



NEW CONCEPT
FOR THE
ACCREDITATION OF THE
ERASMUS MUNDUS
DEGREE PROGRAMME
“VINIFERA EUROMASTER”

Appendix 4-1

MODULE HANDBOOK
First Academic Year (M1)




Contents

MODULES OF THE FIRST ACADEMIC YEAR (M1)

jointly delivered by the EMaVE-Consortium at Montpellier SupAgro

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<u>Optional Additional Module</u>		
Study Trip	1	
ECTS-points (total) for the compulsory modules of the degree programme	60	
ECTS-points for the optional additional modules	1	


COMPULSORY MODULES

	Economics for the Wine Industry
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Luigi Galletto, Prof. PhD (University of Padova)
Lecturers:	<p><u>PU Wine Economics:</u> <u>Lecturer in charge:</u> Luigi Galletto, Prof. PhD (University of Padova), Louis Antoine Saisset, PhD (Montpellier SupAgro); <u>Additional lecturers:</u> Luca Rossetto, Prof. PhD (University of Padova); Alejandro Gennari, Prof. PhD (University of Cujo de Mendoza, Argentina).</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	PU Wine economics 60h
Workload:	<p><u>PU Wine economics:</u> Face to face lectures: 48 h; Case Studies 3 h; Study trips 9 h Student's personal study time in the module: 70 h</p>
Credit points:	6 ECTS
Recommended prerequisites:	None
Targeted learning outcomes:	<p><u>PU Wine economics:</u></p> <ul style="list-style-type: none"> - students have a macro and meso economic view of the wine markets, its structures and regulatory systems (OIV, CMO...) - they will understand the production and consumption situation, international trade, bulk wine markets, and the economics of international firms who operate in the wine sector. - Students have a managerial view of the wine market, with a special emphasis on international business strategies of wine companies, and marketing, both at strategic and operational level. - They know about the market planning, business positioning, marketing mix management,

<p>Content:</p>	<p><u>PU Wine Economics:</u> Introduction to economic analytical approaches and theoretical backgrounds: macro, meso and micro economics. Description and analysis of the wine production system, consumption, and international trade. Relevant drivers in these systems, including coordination and institutional devices at global or local levels. Global and local factors that influence wine prices, with a special insight into the bulk market.</p> <p>Performance drivers in different types of businesses (private and cooperative, large and family business). Introduction to marketing with a particular focus on marketing-mix techniques. Product launch, quality management, branding, communication, packaging, distribution and pricing in the wine sector. Wine tourism economics.</p>
<p>Exam achievements:</p>	<p><u>PU Wine economics:</u> Written examination and presentation</p>
<p>Teaching/learning media:</p>	<p>Powerpoint; whiteboard; reading programme, study visits; discussions</p>
<p>Literature:</p>	<p>AAKER D., (1996), Building Strong Brands, The Free Press. ANDERSON, K. (2004), The World's Wine Market – Globalization at Work, Edward Elgar Publishing Limited, Glensanda House, Montpellier Parade, Cheltenham, Glos GL 50 1 UA, UK (Available online on Google) AGUSTIN Sr H, SCHUEMANN, D, Editor,(2013), 99 Bottles of Wine: The making of the contemporary wine label, Val de Grace Books. ANDERSEN, K, PINILLA, V, (2018), Wine Globalization; A new comparative history, Cambridge University Press. BROOKS, S. (2012), The complete Bordeaux: The wines, the chateaux, the people, Ed: Mitchell Beazley. CAPITALLO, R, CHARTER, S, (editors), (2017), The wine value chain in China: Global dynamics, marketing and communication in the contemporary Chinese wine market, Chandos Publishing. COELHO A.; RASTOIN J.-L.(2006), Financial Strategies of Multinational Enterprises in the World Wine Industry, Agribusiness: An International Journal, 22, 3, Summer 2006, 417-429. CASTAING, Yohan,(2013) Stratégies et marketing du vin(French), Editor: DUNOD. COELHO A.; COUDERC J.-P.(2006), Globalisation + Financialisation= Concentration? Trends on Mergers, Acquisitions and Financial Investment in the Wine Sector, 3rd International Wine Business & Marketing Research Conference, Montpellier, 6-8 July, 30 p. COELHO, A.; MONTAIGNE, E.; AIGRAIN, P.; SIDLOVITS,</p>

	<p>D.(2009), Wine, in CHALMIN P. (coord.), Cyclope: World Commodity Yearbook, Economica, Paris</p> <p>D’HAUTEVILLE F., COUDERC J.-P., HANNIN H., MONTAIGNE E., Bacchus 2005, 2006, 2008 (3 volumes), Enjeux ,Stratégies et pratiques dans la filière vitivinicole, Dunod, Paris.</p> <p>DESMOND J., (2003), Consumer Behaviour, Palgrave</p> <p>EVANS M., MOUTINHO L.(1999)., Contemporary issues in Marketing, MacMillan Business.HANNIN, H.; CODRON, J.-M.; THOYER, S. (2006), The International Office of Vine and Wine (OIV) and the World Trade Organization (WTO): Standardization Issues in the Wine Sector, in BINGEN J.; BUSCH L.(ed.), Agricultural Standards: The Shape of the Global Food and Fiber System, Springer, Netherlands, p.73-96.</p> <p>FLINT, D J & SIGNORI, P (2015), Contemporary wine marketing and supply chain management: A global perspective, Palgrave Macmillan.</p> <p>HALL, C M & MITCHELL, R (2008), Wine marketing: a practical guide, Elsevier.</p> <p>HALLIDAY, J, (2015), Halliday Wine Companion 2015, Editor: Hardie Grant Books, paperback or Kindle.</p> <p>HEIJBROEK, A.(2007), Changing competitiveness in the wine industry, The rise and fall of wine countries, Rabobank Publishing, The Netherlands.</p> <p>HOSSZU,E, (2012), An analytical comparison of wine marketing concepts: in new world and old wineries, Ed: AV Akademiker verlag.</p> <p>INTERNATIONAL ORGANISATION OF VINE AND WINE (OIV), State of the Vitiviniculture World Market OIV Report (2002-2010), (Available online at http://www.oiv.int).</p> <p>JENSTER P.V., SMITH D., MITRY D.J., JENSTER L., (2008), The Business of Wine. A Global Perspective, Copenhagen School Press 197 p.KOTLER P., ARMSTRONG G., (2006), Principles of Marketing, Prentice Hall, New York.</p> <p>MONTAIGNE, E.; COELHO, A. coordinators, (2006), The reform of the common market organization for wine, Policy Department and Cohesion Policies, European Parliament, Brussels, 75 p. + appendixes 120p.</p> <p>LUKACS, P. (2012), Inventing Wine: A new history of one of the world’s most ancient pleasures, Editor: WW Norton & Co Inc (Kindle or Hardcover).</p> <p>MCGECHAN, B (Ed), (2013), Wine Marketing Online: How to use the newest tools of marketing to boost profits and build brands, Wine Appreciation Guild</p> <p>MONTAIGNE, E ; RASTOIN, A., COELHO A.(2006), Globalization of the world wine market and restructuring of the supply side, INRA Sciences Sociales, N° 5-6, November 2006. (Available at http://www.inra.fr/internet/Departements/ESR/publications/iss/pdf_eng/iss06-5_7Globalization_Eng.pdf)</p> <p>MORA, P, (2015), Wine positioning: A handbook with 30 case studies of wine brands and wine regions in the world, Progressive Busines Consulting.</p> <p>MORA, P (2014), Wine business case studies: Thirteen cases</p>
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	<p>from the real world of wine business management, Wine Appreciation Guild.</p> <p>Olivier, G, ORLEY, A, WILLIAM Z, (2018), Handbook of the economics of wine (2 volumes), World Scientific.</p> <p>ROBINSON R N S, SIGALA, M, (2019), Wine tourism destination management and marketing: theory and cases, Palgrave MacMillan.</p> <p>ROUZET E., SEGUIN G., (2003), Le marketing du vin, Savoir vendre le vin, Dunod, Paris.</p> <p>SCARPA R., THIENE M., GALLETTO L., (2009), Consumers WTP for Wine with Certified Origin: Preliminary Results from Latent Classes Based on Attitudinal Responses, Journal of Food Products Marketing, 15, 231-248. http://www.vitisphere.com</p> <p>SMITH, D E, MITRY, D, JENSTER, Per V, JENSTER, L V, (2014), International business of wine: A world of producers, buyers and cellars, CreateSpace Independent publishing platform.</p> <p>SZOLNOKI, G, THACH, L, KOLB, D (2016), Successful social media and ecommerce strategies in the wine industry, Palgrave Macmillan.</p> <p>UGAGLIA, A A, CARDEBAT J-M, CORSI A, (2019), The Palgrave Handbook of Wine Industry Economics, Palgrave MacMillan.</p> <p>WEBSITES and DATA</p> <p>http://www.oiv.int/</p> <p>https://www.adelaide.edu.au/wine-econ/</p> <p>Instituto Español de Comercio Exterior (ICEX):</p> <p>http://www.icex.es/</p> <p>http://www.deutscheweine.de/</p> <p>http://www.austrianwine.com/</p> <p>http://www.calwinexport.com</p> <p>http://www.wineinstitute.org/</p> <p>https://wfanet.org</p> <p>http://www.nzwine.com/</p> <p>http://www.sawis.co.za/</p>
Update:	March 2021

