids and volatiles. Xylem and phloem function.).	Stefano Poni (UCSC)	4 Hours
Environmental constraints and grape physiology: responses to stress. Water: too much or too little? Nutrients: deficiency and excess. Salinity. Temperature: too cold or too warm?	Stefano Poni (UCSC)	6 Hours
Climate change and impact on viticulture: main features of climate change and its effects on viticulture. Adaptation and mitigation techniques. New tools for better assessment and prediction of climate-change related effects and for prevention of climate extremes.	Stefano Poni (UCSC)	12 Hours
Physiology of pruning and canopy management: winter pruning: an ideal case for applied physiology. Physiology of main summer pruning techniques: shoot thinning, shoot trimming, leaf removal, cluster thinning. Methods for assessing efficiency of different training systems.	Stefano Poni (UCSC)	12 Hours
Water relations and water use efficiency: Stomatal action and transpiration. Isohydric and anisohydric adaptation to water stress. Definition and ways of assessment of water use efficiency (WUE) Water relations and nutrient uptake. Invited seminars on specific topics. Audio-video listening of lectures and working groups. Discussion of case studies.	Stefano Poni (UCSC)	14 Hours

PREREQUISITES

None

CREDITS

7 ECTS with 48 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4,5

The module consists of classroom lectures and discussions completed by practical field work. The teaching and evaluation language is English.

COURSE COORDINATOR

Stefano Poni (UCSC): stefano.poni@unicatt.it

SUGGESTED READINGS

- Iland P, Dry P, Proffitt T, Tyerman S (2012). The grapevine: from the science to the practice of growing vines for wine. Campbelltown: Patrick Iland Wine Promotions.
- Jackson RS (2014) Wine science: principles and applications, Academic Press, New York, US.
- Keller M (2010) The science of grapevines: Anatomy and physiology, Academic Press, New York, US.
- Poni S (2022) Designing and managing a sustainable vineyard in a climate change scenario. Available online on Amazon, 2022, self-published.
- Poni S, Bernizzoni F, Civardi S (2008) The effect of early leaf removal on whole-canopy gas exchange and vine performance of Vitis vinifera L. cv. Sangiovese Vitis, 47, pp. 1-6.
- Poni S, Casalini L, Bernizzoni F, Civardi S, Intrieri C (2006) Effects of early defoliation on shoot photosynthesis, yield components, and grape quality. Am. J. Enol. Vitic., 57, pp. 397-407
- Poni S, Gatti M, Bernizzoni F, Civardi S, Bobeica N, Magnanini E, Palliotti A (2013) Late leaf removal aimed at delaying ripening in cv: sangiovese: physiological assessment and vine performance. Aust. J. Grape Wine Res., 19, pp. 378-387
- Poni S, Tombesi S, Palliotti A, Ughini V, Gatti M (2016) Mechanical winter pruning of grapevine: physiological bases and applications. Sci. Hortic., 204, pp. 88-98
- Poni S, Zamboni M, Vercesi A, Garavani A, Gatti M (2014) Effects of early shoot trimming of varying severity on single high-wire trellised pinot noir grapevines. Am. J. Enol. Vitic., 65, pp. 493-498

Additional scientific and technical reading references will be set during the course.

MODULE 2.5 GRAPE VARIETIES & WINE GEOGRAPHY

SCHEDULE & LOCATION

First academic year, second semester at the *Università Cattolica del Sacro Cuore* (UCSC) in Piacenza, Italy.

DESCRIPTION

To teach the student the viticultural, oenological and cultural characteristics of the main wine grape varieties grown worldwide and to describe the main growing areas. The module also includes a 6-day study trip in Italy.

