

Lecturers

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Name: Matteo Daniele

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Course Description

Title: Guardians of the Industry - vol 4.0

Fields of activity: Aerospace/Aeronautical Engineering , Applied Sciences , Architectural Engineering , Architecture , Automotive Engineering , Biological/Biotechnical/Gene Engineering, Biomedical Engineering , Chemical Engineering , Civil Engineering , Computational Sciences , Computer Engineering , Computer Science/Automatic Control/Informatics , Control Engineering/Systems engineering , Economics/Business Administration/Marketing , Electrical/Electromechanical Engineering , Electronic Engineering , Environmental Engineering , Food Engineering , Industrial Engineering , Industrial Management , Logistics , Machine & Instrument engineering/Design , Materials Engineering , Mechanical Engineering , Mechatronics, Mining/Mineral Resources Engineering , Naval Architecture & Engineering , Petroleum Engineering , Physics/Physics Engineering , Power Engineering , Production Engineering/Management , Rural and Surveying Engineering , Telecommunications/Electronics, Territory Engineering , Textile Engineering & Technology , Transport Engineering

Examination type: Case Study

Number of ECTS credits issued: 1.5

Learning Goals and Objective:

- Get introduced to the fourth revolution of Industry.
- Get introduced to the Key Enabling Technologies of Industry 4.0 such as Internet of Things, Cloud, Additive manufacturing and Big Data.
- Learn the importance of developing sustainable and find new ways of production.
- Be involved in the creation of solutions to existing problems, working proactively in a team.

Syllabus

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|--------------------------|---|
| Name of activity | Additive Manufacturing technology |
| Number of working hours | 4 |
| Type of activity | Lecture |
| Lecturer | Atzeni Eleonora |
| Short summary of content | Additive Manufacturing is acquiring more and more importance in many fields causing a dramatic transformation of the manufacturing system. There are already early signs of how this new production process will improve resource efficiency and other sustainability aspects. The key reasons for its growing importance can be summarized in: simplified product design, reduction in weight and improved performances (thanks to honeycomb structures), complex geometry easily achievable. This technology has penetrated every major industry from automotive, aerospace, defence, consumer products to medical and dental. Most common applications include functional prototypes, fit and assembly models, patterns for prototype tooling, patterns for metal casting, presentation models, visual aids, and tooling components. |
| Bibliography | Kaufui V. Wong, Aldo Hernandez; ISRN Mechanical Engineering; 2012. A review of Additive Manufacturing |
| Expected effect | Student will acquire an insight of this innovative production technology and of the importance it's acquiring in the industry. |

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| Name of activity | Cybersecurity |
| Number of working hours | 1,5 |
| Type of activity | Lecture |
| Lecturer | Antonio Lioy |
| Short summary of content | <p>The fourth industrial revolution brings new and growing attention to cybersecurity for connected, smart manufacturers and digital supply networks. The operations of industry 4.0, due to this interconnectivity, are far more sensible to cyberattacks than they were used to be and the world of manufacturers and suppliers may not be ready for this threat. If we think that just roughly one year ago the ransomware attack WannaCry infected more than 300.000 computers all around the world, it's crystal clear how fragile informatics security is.</p> <p>In order to reduce these risks we need cybersecurity strategies to be reliable, vigilant and resilient, as well as fully integrated into organizational and information technology from the start.</p> <p>To conclude, it will be given an overview of how cybersecurity companies are taking the fight back to cyber-criminals.</p> |
| Bibliography | <p>René Waslo, Tyler Lewis, Ramsey Hajj, Robert Carton; Deloitte University Press; 2017.</p> <p>Industry 4.0 and cybersecurity: managing risk in age of connected production</p> |
| Expected effect | <p>The students will understand the growing importance of a cybersecurity strategy due to the interconnected nature of the industry 4.0. They will be provided also an insight of some cybersecurity techniques.</p> |

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| Name of activity | Accenture |
| Number of working hours | 10 |
| Type of activity | Lectures |
| Lecturer | Marco Augusto Lauretti, Raffaele Menolascino, Stefano Spadetto |
| Short summary of content | <p>Accenture, Academic Partner of the course, is a leading global professional services company providing a range of strategy, consulting, digital, technology & operations services.</p> <p>Students will attend 6 lectures concerning some of the key businesses of the company, all the lessons will be building steps towards the final test. At first students will be shown the major trends in global markets, with attention to both new ways of work and new values for customers. Then they will be provided a general framework of what industry X.0 (as it is called by the company the revolution going on) means, focusing on key values for firms such as: core operational efficiency and the leverage on combinations of advanced digital technologies to continuously create new, hyper-personalized experiences.</p> <p>The six main steps to evolve to industry X.0 for existing business will be presented: transform the core, focus on experiences and outcomes, innovate new business models, build a digital-ready workforce, re-architect new ecosystems and pivot wisely. Real case applications will be explored for each step. In the end, the focus will be on how the industry X.0 paradigm is impacting Manufacturing processes (through automation, connected plants and workers, digital supply chain and more) and Customer Services processes (through service transformation, big data analysis, digital customer channels). Real life applications will be used to develop the concepts.</p> |
| Bibliography | N/A |
| Expected effect | <p>During the lectures, students will have the chance to gather a wide view of the evolving world of industry through the eyes of a company which paves the way for this change.</p> <p>The competencies and skills acquired will give consistency to the final work, the case study, proposed by the company itself.</p> |

