Module Code	**MEU23B07**
Module Name	**Manufacturing Processes**
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Associate Professor Daniel Trimble dtrimble@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: • **LO1:** Explain the fundamental principles governing major manufacturing processes including casting, metal forming, sheet metalworking and machining. • **LO2:** Analyse manufacturing processes using engineering theory, including material behaviour, deformation mechanics and machining models. • **LO3:** Evaluate manufacturing processes in terms of tooling, machinery, process parameters, defects, advantages and limitations. • **LO4:** Solve quantitative manufacturing problems related to casting, metal forming and machining processes. • **LO5:** Identify appropriate materials and manufacturing processes for engineering components based on geometry, material behaviour and production requirements. • **LO6:** Apply Design for Manufacture and Assembly (DFMA) principles to analyse an existing product and propose improvements to manufacturing and assembly efficiency. • **LO7:** Communicate engineering analysis and manufacturing decisions through professional engineering drawings, technical documentation and presentations. **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	**Module content:**

Introduction to Manufacturing (L1–L3)

- Role of manufacturing in engineering systems
- Manufacturing process classification
- Production economics and process selection
- Relationship between design, materials and manufacturing

Metal Casting (L4–L7)

- Sand casting fundamentals
- Pattern design, moulding and gating systems
- Solidification and shrinkage
- Risers and casting design
- Casting defects and quality considerations
- Industrial casting processes

Metal Forming (L8–L13)

- Fundamentals of plastic deformation
- Stress–strain behaviour in metal forming
- Rolling processes and equipment
- Forging processes and dies
- Extrusion and drawing
- Sheet metalworking operations (cutting, bending, deep drawing)
- Defects and design considerations in forming processes

Machining (L14–L20)

- Mechanics of metal cutting
- Orthogonal cutting model and Merchant's theory
- Cutting forces, energy and temperature
- Tool wear mechanisms and tool life
- Machine tool technology (turning, milling, drilling)
- Cutting tool materials and geometry
- Design for machining and manufacturability

	Module description: This module introduces the fundamental principles of manufacturing processes used in the production of engineering components. The module focuses on traditional manufacturing processes including metal casting, bulk metal deformation, sheet metalworking and machining. Emphasis is placed on understanding the underlying engineering principles governing each process, including material behaviour, process mechanics, tooling, and process limitations. Students develop the ability to analyse manufacturing processes quantitatively and to make informed engineering decisions when selecting appropriate manufacturing methods. In addition to theoretical knowledge, students apply manufacturing concepts through a Design for Manufacture and Assembly (DFMA) project in which they reverse engineer a real product, analyse its manufacturing processes and propose design improvements. The module aims to develop students' ability to connect engineering design decisions with manufacturing feasibility, cost, and assembly efficiency.
Teaching and Learning Methods	The module is delivered through: • Lectures introducing manufacturing theory and industrial processes • Worked examples and problem-solving sessions • Review questions to reinforce key concepts • A team-based Design for Manufacture and Assembly (DFMA) assignment involving reverse engineering and manufacturing analysis Lecture notes, example problems and supporting materials are provided through Blackboard.

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
In-class Exam 1	Written exam consisting of review questions and quantitative problem-solving covering lecture material from **L1–L10 (Introduction to Manufacturing, Casting and part of Metal Forming)**	LO1, LO2, LO3, LO4	35%	Week 6
In-class Exam 2	Written exam consisting of review questions and quantitative problem-solving covering lecture material from **L11–L20 (Metal Forming and Machining)**	LO1, LO2, LO3, LO4	35%	Week 12
Group Assignment	**Design for Manufacture and Assembly (DFMA) project** involving reverse engineering of a real product, SolidWorks modelling, manufacturing process identification and design improvement proposals	LO5, LO6, LO7	30%	Week 3 to Week 12

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

Contact hours: 44 Hours
Independent Study (preparation for course and review of materials):

[2] TEP Guidelines on Workload and Assessment

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	
Module Co-requisite	
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	
Module Approval Date	15/03/2026
Approved by	Nicole Byrne
Academic Start Year	2019
Academic Year of Date	2019 - 2020