LEARNING OUTCOMES

- 1) Report the main traits of the global wine industry.
- 2) Explain the terroir concept and the role of the different on the wine quality.
- 3) List the origin and the viticultural and enology attributes of the main wine grape varieties.
- 4) Discuss the relationships between the grape varieties and the terroir in which they are grown.
- 5) Correlate the sensory profiles of the wines with the different terroirs.
- 6) Discuss which terroir is more suitable for growing a certain grape variety according to specific wine style.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Wine statistics. Terroir definition and role of the different factors. World viticultural terroirs: history and structure of national wine industries; description of producing areas, emphasizing the role of the grape variety, soil, climate and human being on grape and wine quality traits. Wine as a cultural produce.	Luigi Bavaresco (UCSC)	30 Hours
Grape varieties: Para-domestication and domestication of the grapevine. Origin of the grape varieties grown nowadays. Classification and distribution in the world of the most grown varieties.	Luigi Bavaresco (UCSC)	10 Hours
Grape varieties: Description of the most cultivated varieties: history, ampelographic characterization, phenology, agronomical attitudes, technological traits, wine sensory profiles.	Luigi Bavaresco (UCSC)	20 Hours
Tutorials: Wine sensory analyses.	Luigi Bavaresco (UCSC)	10 Hours
Daily trips: Several daily visits to representative wine estates in different Italian wine regions.	Luigi Bavaresco (UCSC)	35 Hours
Study trip: 5-day study trip to Hungarian wine regions such as Tokaj, Villány, Badacsony and Balaton.	MATE)	35 Hours

PREREQUISITES

None

CREDITS

7 ECTS with 140 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	100%	1,2,3,4,5,6

The module consists of classroom lectures and discussions completed by various study visits in Italy and Switzerland. The teaching and evaluation language is English.

COURSE COORDINATOR

Luigi Bavaresco (UCSC): luigi.bavaresco@unicatt.it

SUGGESTED READINGS

- Anderson K (2013) Which Winegrapes Varieties are Grown where? University of Adelaide Press, e-book.
- Anderson K, Nelgen S (2020) Which Winegrapes Varieties are Grown where? A global empirical pictures. Revised Edition. University of Adelaide Press, e-book.
- Christensen LP, Dokoozlian NK, Walker MA, Wolpert JA (2003) Wine Grape Varieties in California. University of California ANR, Publ. 3419
- Gerrat J, Posluzeny U, Melville L (2015) Taming the Wild Grape., Springer, International Publishing Switzerland.
- MAGHRADZE D., RUSTIONI L., TUKOR J., SCIENZA A., FAILLA O., 2012. Caucasus and Northern Black Sea Region Ampelography. Vitis, Siebeldingen, Germany.
- Robinson J (2006) The Oxford Companion to Wine, Oxford University Press
- Robinson J, Harding SJ, Vouillam OZ (2012) Wine grapes, Allen La.ne.
- Szabo J (2016) Volcanic Wines – Salt, Grit and Power. Jacqui Small LLP London.
- Tomasi D, Gaiotti F, Jones GV (2013) The Power of the Terroir: the Case Study of Prosecco Wine. Springer
- Wilson JE (1998) Terroir. The role of geology, climate and culture in the making of French Wines. Mitchell Beazley, London.

Additional scientific and technical reading references will be set during the course.



SEMESTER 3

WINE IDENTITY

THIRD SEMESTER OVERVIEW

WINE IDENTITY

The global wine sector is undergoing continual transformation, marked by the emergence of new producing regions and the expansion of international markets. Within this increasingly competitive environment, wine producers seek to differentiate their products to secure market share and consumer recognition. Two primary pathways exist: a strategy based on volume and competitive pricing, or one centred on the cultivation of a strong identity that emphasizes premium positioning, consistent quality, and, more recently, responsiveness to consumer demand for environmental sustainability. Wine identity may be articulated at both the territorial and individual levels. Territorial identity is expressed collectively, through features such as distinctive landscapes, established wine styles, cultural heritage, and local expertise. While historically associated with European production systems, regional branding strategies are now widely adopted in new producing countries. However, territorial branding alone is insufficient to guarantee differentiation. Individual wineries must also establish a distinct identity that conveys defined values and consistent expectations, thereby fostering consumer trust. A well-positioned company identity contributes to brand loyalty and enables producers to navigate a marketplace characterized by abundant consumer choice. This course approaches wine identity through a structured sequence of modules. The first two modules are centred on the terroir concept, as a productive and localized cultural system, creating economic, ecological and social value within its territorial setting, including the WSET level 3 award in wines providing a strong international perspective. The third and fourth modules will teach students the techniques of strategic and operational wine management, as well as marketing and branding. During the final module, students will be introduced to the areas of research.

MSc Vintage		<i>Ecole Supérieure des Agricultures in Angers, France.</i>	ECTS Credits
Semester 3	Wine Identity		30
	Module 3.1	Territorial identity of terroir wines	7
	Module 3.2	WSET Level 3 award in Wines	6
	Module 3.3	Applied wine marketing	6
	Module 3.4	Wine economics and business management	6 ³
	Module 3.5	Applied research project	5

³ This module includes a study trip to the Bordeaux wine region and several daily visits in the Loire Valley, France.

