Mechanical Engineering Program
MECH 303 Manufacturing Engineering (3-0) 3
(MUST Course)

Course ECTS Credit: 5.0

Catalogue Description

Introduction. CAM, Strain hardening properties of metals. Theory of metal forming; formability, bulk deformation processes, sheet metal forming processes. Theory of metal cutting; cutting forces and energy requirement, tool life, machinability, tool materials, cutting fluids, surface quality, machining economics. Metrology and quality assurance. Cost analysis in manufacturing.

Prerequisite(s)

MECH202: Manufacturing Technologies with a minimum grade of DD
MECH 206 Strength of Materials with a minimum grade of DD

Textbooks

- J. A. Schey, "*Introduction to Manufacturing Processes*", McGraw Hill, Third Edition, 1999.
- G. Tlusty, "*Manufacturing Process and Equipment*", Prentice Hall Inc., 2000.
- M. P. Groover, "*Fundamentals of Modern Manufacturing*", Prentice Hall, 1996.
- E. M. Mielnik, "*Metal Working Science Engineering*", McGraw Hill, 1991.

Course Learning Outcomes

Having successfully completed this course, the student will be able to:

(1) Explain the role of various deformation mechanisms in metal forming,
(2) Apply equivalent strain concept, compute flow stresses in hot/cold forming, and identify the assumptions and the elements of elementary theory of plasticity,
(3) Formulate bulk forming processes using slab method and elementary theory of plasticity and using energy method and elementary theory of plasticity,
(4) Compute shearing force and power, bending force and the amount of spring-back,
(5) Analyze axisymmetric deep-drawing operations,
(6) Correctly use basic terminology of metal cutting,
(7) Measure, analyze and calculate cutting forces, and find cutting power,
(8) Select proper tools for various applications, identify the effect of cutting fluids on cutting performance, and assess and measure machinability,
(9) Generate data for the optimization model, and find optimum cutting conditions for selected criterion under constrained/unconstrained conditions.

Teaching Format: Three 50 minute lectures per week.

Computer Usage

Use of software: FUSION 360, METU CLASS

Category Content

Mathematics and Basic Sciences	20%
Engineering Sciences	50%
Humanities and Social Sciences	0 %
Departmental	30%
Engineering Design	0%

Grading Policy:

Midterm Exam: 30%
PQ's, Quizzes: 30%
Final Exam: 40%

Weekly Class Schedule

Week 1:	Introduction, CAM
Week 2:	Fusion CAM Tool, milling, turning, drilling
Week 3:	Engineering calculations about casting
Week 4:	Bulk Deformation Processes: Deformation forces and energy requirement
Week 5:	Bulk Deformation Processes: Forging, Rolling
Week 6:	Bulk Deformation Processes: Extrusion, Drawing
Week 7:	Bulk Deformation Processes, Sheet Metal Forming: Shearing
Week 8:	Sheet Metal Forming: Bending
Week 9:	Sheet Metal Forming: Deep drawing
Week 10:	Machining: Cutting forces and energy requirement
Week 11:	Machining: Tool life
Week 12:	Machining: Cutting tool materials
Week 13:	Machining: Cutting fluids
Week 14:	Machining: Machining economics

Relationship to Program Objectives

This course contributes to fulfilment of the following program outcomes:

PI-1a: **Problem Identification and Formulation**: Clearly identify engineering problems and formulate well-defined problem statements using appropriate scientific principles and assumptions

PI-1b: **Mathematical Modeling and Analysis**: Develop and solve mathematical models of engineering problems using appropriate methods, including calculus, linear algebra, and numerical techniques.

PI-1c: **Use of Engineering Tools**: Utilize modern engineering tools (e.g., software, simulations, data analysis tools) to solve and validate models and interpret results.

PI-2a: **Design Planning and Specification**: Define design requirements and constraints based on user needs, applicable standards, and contextual factors (e.g., safety, environmental, social, economic).

PI-2c: **Design Implementation and Realization**: Develop, evaluate, and realize design solutions—from concept generation to prototyping—ensuring they are feasible and ready for production.

Prepared by: Assoc. Prof. Dr. Murat Sönmez **Date:** February 8th, 2026