	Enology
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Jorge M. Ricardo-da-Silva, Prof. PhD HDR (Universidade de Lisboa)
Lecturers:	<p><u>PU Grape and Wine Composition</u> <u>Lecturer in charge:</u> Jorge M. Ricardo-da-Silva, Prof. PhD HDR (Universidade de Lisboa); <u>Additional lecturers:</u> Antonio Morata, Prof. PhD (Universidad Politécnica de Madrid); Santiago Benito, Prof. PhD (Universidad Politécnica de Madrid); Aurélie Roland, Prof. PhD (Montpellier SupAgro)</p> <p><u>PU : Microbiology and Fermentation:</u> <u>Lecturer in charge:</u> Bruno Blondin, Prof. PhD, (Montpellier SupAgro); <u>Additional lecturers:</u> Doris Rauhut, Prof. Dr. (Geisenheim University), Jürgen Wendland, Prof. Dr. (Hochschule Geisenheim University), Isabelle Masneuf, PhD HDR (Bordeaux Sciences Agro)</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	In blocks 2 blocks (PU Grape & Wine composition; PU: Microbiology and Fermentation)
Workload:	<p><u>PU Grape & Wine Composition:</u> Face to face lectures: 38h (theoretical)</p> <p><u>PU Microbiology & Fermentation:</u> Face to face lectures: 28h (Theoretical) + 6h (Practical) Student's personal study time in the module: 70 h</p>
Credit points:	7 ECTS, being 4 ECTS in Grape & Wine Composition and 3 ECTS in Microbiology & Fermentation
Recommended prerequisites:	<p>Basic knowledge in Enology as delivered in the module "Immersion" during the immersion period.</p> <p>Knowledge in chemistry & biochemistry of nitrogen compounds, organic acids, minerals, sugars, carbohydrates, volatile compounds and polyphenols</p>

Targeted learning outcomes:	<p><u>PU Grape & Wine Composition:</u></p> <p>Students know:</p> <ul style="list-style-type: none"> - the major and minor components in musts and wines - technical repercussion of must components - sensorial repercussion of musts and wine components - nutritional repercussion of musts and wine components <p><u>PU Microbiology & Fermentation:</u></p> <p>Students gain knowledge about:</p> <ul style="list-style-type: none"> - the metabolism of yeast and bacteria relevant for wine making (alcoholic & malolactic fermentations), - populations dynamics from vineyard to the fermentation processes (AF & MLF), also comparing spontaneous fermentation with usage of microbial starter cultures - impact of yeast and bacteria nutrients on course of fermentation and formation of positive and negative aroma compounds - selection procedures for yeast and bacteria - impact factors on fermentations - construction of genetically engineered wine yeasts and their properties - microbial spoilage of grapes, musts and wine, - lagging and stuck fermentations and problem solving operations - Biochemistry of yeast autolysis and impact on wine aroma
Content:	<p><u>PU Grape and Wine composition:</u></p> <p>Nitrogen compounds: Proteins. Peptides. Enzymes. Aminoacids. Phenolic compounds I – Anthocyanins: Chemistry, Grape contents, Anthocyanins during fermentation and aging. Organic acids: From grape and must. Formation during yeast fermentation. Formation during MAF. Glucid compounds: Sugars, Polyalcohol, Polysaccharides. Phenolic compounds II: Flavanols, flavanols (proanthocyanidins), flavanols, phenolic acids, stilbens, Varietal aroma and other volatile aroma compounds, Mineral compounds.</p> <p><u>PU Microbiology and Fermentation:</u></p> <p>Yeast cell biology and taxonomy; special carbon metabolism and by-products of fermentations, fermentation cycle. Yeast physiology, nutrition and stress factors. Nitrogen and sulphur metabolism; sulfite production and sulfite management. Role and effects of fermentation additives on fermentation performance. Nutritional demands of yeasts and strain differences. Genetic improvement of wine yeast and risk assessment.</p> <p>Lactic acid bacteria: taxonomy, metabolism, nitrogen and oxygen management. Wine spoilage by yeast and bacteria.</p> <p>Targeted impact of yeast and bacteria on wine flavour (de novo synthesis of compounds and hydrolysis of bound aroma substances from precursors.</p>


	Spontaneous fermentations versus usage of starter cultures; selection scheme for starters. Mixed yeast cultures and simultaneous usage of yeast and bacteria starter cultures. Control of fermentation. Biochemical post-fermentation processes during yeast autolysis: formation of sensory relevant compounds.
Exam achievements:	Written examination
Teaching/learning media:	Power point, whiteboard
Literature:	<p><u>PU Grape and Wine composition:</u></p> <p>Boulton, R.B., Singleton, V.L., Bisson, L.F., Kunkee, R.E. (1996). Principles and Practices of Winemaking. Chapman and Hall, New York.</p> <p>Flanzy, C. (1998). Oenologie. Fondements Scientifiques et Technologiques, Tec&Doc. Lavoisier, Paris.</p> <p>Fleet, G.H. (1993). Wine Microbiology and Biotechnology. Harwood Academic Publishers, Chur.</p> <p>Morata, A (editor). (2019). Red Wine Technology, Elsevier.</p> <p>Ribereau-Gayon, P., Y. Glories, A. Maugean, and D. Dubourdieu. (eds.). (2000). Handbook of Enology Volume 2: The Chemistry of Wine Stabilization and Treatments. John Wiley&Sons, New York. (Chapt. 1-7)</p> <p>Waterhouse, A.L. and S.E. Ebeler (eds.). (1998). Chemistry of Wine Flavor. American Chemical Society, Washington, D.C.</p> <p>Reynolds, A.G. (Ed.), (2010), Understanding and managing wine quality and safety. Two Volumes 624p and 640p. Woodhead Publishing Ltd., Cambridge. Vol 1, Part 1</p> <p><i>SCI Journals for complementary references:</i></p> <p>Am. J. Enol. Vitic.; S. Afric. J. Enol. Vitic.; Aust. J. Grape Wine Res; J.Sci.Food Agric.; J. Int. Sci. Vigne Vin.</p> <p>J. Agric. Food Chem.; Food Chem.; Vitis, Sci. Alim., Ital. J Food Science; https://www.mdpi.com/journal/fermentation</p> <p><i>Scientific Databases (Internet Sources):</i></p> <p>ISI – WEB OF SCIENCE: http://apps.webofknowledge.com/WOS_GeneralSearch_inp_ut.do?product=WOS&search_mode=GeneralSearch&SID=E3sfjkNJRdvnfONzQuG&preferencesSaved=</p> <p>SCIENCE DIRECT: http://www.sciencedirect.com/</p> <p>SCOPUS: http://www.scopus.com/home.url</p> <p>GOOGLE SCHOLAR : https://scholar.google.com/</p> <p><u>PU Microbiology and Fermentation:</u></p> <p>Fleet, G.H. (2002), Wine Microbiology and Biotechnology,</p> <p>Ribereau-Gayon, P. et al.: (2006), Handbook of Enology Vol. 1,</p> <p>König, H., Uden, G., Fröhlich, J., (2009), Biology of Microorganisms in Grapes, in Must and in Wine. Springer Verlag, Heidelberg,</p>

	<p><i>SCI Journals for complementary references:</i> Am. J. Enol. Vitic.; S. Afric. J. Enol. Vitic.; Aust. J. Grape Wine Res; J.Sci.Food Agric.; J. Int. Sci. Vigne Vin.; Vitis; J. Appl. Microbiology; Appl. Environm. Microbiology; J. Ind. Microbiol. Biotechnol. https://www.mdpi.com/journal/fermentation/special_issues/non-saccharomyces</p>
Update:	sept 2020