MODULE 3.1 TERRITORIAL IDENTITY OF TERROIR WINES

SCHEDULE & LOCATION

Second academic year, third semester at the *Ecole Supérieure des Agricultures* (ESA) in Angers, France.

DESCRIPTION

This module examines terroir concept as a productive and localized cultural system that generates economic, ecological, and social value within its territorial context. Building upon the foundations established during the first academic year, the module investigates the relationship between terroir expression and wine identity, with particular emphasis on the sustainable management and branding of terroir-driven wines as a competitive advantage in the global market. To complement the theoretical component, students will apply vineyard design principles to assess planting material and to inform decisions regarding the long-term management and operational strategies of a commercial vineyard, linking scientific understanding to practical decision-making.

LEARNING OUTCOMES

- 1) Define and explain the concept of terroir within the wine sector.
- 2) Describe and evaluate the components of a terroir management system, including natural, biological, and human factors.
- 3) Assess how the concept of terroir contributes to economic, ecological, and social values within its territorial context.
- 4) Discuss and interpret the relationship between place and taste in terroir driven wines.
- 5) Explain and compare the dimensions of authenticity in terroir-based products.
- 6) Analyse responsible and sustainable approaches to the production of terroir wines.
- 7) Evaluate the spatial and temporal challenges facing terroir-driven wines in the context of a changing global climate.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Introduction and concepts: Terroir concept as a local, productive and cultural system; Sensory typicity of wines and defining the specific quality product.	Etienne Neethling and Cécile Coulon-Leroy (ESA).	5 Hours
Terroir wines as collective and territorial development processes: Historical and cultural development of territorial wines; Geographical indications as socio-ecological systems; Geographical indications in the EU: Economic and market approach.	Daniel Henderson; Faustine Ruggieri (INRAE); Tanguy Chever (AND International).	15 Hours
Collective marketing and strategies for terroir wines: Defining terroir brands and branding terroir wines; Collective marketing and strategic use of resources; Applied collective marketing; Framing authenticity and creating markets: The case of the Swartland, South Africa.	Nathalie Spielmann (NEOMA); Mickaël Rouyer; Jonathan Steyn (UCT GSB).	15 Hours
Socio-ecological sustainability of terroir wines: Conservation of biodiversity within sustainable viticulture; Eco-quali-design for a sustainable wine production; Regional dynamics of terroir wines under climate change.	Joséphine Python-Rivallain, Christel Renaud-Gentié and Etienne Neethling (ESA).	9 Hours

Field visits: Characterisation and description of natural terroir components and their interactions – Case of Domaine Bernard Baudry in Chinon.	Etienne Neethling (ESA); Sam Schrock (IFV).	5 Hours
Vineyard establishment: Practical work to characterize the natural environment, choose suitable plant material and make decisions regarding the vineyard layout and design.	Etienne Neethling (ESA); György Lukácsy (MATE).	18 Hours

PREREQUISITES

A strong academic background in viticulture and enology, with knowledge in wine marketing.

CREDITS

7 ECTS with 67 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Individual examination	70%	1,2,3,4,5,6,7
Written assignment	30%	2,3,4,6,7

The module consists of classroom lectures and discussions completed by practical field work and visits. The teaching and evaluation language is English.

COURSE COORDINATOR

Etienne Neethling (ESA): e.neethling@groupe-esa.com

SUGGESTED READINGS

- Charters S, Spielmann N, Babin BJ (2017) The nature and value of terroir products. *European Journal of Marketing*, 51(4), 748-771.
- Coulon-Leroy C, Poulzagues N, Cayla L, Symoneaux R, Masson G (2018) Is the typicality of Provence Rosé wines only a matter of color? *Oeno One*, 52(4), pp. 1-15
- Demossier M (2018) *Burgundy: A Global Anthropology of Place and Taste*. New York: Berghahn.
- Frankel C (2014) *Land and wine: the French terroir*. The University of Chicago Press.
- Leriche C, Molinier C, Caillé S, Razungles A, Symoneaux R, Coulon-Leroy C (2020) Development of a methodology to study typicity of PDO wines with professionals of the wine sector. *Journal of the Science of Food and Agriculture*, 100(10).
- Neethling E, Barbeau G, Coulon-Leroy C, Quénot H (2019) Spatial complexity and temporal dynamics in viticulture: a review of climate-driven scales. *Agric. For. Meteorol.* 276-277:107618
- Rouault A, Perrin A, Renaud-Gentié C, Julien S, Jourjon F (2020) Using LCA in a participatory eco-design approach in agriculture: the example of vineyard management. *Int J Life Cycle Ass* 25 (7):1368-1383.
- Spielmann N, Williams C (2016) It goes with the territory: Communal leverage as a marketing resource. *Journal of Business Research*, 69(12), 5636-5643.
- Van Leeuwen C, Seguin G (2006) The concept of terroir in viticulture. *J. Wine Res*, 17, 1–10.

