# .- Automation and Robotics in Viticulture

## Prof. Matteo Gatti

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Students will acquire fundamental knowledge as it concerns automation in viticulture and robotics applied to vineyard management. Based on a multidisciplinary approach, principles and the most important techniques being part of the digitalization process of agricultural systems will be analysed with specific emphasis on engineering concepts and applications used in viticulture.

Expected learning outcomes: By the end of the course students will be able to: i) identify the needs of automation in viticulture; ii) know the digitalization process in viticulture based on implementation of automation and robotic solutions; iii) know the most recent technical solutions already available at commercial scale.

Students will be able to assess the opportunity to introduce mechanical and/or robotic solutions in vineyard management in order to perform both non selective and selective operations such as vineyard scouting and yield estimation, weed control, pruning, and harvesting.

***COURSE CONTENT***

*Lectures*

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| **Topics** | CFU |
| Introduction to digitalization in agriculture: rural development and agricultural systems. Automation in viticulture, state of the art, needs and vineyard mechanization. | 1.5 |
| Automation and enabling technologies. Basics of Artificial Intelligence, Machine Learning, Deep Learning. Computer vision technology in agricultural automation. Automated systems for crop monitoring. | 1.5 |
| Description of the main robotic platforms adopted in viticulture: autonomous vehicles, wheel-type and crawler-type systems, quadrupeds. | 1.0 |
| Considering variability related to fruit crop architecture, plan material, growing sites and commercial target, the course will be focused on grapevines growing in open field and under controlled conditions to describe the most important robotic applications for the automation of the following practices: harvest, pruning, irrigation, crop protection, weed control. | 2.0 |
| **Tutorials** |  |
| Seminars and practical exercises. | 1.0 |

***READING LIST***

Avital Bechar (Ed.). Innovation in Agricultural Robotics for Precision Agriculture. 1st edition (2021). Springer Nature Switzerland AG

Manoj Karkee and Qin Zhang (Eds.). Fundamentals of Agricultural and Field Robotics. 1st edition (2021). Springer Nature Switzerland AG

Documents and teaching materials will be shared using the Blackboard platform. Additional reading materials will be hand out during the course.

***TEACHING METHOD***

The teaching method will embrace the following activities:

1) Indoor class where main course topics will be covered along with several applied examples. Interactions between instructor and students will be promoted by stimulating discussion of specific case studies.

2) Indoor practical activities and exercises. Technical seminars.

***ASSESSMENT METHODS AND CRITERIA***

Student’s performance will be assessed trough written examination by combining multiple-choice and open questions; 15 multiple-choice questions will be valued a maximum score of 15 (true answer = 1 each). Additional 3 open questions with 5 rows available per each answer will be scored on a 0–5 scale corresponding to a maximum score of 15. Score will reflect the following items: a) knowledge of the subject; b) language clarity; c) ability to make connections between different topics. Final score will be the sum of the two section scores and will be expressed on a 0–30 scale. Indicator of success : Score ≥18/30.

***NOTES AND PREREQUISITES***

Basic knowledge on viticulture is recommended for better understanding of the course contents. Time schedule and location for students’ colloquia : everyday after class at the Department of Sustainable Crop Production (DI.PRO.VE.S.) – Section of Fruit Culture and Viticulture (office 313)