	Project Management in Science
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Bénédicte Fontez, PhD & Florent Pantin PhD (Montpellier SupAgro)
Lecturers:	<p><u>PU Experimental methodology and statistics:</u> Lecturer in charge: Bénédicte Fontez, PhD (Montpellier SupAgro) Additional lecturers: Jorge Cadima, Prof. PhD HDR (Universidade Técnica de Lisboa); Meili Baragatti, PhD (Montpellier SupAgro), Suzana Ferreira- Dias, Prof. PhD HDR (Universidade Técnica de Lisboa) .</p> <p><u>PU Tutored projects:</u> Lecturer in charge: Florent Pantin, PhD (Montpellier SupAgro); Additional lecturers: Meili Baragatti, PhD (Montpellier SupAgro) ; Bénédicte Fontez, PhD (Montpellier SupAgro) and other lecturers of the Vinifera master degree programme as project tutors.</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	2 blocks: PU Experimental methodology and statistics 54 h; PU Research project organisation (continuous) 9 h
Workload:	<p><u>PU Experimental methodology and statistics:</u> Face to face teaching 20 h; tutored application of statistical calculations with the free software R statistic computing 25 h; field and computing sessions on « adopt a vine » 9h.</p> <p><u>PU Tutored projects:</u></p>

	<p>Workshop on project definition and organisation 4 h; intermediate and final workshops with project presentation and discussion 5 h</p> <p>Student's personal study time in the module: 80 h</p> <p>Extra optional lectures are offered: upgrade knowledge in statistics: 4 hours</p>
Credit points:	6 ECTS
Recommended prerequisites:	Basic statistics and data organisation and basic worksheet skills
Targeted learning outcomes:	<p><u>PU Experimental methodology and statistics:</u></p> <p>Students</p> <ul style="list-style-type: none"> - can design simple experiments - Collect field Data and fill Database - know how to avoid observation errors and bias - know and can apply the statistical methods commonly used in viticulture, enology and wine economics - are able to interpret the results obtained by using statistics - have knowledge of less common statistical methods (e.g. principal component analysis, cluster analysis, discriminant analysis) - can use statistical free software for data analysis <p><u>PU Research project organisation:</u></p> <p>Students</p> <ul style="list-style-type: none"> - can identify the technical and scientific questions and problems - make a review to synthesise the current state-of-the-art on a specific topic - are able to propose experimental designs (explanatory variables, measurements, replicates required) - can handle, analyse and discuss data - can write and summarise scientific reports - are able to work in research teams (coordination and structure, milestones)
Content:	<p><u>PU Experimental methodology and statistics:</u></p> <p>Methodology of scientific research The scientific method and the experimental design Hypothesis testing Samples and populations, confidence limits Analysis of Variance (ANOVA) Linear regression Modelling and optimisation (e.g. Response surface methodology) Data Analysis (e.g. Principal components analysis, Cluster analysis, Discriminant analysis) Applications of statistical programmes in case studies in viticulture, enology or wine economics.</p>


	<p><u>PU Research project organisation: Methodology of project organisation</u></p> <p>Scientific working methods (literature research, report writing) Presentation techniques</p>
Exam achievements:	<p>Written examination on statistics - Experimental methodology and statistics (30 %) Literature review and Data analysis report by groups (55 %) Adopt a vine report (15%)</p>
Teaching/learning media:	<p>Reading programme; Power Point; Excel; whiteboard; Computers, statistical programs incl. R-statistics.</p>
Literature:	<p>Balaam, L.N. (1975) Response Surface Designs, In: Developments in Field Experiment Design and Analysis, (V.J. Bolfinger e J.L. Wheeler, eds.). Commonwealth Agricultural Bureaux, pp. 11-32.</p> <p>Burgard, D.R., Kuznicki, J.T. (1990), Chemometrics: Chemical and Sensory Data, CRC Press, Boston, pp. 135-185.</p> <p>Gacula Jr., M.C., Singh, J., 1984. Response surface designs and analysis, In: Statistical Methods in Food and Consumer Research. Food Science and Technology. A Series of Monographs, Academic Press, p. 214-273.</p> <p>Gomez & Gomez. 1984. Statistical Procedures for Agricultural Research. John Wiley & Sons. 680p.</p> <p>Little, T. M. and F.J. Hills. 1978. Agricultural Evaluation, Design and Analysis. John Wiley and Sons. 350p.</p> <p>Vuataz, L., 1986. Statistical Procedures in Food Research, In: Statistical Procedures in Food Research, (J.R. Piggott, ed.), Elsevier Applied Science, London e New York, p. 101-123.</p> <p>Goos, P. and Jones, B. 2011 Optimal design of experiments Wiley p287.</p> <p>http://cran.r-project.org/ “Faraway, J.: Practical Regression and Anova using R”</p> <p>https://rcompanion.org/rcompanion/</p> <p>http://www.biostathandbook.com/</p>
Update:	<p>November 2020</p>

	Vine Biology
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Enrico Peterlunger, Prof. (Università degli studi di Udine, Italy)
Lecturers:	<p><u>PU Vine Anatomy and Genetics:</u> <u>Lecturer in charge:</u> Enrico Peterlunger, Prof. (Università degli studi di Udine);</p> <p><u>Additional lecturers:</u> Laurent Torregrosa, Prof, PhD HDR (Montpellier SupAgro), Guido Cipriani Prof. (Udine Uni), Serena Foria, PhD, Researcher (Università degli studi di Udine).</p> <p><u>PU Ampelography:</u> <u>Lecturer in charge:</u> Thierry Lacombe, PhD (Montpellier SupAgro). Additional lecturers : Anna Schneider, PhD (CNR Torino), Olivier Yobregat (IFV Sud-Ouest), David Maghradze PhD (IHVO Georgia)</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	2 blocks: (PU Vine Anatomy and Genetics 30h; PU Ampelography 21h)
Workload:	<p><u>PU Vine Anatomy and Genetics</u> Face to face lectures: 24 h; Directed exercises (laboratory course with stereo microscope): 4 h; Field visit: 2 h</p> <p><u>PU Ampelography:</u> Face to face lectures: 9 h; Directed exercises 8 h; field visit 4 h Student's personal study time in the module: 70 h.</p>
Credit points:	5 ECTS
Recommended prerequisites:	None
Targeted learning outcomes:	<p><u>PU Vine Anatomy and Genetics:</u></p> <ul style="list-style-type: none"> - Students have acquired basic knowledge of higher plant internal and external anatomy, at a whole plant level, as well as organ and tissue level. - they understand the principles of grapevine development and adaptation mechanisms that determine usual practices

	<p>of grapevine management (pruning, hedging, yield control...)</p> <ul style="list-style-type: none"> - they are introduced to the principles of Mendelian, quantitative and molecular genetics and to the genetic peculiarities of the grapevine genome - they learn strategies for genetic improvement of a perennial heterozygous crop and how molecular/biotechnological approaches are applied to speed up breeding programmes <p><u>PU Ampelography:</u></p> <p>Students</p> <ul style="list-style-type: none"> - in general, they understand the diversity, at different levels, of grapevine plant material. - they know the classification of grapevine plant material: taxonomy and systematics from <i>Vitaceae</i> family to intravarietal variations. - they learn the historical process of grape domestication and varietal evolution for <i>cépages</i>, hybrids and rootstocks. - they understand the different methods for identifying grape varieties and can apply ampelographic description in order to determine the main international cultivars in the field. - they have an overview on agronomical and enological potential of main varieties (<i>cépages</i>, hybrids and rootstocks).
Content:	<p><u>PU Vine Anatomy and Genetics:</u></p> <p>Morphology and anatomy of the grapevine organs. Root, trunk, shoot, cane, leaf, bud, leaf, flower, berry, seed. Systematics of the genus <i>Vitis</i> (basic knowledge). Cultivated species and their use. Annual cycle of the grapevine, vegetational phases. Qualitative and quantitative aspects of the annual cycle: description of the modification of organs and evaluation of biomass involved.</p> <p>Evolution of storage substances along the annual cycle. Foundations of classical genetics. General features of the grapevine genome. Origin and genetic diversity in domesticated grapevines. Conventional breeding and genetic engineering. Genetic control and improvement of agronomic traits.</p> <p><u>PU Ampelography:</u></p> <p>History and utility of ampelography, definitions, different methods of identification.</p> <p>Taxonomy and systematics of <i>Vitaceae</i> botanical family. Diversity of <i>Vitis</i> genus and <i>V. vinifera</i> species. Domestication process. Classification of varieties and clonal variations.</p> <p>Description of main varieties of rootstocks, interspecific hybrids and <i>cépages</i>.</p>
Exam methods:	Written examination
Teaching/learning media:	Power points; Stereo microscopes; Field visits
Literature:	<u>PU Vine Anatomy and Genetics:</u>