Additional scientific and technical reading references will be set during the course.

MODULE 3.2 WSET LEVEL 3 AWARD WINES

SCHEDULE & LOCATION

Second academic year, third semester at the *Ecole Supérieure des Agricultures* (ESA) in Angers, France.

DESCRIPTION

This module is designed to give students a thorough and advanced understanding of the terroir factors that account for the style and quality of the principal still, sparkling and fortified wines of the world. The courses are based on the principles of the Wine and Spirit Education Trust (WSET) level 3 award in wines.

LEARNING OUTCOMES

- 1) Identify and describe the characteristics of the principal still wines produced in the wine producing regions of the world and explain how the natural and human factors in the vineyard, winery and commerce can influence the style, quality and price of these wines.
- 2) Identify and describe the characteristics of the principal sparkling wines of the world and explain how the natural and human factors in the vineyard, winery and commerce can influence the style, quality and price of these wines.
- 3) Identify and describe the characteristics of the principal fortified wines of the world and explain how the natural and human factors in the vineyard, winery and commerce can influence the style, quality and price of these wines.
- 4) Ability to make an assessment of wine quality and readiness for drinking.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Exploring wine identity and diversity: The WSET level 3 award in wines. The Theory of Wines of the World; Natural factors in the vineyard that influence style, quality and price; Human factors in the vineyard that influence style, quality and price; Human factors in the winery that influence style, quality and price; The principal still wine producing regions of the world; Key factors that influence style, quality and price of the principal still wines of the world; Principal sparkling wines of the world; Key factors that influence style, quality and price of sparkling wines; Principal fortified wines of the world; Key factors that influence style, quality and price of fortified wines; The Analytical Tasting of Wine.	Daniel Henderson	40 Hours
E-learning Wine: Video lessons on major study topics of WSET level 3, Online flashcards; multiple choice questions and revision exercises; Library of short written mock exam questions.	Jimmy Smith	40 Hours

PREREQUISITES

A strong academic background in viticulture and enology, with knowledge in wine marketing.

CREDITS

6 ECTS with 40 teaching hours and 40 online teaching hours.

EVALUATION & TEACHING METHODS

<i>ASSESSMENT</i>	<i>WEIGHTING</i>	<i>LEARNING OUTCOME</i>
Individual WSET examination	100%	1,2,3,4

The module consists of classroom lectures and discussions completed with various tasting sessions. The teaching and evaluation language is English.

COURSE COORDINATORS

Etienne Neethling (ESA): e.neethling@groupe-esa.com

Daniel Henderson: dan@angevin-wines.com

SUGGESTED READINGS

- Wine & Spirit Education Trust (WSET) Level 3 Award in Wine. Understanding Wines: Explaining Style and Quality. 200p.

Additional scientific and technical reading references will be set during the course.

MODULE 3.3 APPLIED WINE MARKETING

SCHEDULE & LOCATION

Second academic year, third semester at the *Ecole Supérieure d'Agricultures* (ESA) in Angers, France.

DESCRIPTION

Students will engage with a real-world marketing challenge presented by a sponsoring winery. Through a combination of lectures, masterclasses, meetings with professionals, students will deepen their understanding of the unique challenges and opportunities within the wine sector related to marketing and branding. Students will compete against each other to develop innovative solutions according to the winery's marketing case study, with the company participating in the evaluation process.

