Module Code	**MEU44MM1**
Module Name	**Nanotechnology and Additive Manufacturing II**
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof. Amir Pakdel (pakdela@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 will achieve the following learning outcomes: 1. Gain familiarity with principles of materials properties at the nanoscale and the factors that differentiate their behaviour from bulk materials. 2. Develop an understanding of the manufacturing processes involved in producing nanomaterials and nanostructured surfaces, as well as proficiency in their characterization techniques. 3. Acquire knowledge of the principles of nanotechnology, including interdisciplinary insights into the fabrication and application of structures and devices at the nanoscale. 4. Explore the transformative impact of nanomaterials and nanotechnology on various industrial domains, such as electronics, energy, medical & biomedical applications, and additive manufacturing. 5. Understand the underlying principles of various additive manufacturing technologies, including those based on photopolymer curing, ceramic sintering, metal melting, and their integration with nanotechnology. 6. Compare the most relevant additive manufacturing technologies, such as Selective Laser Melting, Inkjet Printing, Stereolithography, and Fused Deposition Modelling, along with their associated processing parameters. **Graduate Attributes: levels of attainment** To act responsibly - Choose an item. To think independently - Choose an item. To develop continuously - Choose an item. To communicate effectively - Choose an item.

[1] TEP Glossary

Module Content	• Introduction to nanomaterials, nanostructured surfaces, and nanoscale interactions • Manufacturing and characterization techniques at the nanoscale • Nanotechnology and its diverse scientific/industrial applications • Introduction to additive manufacturing and its applications • Economics of additive manufacturing and nanotechnology • Polymer, ceramic, semiconductor, nanomaterial additive manufacturing techniques **Module Description** Nanotechnology and additive manufacturing stand at the forefront of technological innovation, each representing a ground-breaking field with transformative potential across various industries. Nanotechnology, exploring the manipulation of materials at the nanoscale, unlocks unprecedented possibilities in the design and application of materials, promising advancements with unique properties and functionalities. Simultaneously, additive manufacturing, also known as 3D printing, revolutionizes traditional manufacturing methods by building objects layer by layer. This technique offers unparalleled design freedom, reduced material waste, and the ability to create complex structures with precision. Together, nanotechnology and additive manufacturing synergize to redefine the boundaries of what is possible, ushering in a new era of customized, efficient, and sustainable production methods. This module is partially research-led; hence the content may vary on a year-to-year basis. The module will require an active participation of the students.
Teaching and Learning Methods	This module is taught using a combination of lectures, laboratory exercises (either on-line or in-person) and tutorial sessions. The class serves as platforms for both informal discussions on topics and more structured podium-style lectures. Examples provided during class discussions are drawn from recent topics of interest, adding relevance and context to the material. Additionally, guest lectures may be incorporated into the schedule when feasible.

COVID-19 contingency statement for Module Descriptors

While the intention is to deliver all lectures and tutorials face-to-face in a classroom, there is uncertainty due to the Covid-19 situation and part or all of the module delivery may need to change to an online delivery if required by government restrictions. In the case of a possible new lockdown scenario during teaching term:

- All lectures and tutorials will be delivered online using Blackboard Collaborate Ultra. These sessions will be recorded and available for viewing via Blackboard at a later time.

- The class quizzes and the end of semester exam will be online.

Assessment Details[2] **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
	Written examination	Exam	1-7	50%	Exam period
	Continuous assessment	Combination of on-line & in-person labs, quizzes, group projects and/or term reports	1-7	50%	Weeks 1-12

Reassessment Requirements	
Contact Hours and Indicative Student Workload[2]	**Contact hours: 44 hours** **Independent Study (preparation for course and review of materials): 33 hours** **Independent Study (preparation for assessment, incl. completion of assessment): 33 hours**
Recommended Reading List	Textbook of Nanoscience and Nanotechnology, Murty, Shankar, Raj, Rath & Murday, 2013, Springer Understanding Nanomaterials, Johal & Johnson, 2018, Routledge - Taylor & Francis Group Additive Manufacturing Technologies, Gibson, Rosen & Stucker, 2010, Springer Engineering Materials 1,2 Ashby & Jones, 2012, Elsevier Ltd. Journal papers recommended in class.
Module Pre-requisite	Preliminary knowledge about material types and properties, as discussed in MEU11E12 (Engineering Materials and Their Applications) and MEU33B04 (Mechanical Engineering Materials).
Module Co-requisite	
Module Website	

[2] TEP Guidelines on Workload and Assessment

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.
Module Approval Date
Approved by
Academic Start Year
Academic Year of Date