	<p>General books: Winkler et al. (1995) General Viticulture, University of California Press. Mullins MG et al. (1992). Biology of the grapevine, Cambridge University Press. Galet P. (2000) General viticulture. Oenoplurimedia, France. Keller Markus (2011). The science of grapevines: anatomy and physiology. Academic Press-Elsevier. Adam-Blondon et al (2011) Genetics, genomics, and breeding of grapes. Science Publishers.</p> <p>Specific papers: Pratt C. (1971) Reproductive anatomy in cultivated grapes: a review. AJEV 22: 92-109. Pratt C. (1974) Vegetative anatomy of cultivated grapes: a review AJEV 5: 131-150. Hardie WJ, O'Brien TP, Jaudzems VG (1992) Morphology, anatomy and development of the pericarp after anthesis in grape, <i>Vitis vinifera</i> L. AJGWR 2: 97-142. Srinivasan C, Mullins MG (1976) Reproductive anatomy of the grapevine (<i>Vitis vinifera</i> L.): origin and development. Ann Bot. 40: 1079-1084. Ojeda, H.; Andary, C.; Kraeva, E.; Carbonneau, A.; Deloire, A. 2002. Influence of pre- and postveraison water deficit on synthesis and concentration of skin phenolic compounds during berry growth of *<i>Vitis vinifera</i>* cv. Shiraz. AJEV. 53 (4) 261-267 Ollat, N.; Diakou-Verdin, P.; Carde, J. P.; Barrieu, F.; Gaudillere, J. P.; Moing, A. (2002). Grape berry development : A review. Journal International des Sciences de la Vigne et du Vin. 36 (3) 109-131 Kliewer, W. M.; Dokoozlian, N. K. (2005). Leaf area/crop weight ratios of grapevines: Influence on fruit composition and wine quality. AJEV. 56 (2) 170-181 Bergqvist, J.; Dokoozlian, N.; Ebisuda, N. (2001). Sunlight exposure and temperature effects on berry growth and composition of Cabernet Sauvignon and Grenache in the central San Joaquin Valley of California. AJEV. 52 (1) 1-7 Schultz H.R., (1992). An empirical model for the simulation of leaf appearance and leaf development of primary shoots of several grapevine (<i>Vitis vinifera</i> L.). Scientia Hortic. 52, 179-200 Lebon E., Pellegrino A., Tardieu F., Lecoecur J. (2004). Shoot development in Grapevine (<i>Vitis vinifera</i> L.) is affected by the modular branching pattern of the stem and intra- and inter- shoot trophic competition. Ann. Bot. 93: 263-274. Pellegrino A., Lebon E., Simonneau T., Wery J. (2005). Towards a simple indicator of water stress in grapevine (<i>Vitis vinifera</i> L.) based on the differential sensitivities of vegetative growth components. Aust. J. Grape Wine Res.: 11, 306-315. Pallas B., Louarn G., Christophe A., Lebon E., Lecoecur J. (2008). Influence of intra-shoot trophic competition on shoot development in two grapevine cultivars (<i>Vitis vinifera</i> L.) Physiol. Plant. 134, 49-63</p>
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Update:	March 2021

	Vine Ecology and Physiology
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Alain Deloire, Prof. PhD DSc (Montpellier SupAgro), Anne Pellegrino, PhD (Montpellier SupAgro)
Lecturers:	<p><u>PU Vine Physiology:</u> <u>Lecturer in charge:</u> Anne Pellegrino, PhD (Montpellier SupAgro) <u>Additional lecturers:</u> Amelia Caffarra, PhD (ITK Montpellier), Florent Pantin, PhD (Montpellier SupAgro), Charles Romieu, PhD DSc (INRA Montpellier), Nicola Tomasi PhD (University of Udine), Manfred Stoll, Prof. PhD (Geisenheim University)</p> <p><u>PU Vine Ecology:</u> <u>Lecturer in charge:</u> Pilar Baeza Trujillo, Prof. PhD (University Politécnica de Madrid) <u>Additional lecturers:</u> François Colin, Prof. PhD DSc (Montpellier SupAgro); Silvia Guidoni (University of Turin), Damien Fumey, PhD (ITK Montpellier), Ignacio García de Cortázar-Atauri, PhD (INRA-Avignon), Claire Marsden, PhD (Montpellier SupAgro), Bruno Tisseyre, Prof. PhD (Montpellier SupAgro).</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	In block (2 blocks: PU Vine Ecology 41.5 h and PU Vine Physiology 38 h)
Workload:	<p><u>PU Vine Ecology</u> Face to face lectures 37.5 h; directed exercises (practices) 4 h;</p> <p><u>PU Vine Physiology:</u> Face to face lectures 32 h; directed exercises 6 h, Student's personal study time in the module: 28h</p>
Credit points:	8 ECTS
Recommended prerequisites:	<ul style="list-style-type: none"> - Basic knowledge in Viticulture as delivered in the module "Immersion" - Basics in soil sciences - Module "Vine Biology"

Targeted learning outcomes:	<p>PU Vine Physiology:</p> <ul style="list-style-type: none"> - To get a basic understanding about grapevine physiology, fruit growth and composition and their responses to the interactive effects of Genotype vs abiotic Environment vs crop Management in order to be able to reason vineyard and crop management (pruning, canopy architecture, crop load...), and inputs (water, nutrients), according to specific objectives of yield and wine profiles. - To be able to reason and apply practical methods issued from research, including a first insight in remote sensing approaches, and specific decision making tools identifying physiological measures, to assess fruit development, composition and ripening to better manage cultural practices and harvest decisions. <p>PU Vine Ecology:</p> <ul style="list-style-type: none"> - To understand the overall impacts of climatic factors vs soil characteristics and their interaction with viticultural practices (irrigation, soil preparation, cover crops; nutrient supply) for the production of desired wine styles and yield. - To be able to assess and eventually to manage/correct the potential negatives impacts of climate (drought, radiation, frost, hail, high wind...) or soil (acidity, pH, erosion, poor organic matter content, salinity...). - To be able to evaluate/measure the climate and soil parameters in order to characterize current or new sites/terroir and being able notably to adapt the varieties and rootstocks to new sites; to answer the market in terms of wine styles; to manage inputs (water, nutrient).
Content:	<p>PU Vine Physiology:</p> <p>Lectures:</p> <ul style="list-style-type: none"> • Berry development and biochemistry • Vegetative development • Light interception efficiency • Phenology modelling. Application for the prediction of abiotic risks • Water relations • Remote sensing • Root to shoot communication • Carbon and nutrient acquisition <p>Practices:</p> <ul style="list-style-type: none"> • Sequential harvest and wine flavours profiles • Phenology modelling • Light interception modelling <p>PU Vine Ecology:</p> <p>Lectures:</p>

	<ul style="list-style-type: none"> • Climate factors affecting vine growth: temp, hail, rain, wind • Climate change and grapevines. Observed and simulated impacts and adaptation strategies • Climate indexes • Water Balance (Terroir) • Water Balance (model) • Basics in Soil • Soil Ecology <p>Practicals:</p> <ul style="list-style-type: none"> • Visit to Domaine du Chapitre • Climate indexes (practice) <p>PU Vine Physiology & PU Vine Ecology: General discussion:</p> <ul style="list-style-type: none"> • Have you noticed controversies across the Physiology and Ecology lectures? Great, then let's talk about it!
Exam methods:	<p>A combined 2 hours written exam</p> <p>PU Vine Physiology (50 % of final mark) :</p> <p>Study Case work (group of 2 or 3): 25% of module mark</p> <p>Multiple choice exam on paper (1hour) 25% of module mark</p> <p>PU Vine Ecology (50 % of final mark: 25% for climate and 25% for soils) :</p> <p>Home written paper (individual) 25% of module mark</p> <p>Multiple choice exam on paper (1hour): 25% of module mark</p>
Teaching/learning media:	Power point presentations; whiteboard, scientific papers and technical documents; computer programmes
Literature:	<p>Journals:</p> <p>OenoOne: https://oeno-one.eu</p> <p>American Journal of Enology and Viticulture</p> <p>Australian J. of Grape and Wine Research</p> <p>Scientia Horticulturae</p> <p>Acta Horticulturae (ISHS)</p> <p>South African Journal of Enology and Viticulture</p> <p>Vitis</p> <p>Books:</p> <p>Atwell B.J., P.E. Kriedemann, and C.G.N. Turnbull, (1998), Plants in Action: adaptation in nature, performance in cultivation. MacMillan Education Australia, South Yarra, Victoria, Australia, 664 pp.</p> <p>Carbonneau A., Torregrosa L., Deloire A., Pellegrino A., Pantin F., Romieu C., Ojeda H., Jaillard B., Metay A., Abbal P. (2020), Traité de la vigne, 3^e Ed. Dunod Ed., 712pp.</p>