LEARNING OUTCOMES

- 1) Develop skills in creating and managing wine brand value propositions.
- 2) Analyse and evaluate real-world wine branding and marketing campaigns.
- 3) Apply marketing concepts to develop effective branding, packaging, and distribution plans for a winery.
- 4) Explore the dynamics of working with a sponsoring wine company.
- 5) Gain insights into sales and distribution strategies, with a focus on international markets.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Applied wine brand case study: General presentation of case studies; Strategy, benchmarking, positioning and storytelling; Product design and product innovation; Distribution channels; Cost of good vs consumer value approach; Building a communication plan.	Baptiste Fabre and Estelle Guerin (ESA)	6 Hours
Marketing wine in a global world: Consumer behaviour and insights; Global brand strategy; Premium wine marketing and gatekeeper strategy.	<i>Invited teachers</i>	20 Hours
Specific international considerations: Understanding the US market	Marcela Dibildox-Huot	3 Hours
Invited masterclasses: The principles of growth, mental availability, and category entry points applied to wine industry; Wine Tourism; The Genesis of Wine Explorers: Global Vineyards, Entrepreneurial Journeys, and Lessons from Wine Tourism.	Justin Cohen (Erhenberg Bass Institute); Céline Charier (Avinoe); Jean-Baptiste Ancelot (Wine Explorers)	15 Hours

PREREQUISITES

A strong academic background in viticulture and enology, with knowledge in wine marketing.

CREDITS

6 ECTS with 44 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Group assignment	100%	1,2,3,4,5

The module consists of classroom lectures and discussions. The teaching and evaluation language is English.

COURSE COORDINATOR

Baptiste Fabre (ESA): b.fabre@groupe-esa.com

SUGGESTED READINGS

- Lapsley J and Moulton K (2001) Successful Wine Marketing. New York: Springer Science, 297pp.
- Anderson K and Golin G (2004) The World's Wine Markets. Globalization at Work. Edward Elgar, Cheltenham, UK; Northampton, MA, USA.
- Hall CM and Mitchell R (2008) Wine Marketing. A practical guide. Oxford: Elsevier, 344pp.

Additional scientific and technical reading references will be set during the course.

MODULE 3.4 WINE ECONOMICS AND BUSINESS MANAGEMENT

SCHEDULE & LOCATION

Second academic year, third semester at the *Ecole Supérieure des Agricultures* (ESA) in Angers, France.

DESCRIPTION

This module covers fundamental economics, finance and management principles as applied to the management of vineyards and other wine-related business practices. Through a combination of a course textbook, extra-curricular readings, and independent case studies, students are led to develop critical thinking and problem-solving skills, while acquiring basic economics and management theory.

LEARNING OUTCOMES

- 1) Understand the global wine structures, producer vs consumer economies and attitudes to wine consumption.
- 2) Explain industry organisation structures including appellations, clusters, cooperatives and individual producers. Discuss advantages and drawbacks of each.
- 3) Describe and explain different approaches to wine production management. Explain internal and external factors and forces impacting winery profitability.
- 4) Identify fundamental financial and economic concepts as applied to the wine industry. Discuss management organisation options in the wine industry.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Context of international wine business: World's wine economy, the internationalization of wine; production and consumption statistics by country; Fundamental economics of wine across international markets, aspects of regulation and world wine laws.	Daniel Henderson	6 Hours
Wine industry organisation: Clusters, leadership, innovation and change; Strategic decision making, cooperation and competition; Vertical industry integration; Economies of scale.	Daniel Henderson	9 Hours
Market forces and influences on decision making: Policy, social externalities, taxes, regulation; Négociants, winegrowers and wholesale structures; Individual vs collective reputations; Terroir and appellations.	Daniel Henderson	9 Hours
Basic financial concepts applied to the wine industry: Profitability, value and efficiency ratios; growth, debt and debt financing, balance sheets; Staffing and leadership.	Daniel Henderson	6 Hours
Field visits: Daily visits with different local stakeholders of Pays Nantais, Anjou-Saumur and Touraine.	Daniel Henderson	18 Hours
Study visit: Daily visits with different local stakeholders of Bordeaux (grape growers, wine producers, trade houses, syndicates, etc.).	Daniel Henderson; Clément Miramont (ESA)	30 Hours

PREREQUISITES

A strong academic background in viticulture and enology, with knowledge in wine marketing.

CREDITS

6 ECTS with 78 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Class participation, case preparation and discussions	50%	1,2,3,4
Individual examination	50%	1,2,3,4

The module consists of classroom lectures and discussions, supplemented by outside-of-class readings and case preparation. The teaching and evaluation language is English.

