MNE3119: MANUFACTURING TECHNOLOGY

Effective Term
Semester B 2023/24

Part I Course Overview

Course Title
Manufacturing Technology

Subject Code
MNE - Mechanical Engineering
Course Number
3119

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MBE2110/MNE2110 Engineering Materials or
MSE2102 Introduction to Materials Science and Engineering

Precursors
MNE2109 Engineering Mechanics

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to equip the students with: the ability to identify the common range of processes and operations for the conversion and shaping of different engineering materials into discrete components, knowledge about the interactions between component or product design and the processes by which they are planned to be manufactured, analysis of selected manufacturing processes to understand the influence of process variables on component formation and limits, and ability to economically produce good quality components for use in various products by selected appropriate manufacturing processes and systems, and adopt sustainable green manufacturing and environmental conditions whatever possible.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Outline the operational principles and application of various manufacturing processes for making metallic/ plastic/ composite components, basic defects likely to occur and their causing mechanisms, important factors to reduce scrap in processing, and issues relevant to green manufacturing.		x	x	
2	Explain the relevant principles of designing products and selection of materials that facilitate efficient manufacturing of quality products, and compare alternate routes of manufacturing for providing cost-effective solutions.			x	
3	Analyse the characteristics of selected processes and the influence of operating variables on material removal, forming, or flow behaviour during manufacturing.			x	
4	Communicate the findings from actual experiments in a written form linking the key results and observations on a scientific basis.			x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain the operational principles and application of various manufacturing processes for making metallic/ plastic/ composite components. Illustrate the interaction between product design and manufacturing processes; criteria and considerations related to designing a product to be economically producible by a selected process and system; the causes of defective quality in individual processes of various manufacturing processes; concept of manufacturing systems and smart/intelligent manufacturing.	1, 2, 3	3 hrs/week
2	Laboratory Work	Students conduct experiments with different manufacturing processes, and analyse the data to find out the effect of operational parameters on the quality of components produced, and further familiarize with the safety and quality issues associated with different processes.	1, 2, 3, 4	3 hrs/week for 3 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests and Assignments	1, 2, 3	20	
2	Laboratory Reports	1, 2, 3, 4	20	3 reports

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2.5

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task
1. Tests and Assignments

Criterion
Apply the learned knowledge in the lectures to solve manufacturing problems

Excellent (A+, A, A-)
75%-100%

Good (B+, B, B-)
60%-74%

Fair (C+, C, C-)
45%-59%

Marginal (D)
40%-44%

Failure (F)
<40%

Assessment Task
2. Laboratory Reports

Criterion
Explain the methodology and conduct the procedure, analyse the experimental data and discuss the experimental findings, and appreciate the features and working principles of various manufacturing processes

Excellent (A+, A, A-)
Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge of the experimental matters concerned

Good (B+, B, B-)
Evidence of grasp of subject; some evidence of critical capacity of analytic ability; reasonable understanding of issues; evidence of familiarity with experiment

Fair (C+, C, C-)
Student who is profiting from the laboratory class; understanding of the subject; ability to develop solutions concerning the experiment

Marginal (D)
Sufficient familiarity with the laboratory content to enable the student to move onto other laboratory materials

Failure (F)
Little evidence of familiarity with the laboratory class materials; weakness in critical and analytic skills; limited or irrelevant use of data

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Assessment Task

3. Examination

Criterion

Explain the working principle of various manufacturing processes, illustrate the relationship between process parameters and outcomes, and select proper processes to manufacture specific components/products while considering the cost

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base

Good (B+, B, B-)

Significant evidence of grasp of subject; some evidence of critical capacity of analytic ability; reasonable understanding of issues; evidence of familiarity with course matter

Fair (C+, C, C-)

Student who is profiting from the university experience; understanding of the subject; ability to develop solutions to simple manufacturing problems

Marginal (D)

Basic familiarity with the subject matter to enable the student to progress without repeating the course

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correctly using knowledge regarding manufacturing

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Additional Information for AR

Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

Casting; Injection molding; Thermal plastic materials; Plastic deformation; Forming; Rolling; Forging; Extrusion; Drawing; Sheet metal forming; Blanking and shearing; Bending; Machining; Turning; Milling; Drilling; Grinding; Material Removal; Abrasive machining; Honing; Polishing; Additive manufacturing; Selective laser melting; Non-conventional manufacturing; electrical discharge machining; Chemical machining; Chemical mechanical Polishing; Laser machining; Surface integrity; Surface roughness; Allowance and tolerance; Manufacturing cost; Quality control; Manufacturing system; Sustainable manufacturing; Robotic-assisted machining; Product life cycle; Smart manufacturing; Extreme manufacturing.

Reading List

Compulsory Readings

	Title
1	“Manufacturing Engineering and Technology”, Serope Kalpakjian and Steven R. Schmid, Prentice Hall., 4th Edition, 2000.
2	“DeGarmo’s Materials and processes in manufacturing”, DeGarmo, E. P. (Ernest P., Black, J. T., & Kohser, R. A., Wiley, 11th Edition, 2012.

Additional Readings

	Title
1	“Principles of Polymer Engineering” by N.G. McCrum & C.P. Buckley, Oxford Publications.
2	“Introduction to Manufacturing Processes”, John A. Schey, McGraw-Hill International 2nd or later edition.

3	“Manufacturing Processes for Engineering Materials”, Serope Kalpakjian, Addison Wesley Publishing Co., 3rd or later edition.
4	“Handbook of products design for manufacturing: A practical guide to low-cost production”, Bralla, James G., McGraw Hill, New York, any edition.
5	“Selection of Manufacturing Processes for Engineering Design”, Farag, Mahmoud M., Prentice-Hall, London, any edition.
6	“Processes and Materials of Manufacture”, Linberg, Roy A., 4th or later edition, Allyn and Bacon, Boston, U.S.A.
7	“Design for Economical Production”, Trucks, H.E., 2nd or later edition, SME, Dearborn, Michigan.
8	“Product design and manufacture”, Linbeck, J.R., Prentice-Hall, N.J., any edition.
9	“Post-Processing Techniques for Metal-Based Additive Manufacturing: Towards Precision Fabrication”, Wang, H., Lee, Y.J., Bai, Y. and Zhang, J., CRC Press, 2023.
10	“Manufacturing automation: metal cutting mechanics, machine tool vibrations, and CNC design”, Altintas, Y., Cambridge University Press, any edition.