	<p>Coombe BG and Dry PR. 2001. Viticulture vol 1 & 2 Winetittles. Adelaide (Australia) 255pp/ 376pp.</p> <p>Deloire A. A few thoughts on grapevine training systems, (June 2012), Wineland, 82-86.</p> <p>Geros, H Chaves, M.M, Gil, H.M, Delrot, S., (2015), Grapevine in a Changing Environment; A Molecular and Ecophysiological Perspective, Wiley-Blackwell.</p> <p>Huglin P. and C. Schneider. Biology and écologie de la Vigne. Pyot-Lausanne. Rustica. Gladstones J. (2002). Viticulture and Environment. Winetittles. Adelaide (Australia). 320pp.</p> <p>Ingels C.A., R.L. Bugg, G. T McGourty and L.P. Christensen. (1998). Cover Cropping in Vineyards: A Grower's Handbook. Winetittles. Adelaide (Australia). 162 pp</p> <p>Iland, P.; Dry, P.R. Proffitt, T. and S. Tyerman (2011). The Grapevine: from the science to the practice of growing vines for wine; publisher: Patrick Iland Wine Promotions Pty Ltd</p> <p>Jackson D. Monographs in Cool Climate Viticulture 2. Climate. (2001). Adelaide (Australia). 80 pp.</p> <p>Jackson D., Wine Science,- Principles and Applications. Academic Press, San Diego, 475pp.</p> <p>Jones H.G., Plants and microclimate, third Edition. Cambridge University Press, 428 pp.</p> <p>Jones, H. G. and Vaughan, R. A. (2010). Remote Sensing of Vegetation: Principles, Techniques, and Applications Oxford: Oxford University Press.</p> <p>Keller, M. The Science of Grapevines: Anatomy and Physiology, Kindle, 391pp.</p> <p>Lambers and Ribas-Carbo. Advances in Photosynthesis and Respiration: Plant respiration: From cell to Ecosystem, Springer Berlin, 250pp.</p> <p>Martínez de Toda f. (1991). Biología de la vid. Mundi-Prensa. Madrid. 346 pp.</p> <p>Mullins, Bouquet, Williams. Biology of the Grapevine. Cambridge University Press, 239 pp.</p> <p>Smart R and Robinson M. 2006. Sunlight into Wine: A Handbook for Winegrape Canopy Management. Wintetittles. Adelaide (Australia) 96pp.</p> <p>White RE. (2003). Soils for Fine Wines. Oxford University Press. New York (USA).279pp.</p>
Update:	July 2020

	Viticulture
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Pilar Baeza Trujillo, Prof. PhD (Universidad Politécnica de Madrid); Manfred Stoll, PhD (Hochschule Geisenheim University)
Lecturers:	<p><u>PU Vineyard management coordinator: Pilar Baeza</u> <i>Additional lecturers:</i> Jorge Queiroz, Prof. PhD (University of Porto); Marco Contin, Prof. PhD (University of Udine); Jesus Yuste, PhD (ITACyL Castilla y Leon, Valladolid); Aurélie Métay, PhD (Montpellier SupAgro); Alain Deloire, Prof. PhD HDR (Montpellier SupAgro), Thibault Scholasch, PhD (Fruition Sciences); Laurent Torregrosa, Prof. PhD HDR (Montpellier SupAgro), Carlos Lopes. PhD (Universidade Técnica de Lisboa); Vittorino Novello Prof. PhD (University of Turin), Elena Kazakou (Montpellier SupAgro).</p> <p><u>PU Vine pest control coordinator: Véronique Marie-Jeanne, PhD (Montpellier SupAgro),</u> <i>Additional lecturers:</i> Selim Moustafa, PhD. (Geisenheim University); Véronique Marie-Jeanne, PhD (Montpellier SupAgro); Marie-Stéphane Tixier, PhD HDR (Montpellier SupAgro); Serge Kreiter, PhD HDR (Montpellier SupAgro); Elena Kazakou PhD HDR (Montpellier SupAgro).</p>
Language:	English
Classification curriculum:	Core module of the common first academic year
Teaching format:	In blocks: PU Vineyard management 53 h, Vine pest control 31 h,
Workload:	<p><u>PU Vineyard Management (3.5 ECTS)</u> Face to face teaching: 24 h of lectures + 3 h of field visits (partly together with PU Vine pest control) + 3 half-day seminars Personal study: 30 hours minimum.</p> <p><u>PU Vine Pest Control (3.5 ECTS)</u> Face to face teaching: 27 h of lectures + 3 h of directed exercises Personal study: 30 hours minimum.</p>
Credit points:	9.5 ECTS

Recommended prerequisites:	Basic knowledge in Viticulture as delivered in the module Terroir and Company Auditing and during the Vine Biology, Ecology & Physiology modules.
Targeted learning outcomes:	<ul style="list-style-type: none"> - To be able to manage cultural practices and to make the correct choices in the context of vineyard/site specificities: ecophysiology and environment interactions - To be able to use and/or source innovative technics/decision making tools developed or under calibration by research - To be able to do a vineyard diagnostic/assessment to implement a cultural practice programme which will allow achieving the yield and quality/wine styles goals in the context of sustainable viticulture. - To be able to identify and manage bio-aggressors by learning about the biology and epidemiology of the main pests, diseases and weeds of vines in the world, how they interact and by understanding integrated and organic strategies of control - To be able to implement tools for the diagnosis of pests and diseases
Content:	<ul style="list-style-type: none"> - Techniques needed to set up vineyard establishment - Soil management strategies - Irrigation equipment and monitoring - Canopy management, trellising - Table grapes - Steep slope and tropical viticulture - Mites in vineyards - Cicadellids and transmitted pathogens - Grape moths and other insects - Viruses of vines - Coccoids and transmitted pathogens - Grapevine wood diseases - Vine fungi and bacteria - Weeds in the vineyard - Study visits
Exam achievements:	Evaluation of practical work (case study) and written examination (quizzes) (50% <u>Vineyard management</u> ; 50% <u>Vine pest control</u>)
Teaching/learning media:	Powerpoint, whiteboard, internet, field visit and practical work; field studies
Literature:	<p>Almeida R., Daane K., Bell V.A., Blaisdell G. K., Cooper M., Herrbach E and Pietersen G. (2014). Ecology and management of Grapevine leafroll diseases. <i>Frontiers in Microbiology</i> Vol 4 , article 94.</p> <p>Carbonneau A., Torregrosa L., Deloire A., Pellegrino A., Pantin F., Romieu C., Ojeda H., Jaillard B., Méta y A., Abbal P., 2020. <i>Traité de la Vigne, Physiologie-Terroir-Culture</i>, Dunod Editeur, Paris, France, ISBN 978-2-10-079857-5, 689 p.</p>