COURSE COORDINATORS

Etienne Neethling (ESA): e.neethling@groupe-esa.com

Daniel Henderson: dan@angevin-wines.com

SUGGESTED READINGS

- Wine Business Management, Steve Charters and Jérôme Gallo. 2014 Pearson France. ISBN 978-2-3260-0052-0
- Wine Economics, Stefan Castriota. 2020 Massachusetts Institute of Technology Press. ISBN 9780262044677
- The Palgrave Handbook of Wine Industry Economics, 2019 Palgrave/Macmillan. ISBN 978-3-319-98632-6
- The Globalization of wine, Inglis & Amila, 2020 Bloomsbury Academic Press. ISBN 978-1-4742-6499-0.

Additional scientific and technical reading references will be set during the course.

MODULE 3.5 APPLIED RESEARCH PROJECT

SCHEDULE & LOCATION

Second academic year, third semester at the *Ecole Supérieure des Agricultures* (ESA) in Angers, France.

DESCRIPTION

This module provides students with the opportunity to design, manage, and execute an applied research or entrepreneurship project under the guidance of an academic supervisor. Project topics may span the full wine value chain, from production to sales, and are tailored to each student's study focus. Students are expected to define a clear research question, develop an appropriate study framework, analyse results rigorously, and present well-argued conclusions and recommendations.

LEARNING OUTCOMES

- 1) Develop methodological skills in contextualising and designing research or applied project.
- 2) Apply scientific knowledge and principles to effectively manage and implement the project.
- 3) Demonstrate in-depth understanding and expertise in their chosen study area.
- 4) Formulate evidence-based recommendations and solutions informed by the project findings.

COURSE CONTENTS

TOPICS	TEACHERS	TEACHING
Introduction: Presentation of case studies, methodological approaches and expected results.	Etienne Neethling, Baptiste Fabre (ESA); Daniel Henderson	2 Hours
Supervised project: Individual teacher meetings	Academic Supervisor (ESA)	20 Hours

PREREQUISITES

A strong academic background in viticulture and enology, with knowledge in wine marketing.

CREDITS

5 ECTS with 22 teaching hours.

EVALUATION & TEACHING METHODS

ASSESSMENT	WEIGHTING	LEARNING OUTCOME
Specifications report	10%	1
Final examination	90%	1,2,3,4

The teaching and evaluation language is English.

COURSE COORDINATOR

Etienne Neethling (ESA): e.neethling@groupe-esa.com

SUGGESTED READINGS

Scientific and technical reading references will be set during the module depending on the study focus.

A low-angle photograph of a path lined with green trees, with a semi-transparent text box in the foreground.

SEMESTER 4

MASTER THESIS

FOURTH SEMESTER OVERVIEW

MASTER THESIS

According to the International Organisation of Vine and Wine (OIV), global wine exports totalled around 99 million hectolitres in 2023, representing 36 billion euros in value. Given the significant economic impact, the wine sector generates an overwhelming number of wine-related jobs. They range from positions in grape growing or wine production to, for example, careers in vine nurseries, tank or barrel producing facilities, sales and marketing teams, restaurateurs, wine tourism, education or training. This dynamic sector is also highly competitive, requiring professionals with diverse and specialised skills. In this context, the Master of Science programme in Vine, Wine and Terroir Management has a double purpose. Firstly, to educate and equip students with a comprehensive overview of the wine sector, from soil to consumer. Indeed, the economic growth and sustainable development of the wine sector will benefit from new leaders and actors with a broad technical and strategic background of grape and wine production, with knowledge in wine business management. And secondly, to grant students the opportunity to gain specific competencies by conducting a research project in any company or country of their choice. This exposure in real life situations will empower students to address the various challenges and issues that await them after graduation. They will learn to be more autonomous and responsible, develop skills and expertise in the field of interest. The fourth semester is therefore devoted to the professional research project, serving as the final assessment to obtain the Master of Science degree. It challenges students to solve a complex, real-world problem while developing specific skills related to their thesis topic. It takes place for a duration of six months in a working environment and answers a research question through a scientific literature review and evidence-based arguments. The written thesis is defended before an academic jury, ensuring both academic rigour and professional relevance. The Master thesis may focus on research, technological development, or a combination of both. It is also a key moment to acquire transversal competencies such as writing, communication, planning, critical thinking and openness to societal issues. This experience prepares graduates to become skilled, innovative and adaptable actors in the global wine sector.

MSc Vintage		ECTS Credits
Semester 4	Master Thesis	30
	Module 4	Professional research project 30