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| Name of activity | Supply Chain |
| Number of working hours | 2 |
| Type of activity | Lecture |
| Lecturer | Cagliano Anna Corinna |
| Short summary of content | Supply chain in industry 4.0 is: flexibility, speed and quality. The road ahead is one of more autonomy across various logistics components such as supply chain logistics, inbound logistics, warehouse management, intralogistics, outbound logistics and logistics routing. This will be achieved through automatic warehouse management systems, intelligent containers and driverless transportation systems, while intralogistics is increasingly supporting intelligent production reducing non-productive times. |
| Bibliography | N/A |
| Expected effect | Students will understand how the supply chain is being disrupted by digitalization through Internet of Things and other technologies. |

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| Name of activity | Team Hackability |
| Number of working hours | 0.5 |
| Type of activity | Workshop |
| Lecturer | Maurizio Contu, Brunella Vizziello, Anisia Lauditi |
| Short summary of content | Introduction of the student team "Hackability": -The team, a little bit of history -The mission: to develop cheap and innovative solutions for people with disabilities to improve their everyday life. -Presentation of the prototypes developed through 3D printing and software development. |
| Bibliography | N/A |
| Expected effect | Students will be given the opportunity to see how a student team actually works and how 3D printing technology can be applied to achieve a positive impact on society. |

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| Name of activity | AVIO Aero |
| Number of working hours | 4 |
| Type of activity | Company visit |
| Lecturer | Davide Marietta, Gaetano Arcuri, Carrà Piera, Davis Quirico |
| Short summary of content | <p>Avio Aero is a GE Aviation business that designs, manufactures and maintains components and systems for civil and military aviation. Their main focuses are: additive manufacturing, rapid prototyping, as well as technologies dedicated to the production of mechanical transmissions, turbines and combustors.</p> <p>Avio embraced the opportunities offered by digitalization and the fourth industrial revolution with "Brilliant Factory", a production site that can constantly self-improve its products and processes through real-time gathering, transmission and analysis of data.</p> <p>The visit will be at the head office, in Rivalta, and the main topics will be:</p> <ul style="list-style-type: none"> - history of the IT transformation of Avio - how digital skills have been implemented and the main actual projects - the evolution of the products and productive processes - digital league task oriented |
| Bibliography | N/A |
| Expected effect | Students will acquire knowledge on the structure of a state-of-the-art facility and on the evolving business of a leading company in the aviation business. |

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| Name of activity | Casa Jasmina and FabLab |
| Number of working hours | 3 |
| Type of activity | Company visit |
| Lecturer | Davide Gomba |
| Short summary of content | <p>The visit will be composed of two parts: a visit to FabLab to touch with hand additive manufacturing and much more, and the visit of Casa Jasmina.</p> <p>Visit schedule:</p> <ul style="list-style-type: none"> -What's a Fablab? Explanation about the Maker movement and digital fabrication labs. -Presentation of FabLab Torino: how it started and how it works -Tour of the lab explaining how each machine works from 3D printers to Laser Cutter and CNC machines. -Exposition of the projects, inventions and experiments developed by their makers. -Not only makers: skills and professions of the future, opportunities and advantages of having access to a makerspace. -Visit tour at Casa Jasmina. It is a living experience, an IoT project, an open source and design experiment. It's a house of the near future with smart, concrete objects and solutions, everything connected through Arduino. -Demonstration of the home assistant system and overview of the IoT world. -Demonstration of the latest introduction in the house: the smart mirror. |
| Bibliography | N/A |
| Expected effect | The students will be able to see how IoT can change our everyday life and how additive manufacturing and other technologies can foster innovation, especially enabling open source work. |

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| Name of activity | Industry 4.0 and the Transformation of Work |
| Number of working hours | 2 |
| Type of activity | Lecture |
| Lecturer | Neirotti Paolo |
| Short summary of content | The lesson will focus on how the work world is going to evolve due to the revolution of Industry 4.0. Starting from the lessons learned from the previous Industrial Revolutions, the way machine will “augment” workers and the other way around will be investigated. In addition, the new organization and industrial architectures will be presented, analysing where is the economic value migrating. |
| Bibliography | N/A |
| Expected effect | The students will acquire awareness of the new competencies required to them by the society. |