	<p>Coombe B., Dry P., (2006). Viticulture. Volume 2 Practices. Winetitles Ed. Chapters on Irrigation, Soil management, Fertilization.</p> <p>Smart and Robinson. 1992. Sunlight into wine. Winetitles.</p> <p>Compant, S, Mathieu, F. (eds;) (2016), Biocontrol of major grapevine diseases: leading research, CABI.</p> <p>Dermastia, M (2017), Grapevine Yellow Diseases and their phytoplasma agents, Biology and Detection, Springer.</p> <p>Compendium of grape diseases. Pearson, Lavoisier ed. 01-1988.</p> <p>Grape Pest Management. Second Edition. Publication 3343. Published 1992. 412 pages - ISBN 0-931876-96-6</p> <p>Hemmer C., Djennane S., Ackerer L., Hleibieh K., Marmonnier A., Gersch S., Garcia S., Vigne E., Komar V., Perrin M., Gertz C., Belval L., Berthold F., Monsion B., Schmitt-Keisinger C., Lemaire O., Lorber B., Gutierrez C., Muyltermans S., Demangeat G and Ritzenthaler C. Nanobody mediated resistance to Grapevine Fanleaf Virus in plants. Plant Biotechnology Journal 2018 5(16) pp 660-671.</p> <p>Integrated pest management of grapevines: Present and future strategies. Proceedings of the Nelson J. Shaulis Viticulture Symposium, March 5 and 6, 1991. New York State Agricultural Experiment Station, Cornell University, Geneva, New York.</p> <p>Nicholas, P. (1994), Diseases and Pests. Grape Production Series Number 1. Winetitles Media</p> <p>M.C. Kelly, A.M. McGregor, M.F. Wachtel, P.A. Magarey. (2000). Field Guide to Diseases, Pests and Disorders of Grapes Winetitles. http://ipm.ucanr.edu/PMG/C302/m302yi01.html</p> <p>Magarey, P (2018), The Australian and New Zealand Field Guide to Diseases, Pests and Disorders of Grapes, (pocket sized book useful for taking to the vineyard), Winetitles Media.</p> <p>Mani, M., Shivaraju, C., Narendra Kulkarni, S., (2014), The Grape Entomology, Springer.</p> <p>Martelli G.P.(2014). Directory of virus and virus-like diseases of the grapevine and their agents. Journal of Plant Pathology vol 96 suppl (1) 2014.</p> <p>Meng, B Martelli, G.P., Golino, D.A., Fuchs, M. (Eds.) (2017), Grapevine Viruses: Molecular Biology, Diagnostics and Management, Springer.</p> <p>Van Leeuwen C., Trégoat O., Choné X., Bois B., Pernet D. and Gaudillère J.-P., 2009. Vine water status is a key factor in grape ripening and vintage quality for red Bordeaux wine. How can it be assessed for vineyard management purposes? J. Int. Sci. Vigne Vin, 43, n°3, 121-134.</p> <p>de la vigne. 2e édition. Ed. Synthèse Agricole – Lavoisier, Paris. ISBN 978-910340-50-6, 269p.</p> <p>Wilcox, W.F, Gubler, W.D., Uyemoto, J.K. (2015), Compendium of Grape Diseases, Disorders and Pests, Amer Phytopathological Society</p>
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Update:	February 2020
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	Wine Analysis
Academic Year:	1st academic year at Montpellier SupAgro
Module coordinator:	Sofia Catarino, Prof. PhD (Universidade de Lisboa)
Lecturers:	<p>PU Wine Analysis Lecturer in charge: Sofia Catarino, Prof. PhD (Universidade de Lisboa)</p> <p>Additional lecturers: Aurélie Roland, Prof. PhD (Montpellier SupAgro); Iris Loira, Prof. PhD (Universidad Politécnica de Madrid); Piergiorgio Comuzzo, Prof. PhD (Università di Udine)</p> <p>PU Wine Sensory Analysis Lecturer in charge: Patrice Lallemand, MS (Montpellier SupAgro)</p> <p>Additional lecturers: Jean-Christophe Barbe, Prof. PhD (Bordeaux Sciences Agro); Jung Rainer, Prof. PhD (Hochschule Geisenheim University); Doris Häge PhD (Hochschule Geisenheim University); Jonas Tofterup, MS MW (Iberian Wine Academy).</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	<p>In a block: PU Wine Analysis 42.5 h</p> <p>In a block: PU Wine Sensory Analysis 10 h lectures</p> <p>Continuous: PU Wine Sensory Analysis 19 h Tutorials</p>
Workload:	<p>PU Wine Analysis: Face to face lectures: 12.5 h; Laboratory exercises: 30 h</p> <p>PU Wine Sensory Analysis: Montpellier: Face to face lectures: 7 h; Practical: 12 h Bordeaux: 10 h (3 h lectures + 7 h Tutorials)</p> <p>Students' personal study time in the module: 30 h (optional wine tasting sessions are offered)</p>
Credit points:	5 ECTS
Recommended prerequisites:	NONE
Targeted learning outcomes:	<p>By the end of the module, students will be able to:</p> <p>PU Wine Analysis</p>

	<ul style="list-style-type: none"> - Understand the role of analytical chemistry on grape and wine quality control; - Know the main analytical methods applied in grape must and wine analysis; - Interpret the wine analysis results in order to decide and to control the wine treatments as well the assessment of legal and commercial wine specifications. <p>PU Wine Sensory Analysis</p> <ul style="list-style-type: none"> - Know the theoretical background and the vocabulary of sensory analysis; - Know the main principles, techniques and tools applied in wine sensory analysis; - Understand the different applications of the sensory analysis methodology in a professional context: research, wine-making, hospitality; - Be able to use the relevant sensory analysis methodology in order to carry out quality control from the harvest to the final product ready for the customer; - Know how Descriptive Sensory Analysis permits product traceability; - Know a vast field of application implying varied techniques covering comparative and descriptive tests.
Content:	<p>PU Wine Analysis:</p> <p>Wine quality and quality control: quality characteristics; critical control points in wine processing; legal and commercial wine specifications.</p> <p>Methods of analysis of wines and musts. Classical and modern wine analysis. Regulatory requirements. Methods' figures of merit/validation.</p> <p>Grape ripeness control: analytical control of sugars and acidity; concepts and analysis of technological and phenolic maturity indexes.</p> <p>Wine quality control through the production process: general chemical analysis.</p> <p>Wine safety/Wine contaminants (heavy metals, ochratoxin A; biogenic amines; ethyl carbamate) and pesticide residues; occurrence and enological strategies to reduce the risk of contamination.</p> <p>PU Wine Sensory Analysis:</p> <p>Introduction to Sensory Analysis in general and especially of wine: Data analysis; Selection and training of judges called for Sensory Analysis; Make up of homogeneous jury adapted to the different tests; Different tests applied in Sensory Analysis (parametric or not) and statistical analysis of results; Different steps of practical</p>

	descriptive tastings; Semantics of descriptive Sensory Analysis and its various techniques of application in tastings, use of vocabulary (free and pre-established); Tasting grids; Descriptive Sensory Analysis versus the influence of quality factors (terroir, grape varieties).
Exam methods:	<p>PU Wine Analysis: Attendance at laboratory sessions; Written (group) report of the laboratory sessions; Critical literature review (individual).</p> <p>PU Wine Sensory Analysis: Individual portfolio; Final exam: multiple choice questions.</p>
Teaching/learning media:	Power point, whiteboard, scientific and technical articles.
Literature:	<p>PU Wine Analysis: Boulton R.B., Singleton V.L., Bisson L.F., Kunkee R.E., 1996. Principles and Practices of Winemaking. Chapman and Hall, New York.</p> <p>Curvelo-Garcia A.S., Barros P. (Eds), 2015. Química Enológica – métodos analíticos. Avanços recentes no controlo da qualidade de vinho e de outros produtos vitivinícolas. Publindústria, Porto.</p> <p>Curvelo-Garcia A.S., Barros P., Catarino S., 2017. Caracterização química e física de uvas, mostos e vinhos. In Glossário Ilustrado do Vinho/Illustriertes Glossarium des Weines/Illustrated Wine Glossary/Glossaire Illustré du Vin, 193-209, Bohm J. (Ed.). Dinalivro.</p> <p>Dukes B.C., Butzke C.E., 1998. Rapid determination of primary amino acids in grape juice using an o-phthaldialdehyde/N-acetyl-L-cysteine spectrophotometric assay. Am. J. Enol. Vitic. 49:125-134</p> <p>Flanzly C., 1998. Oenologie. Fondements scientifiques et technologiques. Tec & Doc. Lavoisier, Paris.</p> <p>Jacobson, J. L., 2006. Introduction to wine laboratory practices and procedures. Springer Science & Business Media.</p> <p>Jackson, R. S., 2008. Wine science: principles and applications. Academic press.</p> <p>Miller J., Miller J., Miller R., 2018. Statistics and Chemometrics for Analytical Chemistry. 7th edition. Pearson Higher Education, Instock.</p> <p>Morata A., 2019. Red Wine Technology. Academic Press, Elsevier.</p> <p>OIV, 2019. International Oenological Codex. OIV, Paris.</p> <p>OIV, 2019. Compendium of International Methods of Wine and Must Analysis. Vol. 1 and 2. OIV, Paris.</p> <p>Ribéreau-Gayon, P.; Glories, Y.; Maujean, A.; Dubourdieu, D. (Eds.), 2006. Handbook of Enology. Vol. 2. The chemistry of wine. Stabilization and treatments. 2nd edition. Wiley, England.</p>


	<p>Rousseau, J., Delteil, D. (2000). Présentation d'une méthode d'analyse sensorielle des raisins. Principe, méthode et grille d'interprétation. Rev. Fr. Œnol., 183:10-13.</p> <p>Zoecklein, B.; Fugelsang, K.C.; Gump, B.H.; Nury, F.S., 1999. Wine analysis and Production. Springer.</p> <p>CI Journals for complementary references: Am. J. Enol. Vitic.; Aust. J. Grape Wine Res.; Ciência Téc. Vitiv.; Food Chem.; J. Agric. Food Chem.; J. Int. Sci. Vigne Vin; J. Sci. Food Agric.; S. Afr. J. Enol. Vitic.; Vitis</p> <p>Scientific Databases (Internet Sources): VITIS-VITICULTURE AND ENOLOGY ABSTRACTS: https://www.vitis-vea.de ISI – WEB OF SCIENCE: www.webofknowledge.com SCIENCE DIRECT: https://www.sciencedirect.com/ SCOPUS: https://www.scopus.com</p> <p>PU Wine Sensory Analysis: O'Mahony. Sensory evaluation of food – Statistical methods. 1986. Ed. Marcel Dekker, Inc. New York.</p> <p>Ronald S.Jackson – Wine tasting A professional Handbook 3rd edition. 2012. Ed. Academic Press Publication, UK</p> <p>Rosario Caballero, Ernesto Suarez-Toste, Carita Paradis – Representing Wine – Sensory Perceptions, Communication and Cultures. 2019. Ed. John Benjamins Publishing Cie, Amsterdam</p> <p>Leriche, Coline & Molinier, Clara & Caillé, Soline & Razungles, Alain & Symoneaux, Ronan & Coulon-Leroy, Cécile. (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. 10.1002/jsfa.10428.</p> <p>R. Pfister – Les parfums du vin, 2013, Ed. Delachaux et Niestlé, Paris</p>
Update:	March 2021

