

Module Code	MEU33EM1
Module Name	Laser Processing & Additive Manufacturing 1
ECTS Weighting ¹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Rocco Lupoi LUPOIR@tcd.ie
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: 1. Comprehend the fundamentals of different additive manufacturing technologies, whether they are based on cold spray or metal melting. 2. Provide an appreciation for why additive manufacturing is so important to many branches of industry and how to apply additive manufacturing technology in different settings. 3. Compare against each other, the most relevant additive technologies such as Laser Powder Bed Fusion and Cold Spray. Understand involved processing parameters and advantages and challenges with implementing robotics assisted additive manufacturing methods. 4. Calculate power requirements and process performance in laser manufacturing. 5. Understand the basic working mechanisms of lasers, components, and be aware of the laser types currently available. 6. Understanding the role of optics in laser-based systems. Graduate Attributes: levels of attainment To act responsibly - Introduced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Introduced

¹ [TEP Glossary](#)

Module Content

- Introduction to Additive Manufacturing
- Lasers and basic principles. Cavity design for CO2 lasers. Laser cutting, drilling, and welding. Laser surface treatments. Laser micro-manufacturing.
- Laser Powder Bed Fusion (L-PBF)
- Powder metallurgy
- Titanium metallurgy and heat treatment processes
- Robot Assisted Additive Manufacturing
- Thermal Spray

Module description:

In high value-added manufacturing industry, engineers are required to understand how mechanical systems and materials behave at length scales at the micron level. The objective of this module is to develop the student's skills and knowledge in both precision engineering and micro engineering. The module will consider selected topics in precision, micro-manufacturing, ranging from enabling technologies and processes to applications. The module is research-lead, hence the content can vary on a year to year basis. Currently, most of the module is around LASER based manufacturing, LASER-Additive Manufacturing (3D printing) with metallic materials, and related automation. The module will require an active participation of the students.

Teaching and Learning Methods

This module is taught using a combination of lecturers, multiple choice review quizzes, and visiting lectures range from industry to visiting researchers. All lecture notes and multiple-choice quizzes will be available through Blackboard.

Assessment Details² Please include the following: • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date	Assessment Component	Assessment Description	LO Addressed	% of total	Week due
	Continuous Assessment	Multiple Choice Quizzes	1-8	100%	Continuous
Reassessment Requirements					
Contact Hours and Indicative Student Workload²	Contact hours: 42 Hours (33 lectures)				
	Independent Study (preparation for course and review of materials): 39				
	Independent Study (preparation for assessment, incl. completion of assessment): 39				
Recommended Reading List	• Groover's Principles of Modern Manufacturing, materials, processes, and systems. SI Version. Mikell P. Groover. ISBN: 978-1-119-24912-2. • Manufacturing Engineering and Technology. Kalpakjian and Schmid				
Module Pre-requisite	None				
Module Co-requisite	None				
Module Website	N.A				
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No				
Module Approval Date	4/06/2026				
Approved by	Nicole Byrne				
Academic Start Year	2026				
Academic Year of Date	2026- 2027				

² [TEP Guidelines on Workload and Assessment](#)