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| Name of activity | International Cafè |
| Number of working hours | 3 |
| Type of activity | Group seminar |
| Lecturer | Matteo Daniele, Jacopo Toniolo, Emiliano Parini, Edoardo Parini, Marco Augusto Lauretti |
| Short summary of content | <p>The activity will be an opportunity to interact, in teams, with experts coming from different fields related to the Industry 4.0, each one leading a discussion on a table.</p> <p>At first the main topic of the table will be exposed by the speaker in order to guide the debate according to predefined lines.</p> <p>After a dynamic discussion, the topic will switch, and every team will start another discussion from the results of the previous team of the table.</p> <p>The main topics will be similar to the ones encountered throughout the course (additive manufacturing, energy efficiency, human-machine interface) but deepened and observed with a critical approach.</p> |
| Bibliography | N/A |
| Expected effect | All these arguments and discussions will give students a broader development of their critical thinking and how to develop all those ideas with a consistent reasoning, while also make them feel the main actors in the revolution in progress. |

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| Name of activity | Evaluation |
| Number of working hours | 8 |
| Type of activity | Case Study |
| Lecturer | Marco Augusto Lauretti |
| Short summary of content | <p>Students will have to elaborate an innovative and consistent solution to a case study, which will be established in cooperation with our academic partner, Accenture.</p> <p>During the activity the topic of the case study will be presented along with the modalities and procedures to be followed to deliver the final solution. A tutor will be present for the entire activity, in order to ensure support and clarify doubts.</p> <p>Students will be provided everything needed for the activity: tools and materials for brainstorm and teamwork and technological supports to express in the best way their solution.</p> |
| Bibliography | N/A |
| Expected effect | <p>Students will be asked to extrapolate the relevant information provided during the course, and put them into practice in a creative and effective way.</p> <p>In addition, the activity is designed to enhance some soft skills of the participants, like team-working, creative thinking, and decision making.</p> |

Pre-materials

Conferences and ted talks:

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| Name | Industry 4.0: not just the future of the industry |
| Topic/field | Big Data, Internet of Things |
| Short description | Are we witnessing the 4.0 Industrial Revolution? What is IoT and how can we use big data when it comes to all processes? The video explains how to perform the transformation from unoptimized manufacturing to efficient and smart manufacturing. |

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|--------------------------|--|
| Name | The challenges of the fourth industrial revolution |
| Topic/field | Artificial Intelligence, Big Data, Internet of Things, Economy, Biological Engineering |
| Short description | A broad overview by the World Economic Forum of the changes all around us which are happening at exponential speed in every field. |

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|--------------------------|---|
| Name | The year data went worldwide |
| Topic/field | Big Data |
| Short description | The new digital technology had huge impact in the industrial world, one of these it's the data openly available on the web by governments, scientists and institutions. These are few results when the data gets linked up. |

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| Name | What is Big Data and why does it matter? |
| Topic/field | Big Data |
| Short description | What is Big Data? Can it help us solve some of society's big challenges? If so, how? Donna Green provides answers to these and other questions in this fact filled and fascinating talk. |

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| Name | Industry 4.0: how intelligent machines will transform everything we know |
| Topic/field | Artificial intelligence, Internet of things |
| Short description | The fourth industrial revolution is upon us: machines infused with intelligence. This transformation will transform how manufacturing works today, making it 30% faster and 25% cheaper because a machine will know when it makes a mistake and will correct itself. |

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| Name | How 3D printing is enabling the '4th Industrial Revolution' |
| Topic/field | Additive manufacturing |
| Short description | 3D printing is not just a cool technology for rapid prototyping, modelling and specialist one-off products. It is a fundamental building block of the '4th industrial revolution' that has the potential to transform the way in which production and consumption are connected. |

Articles and books:

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| Name | Big data, big confusion, what do they really are? |
| Topic/field | Big data |
| Short description | Big data is a collection of data from traditional and digital sources that represents a source for discovery and analysis. |

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|--------------------------|---|
| Name | A beginner guide to understand Internet of Things |
| Topic/field | Internet of Things |
| Short description | The Internet of things (IoT) is the network of physical devices embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data. |

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|--------------------------|--|
| Name | What's the cloud? |
| Topic/field | Big data, Internet of Things |
| Short description | The Cloud technology consists in the storage of software programs, services or entire IT infrastructures in data centers available through WAN or internet connectivity. |

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|--------------------------|---|
| Name | Basic principles of additive manufacturing |
| Topic/field | Additive manufacturing |
| Short description | Additive Manufacturing is a whole world of technologies and techniques of production in which the final product is built by adding subsequent layers of material. The material can vary from plastic to metal and human tissue. |

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|--------------------------|---|
| Name | A new frontier of 3D printing: medicine |
| Topic/field | Biomedical Engineering |
| Short description | An insight of the skyrocketing of 3D printing in medicine through some examples that demonstrates the potential that this technology holds for healthcare in the near future. |
| Author | Bertalan Meskó |