	<h2 style="margin: 0;">Wine Processing</h2>
Academic Year:	1 st academic year at Montpellier SupAgro
Module coordinator:	Aude Vernhet, Prof. PhD HDR (Montpellier SupAgro)
Lecturers:	<p><u>PU Wine making:</u> <u>Lecturer in charge:</u> Antonio Morata, Prof. PhD (Universidad Politécnica de Madrid), <u>Additional lecturers:</u> Simone Giacosa, Prof. PhD (University of Torino), Santiago Benito, Prof. PhD (Universidad Politécnica de Madrid), Matthias Schmitt, PhD, (Geisenheim Hochschule University), Wendu Tesfaye, Prof. PhD (Universidad Politécnica de Madrid).</p> <p><u>PU Post-vinification:</u> <u>Lecturer in charge</u> Aude Vernhet, Prof. PhD HDR (Montpellier SupAgro) <u>Additional lecturer:</u> Mark Strobl, Prof. Dr.-Ing. (Geisenheim University).</p>
Language:	English
Classification within the curriculum:	Core module of the common first academic year
Teaching format:	In block (2 blocks: PU Wine making 43 h; PU Post-vinification 36 h)
Workload:	<p><u>PU Wine making:</u> Face to face lectures: 43 h <u>PU Post-vinification:</u> Face to face lectures: 27 h; directed exercises 4 h; study visit 8 h Student's personal study time in the module: 100 h</p>
Credit points:	7 ECTS
Recommended prerequisites:	Basic knowledge in Enology as delivered in the module “Immersion” during the immersion period.
Targeted learning outcomes:	<p><u>PU Wine Making:</u></p> <ul style="list-style-type: none"> - students know wine making process in white and rosé wines - they know wine making process in red wines - they understand ageing of white and red wines (vat/barrel) - and know other kinds of wines: Sparkling, fortified, sweet wines <p><u>PU Post-vinification:</u></p> <ul style="list-style-type: none"> - students know about the main physico-chemical changes and alterations liable to occur in wines;

	<ul style="list-style-type: none"> - they know the methods used to assess the risks and the stabilization methods (unit operations, fining, additives...) implemented to prevent them and ensure product conservation; - students have acquired theoretical and applied basis for the implementation and control of the unit operations used for wine (must clarification and microbiological stabilization); - they know basics about wine packaging technologies.
Content:	<p><u>PU Wine Making:</u></p> <p>Engineering of pre-fermentative processes</p> <p>White and rosé wines: Preparation of must and juice (Destem, Crush, Pressing, SO₂ addition.). Fermentation.</p> <p>Red Wines: Preparation of must and juice (Destem, Crush, SO₂ addition). Maceration/Fermentation. Maceration techniques-increasing the extraction, Pressing. MLF.</p> <p>Barrel Aging of white and red wines</p> <p>Special wines/Special techniques</p> <ul style="list-style-type: none"> - Thermovinification - Flash expansion - Carbonic maceration - Special vinifications - Sparkling wines - Fortified wines - Botrytis spoiled wines <p><u>PU Post-vinification:</u></p> <ul style="list-style-type: none"> - Wine clarification and stabilization: necessity and objectives - Main colloidal instabilities in wines – risk assessment and stabilization methods. - Theoretical and practical aspects of wine fining. - Wine (must) clarification: principle of the different unit operations and their control in enology (centrifugation/floatation, dead-end filtrations, cross-flow microfiltration) - Crystallization of tartaric salts in wines: origin and stabilization methods (nucleation and crystal growth, impact of wine constituents, TID, Tsat and ISTC 50 tests, cold stabilization, electro dialysis, additives). - Microbiological stabilization (membrane filtration, flash pasteurization, pasteurization, hotfilling, tunnel pasteurization). - SO₂ and other additives. - Glass bottle production, PET bottle production, bottle inspection, bottling of glass bottles, PET bottles, Tetra Pak, Bag in Box and kegs, flash pasteurization, pasteurization, hot filling, membrane filtration, corks, crown corks, screw closures, Vino Lok, level adjustment and control, labelling.
Assessment methods:	Written Examination
Teaching media:	PowerPoints; whiteboard; papers, industry films, pdf scripts
Literature:	<u>PU Wine Making:</u>

<p>Boulton, R. B., Singleton, V. L., Bisson, L. F., Kunkee, R. E. 1996. Principles and Practices of Winemaking. Chapman and Hall, New York. Chapter 3. Preparation of musts and juice. Chapter 5. Red and white table wines. Chapter 10. The maturation and aging of wines</p> <p>Ribereau-Gayon, P., Y. Glories, A. Maugean, and D. Dubourdieu. (eds.). (2000). Handbook of Enology Volume 2: The Chemistry of Wine Stabilization and Treatments. John Wiley & Sons, New York. Chapter 13. Aging red wines in vat and barrel: Phenomena occurring during aging.</p> <p>Reynolds A.G. (Ed.), (2010). Understanding and managing wine quality and safety. Two Volumes 624p and 640p. Woodhead Publishing Ltd., Cambridge. Vol 1 Part 3. Vol 2 Part 1 and 2</p> <p>Butzke C.E. (Ed.), (2010). Winemaking problems solved. 398p. Woodhead Publishing Ltd., Cambridge.</p> <p><i>SCI Journals for complementary references:</i></p> <p>Am. J. Enol. Vitic.; S. Afric. J. Enol. Vitic.; Aust. J. Grape Wine Res.; J. Int. Sci. Vin. Wine.; J. Agric. Food Chem.; Food Chem.</p> <p><i>Suggested reviews:</i></p> <p>Sacchi, K. L., Bisson, L. F. & Adams, D. O. (2005). A review of the effect of winemaking techniques on phenolic extraction in red wines. Am. J. Enol. Vitic. 56, 197-206.</p> <p>Gómez-Plaza, E. & Cano-López, M. (2011). A review on micro-oxygenation of red wines: Claims, benefits and the underlying chemistry. Food Chemistry, 125, 1131–1140.</p> <p>Garde-Cerdán, T. & Ancín-Azpilicueta, C. (2006). Review of quality factors on wine ageing in oak barrels Trends in Food Science & Technology, 17, 438–447.</p> <p><u>PU Post-vinification:</u></p> <p>Ribereau-Gayon, P., Y. Glories, A. Maugean, and D. Dubourdieu. (eds.). 2000. Handbook of Enology Volume 2: The Chemistry of Wine Stabilization and Treatments. John Wiley & Sons, New York.:</p> <ul style="list-style-type: none"> * Chapter 8. Chemical nature, origin and consequences of the main organoleptic defects. * Chapter 9. The concept of clarity and colloidal phenomena. * Chapter 10. Clarification and stabilization treatments: fining wines. * Chapter 11. Clarifying wine by filtration and centrifugation. * Chapter 12. Stabilizing wine physical and physicochemical processes <p>- Gautier B. - Practical aspects of wine filtration – Avenir œnologie – France.</p> <p><i>SCI Journals for complementary references</i> (Am. J. Enol. Vitic., J. Int. Sci. Vin. Wine, J. Agric. Food Chem., J. Membrane Science, Food chemistry,...)</p> <p><i>Reviews:</i></p> <ul style="list-style-type: none"> - Cadot Y. New developments in crossflow filtration. The Australian Grapegrower & Winemaker, August 2001, pp 101-105. - Daufin, G.Escudier, J. P.Carrere, H.Berot, S.Fillaudeau, L.Decloux, M., 2001. Recent and emerging applications of membrane processes in the food and dairy industry. Food and Bioproducts Processing, 79 (C2), 89-102.

	Waters, E.J., Alexander, G., Muhlack, R.Pocock, K.F.Colby, C.O'Neill, B.K.Hoj, P.B.Jones, P.(2005). Preventing protein haze in bottled white wine. The Australian Journal of Grape and Wine Research, 11, 215-225.
Update:	Sept 2020

	Terroir and Company auditing
Academic Year:	A module of the Immersion period that is delivered at the beginning of the Vinifera EuroMaster degree programme, and as an integrative course at the end of the M1.
Module coordinators:	Jean Philippe Roby (Bordeaux Sciences Agro) and Patrice Lallemand (Montpellier SupAgro)
Lecturers: (including immersion period)	Vittorino Novello, Prof. (Unisversità degli studi di Torino);; Aude Vernhet, Prof. PhD HDR (Montpellier SupAgro); Didier Olle, PhD (Montpellier SupAgro), Laetitia Mouls, PhD (University of Montpellier 1); Mark Strobl, Prof. PhD (Hochschule RheinMain); Bruno Blondin, Prof. PhD HDR (Montpellier SupAgro), Kees Van Leeuwen, Prof. Ph.D (Montpellier SupAgro), Anne Pellegrino, PhD (Montpellier SupAgro); Laurent Torregrosa, Prof. PhD HDR (Montpellier SupAgro); Patrice Lallemand, MS (Montpellier SupAgro) Jean-Philippe Roby, Eng. Agr. (Bordeaux Sciences Agro), Bernard Del'Homme, Ph.D (Bordeaux Sciences Agro); Isabelle Masneuf, PhD (Bordeaux Sciences Agro), Jean-Christophe Barbe, PhD (Bordeaux Sciences Agro).
Language:	English
Classification within the curriculum:	Compulsory module
Teaching format:	<p>In 2 blocks:</p> <p>1/ offered during the 2-week long Immersion period* at Montpellier SupAgro and Pech Rouge (experimental field station/winery in Gruissan, Aude):</p> <p>* The aim of the Immersion Period is:</p> <ul style="list-style-type: none"> - to organize all necessary administrative matters and to introduce the international dimension into the new study environment (local and regional) - to introduce the students to the structure and organization of the Vinifera EuroMaster degree programme - to offer the introduction and cultural learning module "Immersion"

	2/ offered during the 4-week integrative module at the end of the M1 at Bordeaux Sciences Agro
Workload:	Lectures (55 h): viticulture 15 h; oenology 15 h; inter cultural workshops 5 h; auditing 20h Practical exercises: 10 h (tasting and wine-making) 10h (auditing) Study trip: 1 day Personal studies including literature studies to bridge existing gaps and project 40 hours
Credit points:	5 ECTS
Recommended prerequisites:	Basic knowledge in chemistry, physic, biochemistry, botany and plant biology usually obtained in former Bachelor studies in plant production or Food Sciences. Knowledge of the economics module
Targeted learning outcomes:	Students <ul style="list-style-type: none"> - have a first overview concerning worldwide viticulture - know the history of viticulture and grape production - know the basic technologies for the cultivation of grapevine and the production of grapes for wine making - are aware of the main characteristics and challenges of the Wine Sector - understand the on-going activities in vineyards and cellars around Montpellier and know the special professional features of this region - have the chemical, biochemical and physical bases necessary to follow the enological courses. These bases are common to food science and processing in general and also in beverage and wine production. - know the basic technologies and equipment for winemaking - know about the diversity of the skills needed by oenologists - have experience in intercultural communication and in working in multicultural groups - have first experience in Sensory Analysis of wines - know about the financial aspects of wine company management - understand the interactions between vineyard, wine production and commercial aspects (systematic approach) - can apply practical methods in company auditing
Content:	<u>Introduction to viticulture and enology</u> <ul style="list-style-type: none"> - worldwide Viticulture - technologies and approaches in grapevine cultivation and grape production - history of viticulture and grape production - special features of the agriculture, viticulture and enology of the Languedoc-Roussillon region (including study trip) - workshops on harvest and wine-making at Pech Rouge research station

	<ul style="list-style-type: none"> - fundamentals in biochemistry and their application in wine making - fundamentals in chemistry in relation to wine making - laboratory analyses techniques - fundamentals in physics in relation to the application in wine making - extraction and separation techniques - biological transformations - temperature control - hygiene measures and materials <p><u>Intercultural learning</u></p> <ul style="list-style-type: none"> - workshops on intercultural communication - workshops on intercultural experience <p><u>Company Auditing:</u></p> <ul style="list-style-type: none"> - Methodology of company auditing (wine making aspects and economic aspects) - Audit coaching - Study visit
Exam achievements:	Auditing: Written examination (group and individual evaluation Powerpoint presentation on company audit 50 %) - 4 ECTS Group Project (1 ECTS)
Teaching/learning media:	Field visits, power point, black board, scientific and technological articles, serious game and workshops. Script with pdf- files, films on CD
Literature:	<p>During the Immersion Period the students will be introduced to the library of Montpellier SupAgro.</p> <p>ENOLOGY:</p> <p>Introduction to Food Chemistry by Richard K. OWUSU-APENTEN (2004). CRC Press.</p> <p>Food: the chemistry of its components by T.P. Coutate Royal Society of Chemistry, 4 edition, 2001</p> <p>Transport Processes and Separation Process Principles by Christie J. Geankoplis, Prentice Hall PTR, 4 edition, (March 2003)</p> <p>Physical principles of food preservation, by Marcus KAREL, Daryl B. Lund and Karel KAREL CRC (Marcel Dekker Ltd) 2003</p> <p>VITICULTURE:</p> <p>Mullins, M. Bouquet, A. & Williams, L. E.: Biology of the Grapevine. Cambridge University Press 1992.</p> <p>Coombe B.G., Dry P.R., Viticulture. Vol. 1. Winetitle, 1992</p> <p>Winkler A. et al., General viticulture, University of California Press, 1975.</p>

	<p>Iland P., Dry P., Proffitt T., Tyerman S.: The Grapevine: from the science to the practice of growing vines for wines, Patrick Iland Wine Promotions Pty Ltd 2011.</p> <p>INTERCULTURAL LEARNING: Erin Meyer, the culture map: decoding how people think and get things across cultures, Ed. Publicaffairs 2016. Claire Michalon, Différences culturelles mode d'emploi, Ed. Sepia 2001 K. Y. Ng, L. Van Dyne, S. Ang, From Experience to Experiential Learning: Cultural Intelligence as a Learning Capability for Global Leader Development, Published Online: 30 Nov 2017 https://doi.org/10.5465/amle.8.4.zqr511</p> <p>Publications of the Directorate of youth and of the Partnership between the Council of Europe and the European Commission : https://pjp-eu.coe.int/documents/42128013/47262514/PREMS+042218+T-kit4+WEB.pdf/37396481-d543-88c6-dccc-d81719537b32</p> <p>AUDITING: AAKER D., (1996), Building Strong Brands, The Free Press. ANDERSON, K. (2004), The World's Wine Market – Globalization at Work, Edward Elgar Publishing Limited, Glensanda House, Montpellier Parade, Cheltenham, Glos GL 50 1 UA, UK (Available online on Google) C D'HAUTEVILLE F., COUDERC J.-P., HANNIN H., MONTAIGNE E., Bacchus 2005, 2006, 2008 (3 volumes), Enjeux ,Stratégies et pratiques dans la filière vitivinicole, Dunod, Paris. DESMOND J., (2003), Consumer Behaviour, Palgrave EVANS M., MOUTINHO L.(1999)., Contemporary issues in Marketing, MacMillan Business. HANNIN, H.; CODRON, J.-M.; THOYER, S. (2006), The International Office of Vine and Wine (OIV) and the World Trade Organization (WTO): Standardization Issues in the Wine Sector, in BINGEN J.; BUSCH L.(ed.), Agricultural Standards: The Shape of the Global Food and Fiber System, Springer, Netherlands, p.73-96. HEIJBROEK, A.(2007), Changing competitiveness in the wine industry, The rise and fall of wine countries, Rabobank Publishing, The Netherlands.</p> <p>INTERNATIONAL ORGANISATION OF VINE AND WINE (OIV), State of the Vitiviniculture World Market OIV Report (2002-2010), (Available online at http://www.oiv.int) JENSTER P.V., SMITH D., MITRY D.J., JENSTER L., (2008),</p>
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	<p>The Business of Wine. A Global Perspective, Copenhagen School Press 197 p. KOTLER P., ARMSTRONG G., (2006), Principles of Marketing, Prentice Hall, New York.</p> <p>MONTAIGNE, E.; COELHO, A. coordinators, (2006), The reform of the common market organization for wine, Policy Department and Cohesion Policies, European Parliament, Brussels, 75 p. + appendixes 120p. (Available online at http://www.pedz.uni-mannheim.de/daten/edz-ma/ep/07/pe369.020_en.pdf; http://www.pedz.uni-mannheim.de/daten/edz-ma/ep/07/pe369.020_annex_en.pdf)</p> <p>MONTAIGNE, E ; RASTOIN, A., COELHO A.(2006), Globalization of the world wine market and restructuring of the supply side, INRA Sciences Sociales, No 5-6, November 2006. (Available at http://www.inra.fr/internet/Departements/ESR/publications/iss/pdf_eng/iss06-5_7Globalization_Eng.pdf)</p> <p>ROUZET E., SEGUIN G., (2003), Le marketing du vin, Savoir vendre le vin, Dunod, Paris. SCARPA R., THIENE M., GALLETTO L., (2009), Consumers WTP for Wine with Certified Origin: Preliminary Results from Latent Classes Based on Attitudinal Responses, Journal of Food Products Marketing, 15, 231-248. http://www.vitisphere.com</p>
Update:	March 2021