DEPARTMENT OF MECHATRONICS ENGINEERING
COURSE SYLLABUS

Course Details				
Code	**Academic Year**			**Semester**
MEC048	4			8
Title	**T**	**A**	**L**	**ECTS**
Rapid Prototyping	3	0	2	6

Language	German					
Level	**Undergraduate**	✓	**Graduate**		**Postgraduate**	
Department / Program	Mechatronics Engineering					
Forms of Teaching and Learning	Face to face					
Course Type	**Compulsory**		**Elective**	✓		
Objectives	The objective of this lecture is to provide students with a comprehensive understanding of rapid prototyping technologies, including the principles, processes, and materials used in additive manufacturing. Students will learn how to design and fabricate physical models from digital data through layer-by-layer construction techniques. The course covers major rapid prototyping methods such as vat photopolymerization, extrusion-based systems, and powder bed fusion, along with essential topics like reverse engineering, finite element modeling, and topology optimization. Through theoretical instruction and hands-on practice, the lecture aims to equip students with the skills needed to develop, optimize, and manufacture prototype components efficiently and cost-effectively.					
Content	1. Introduction to Rapid Prototyping 2. Rapid Prototyping Technologies 2.1 Vat Photopolymerization 2.2 Extrusion-Based Systems 2.3 Powder Bed Fusion (PBF) 3. Reverse Engineering 4. Introduction to Finite Element Modeling 5. Introduction to ABAQUS CAE 6. Topology Optimization 7. Practical Work 7.1 Design for Additive Manufacturing (DFAM) 7.2 Fabrication of Parts					
Prerequisites	MEC207 Material Technology 1					
Coordinator	Assoc. Prof. Dr. Ali Can KAYA					
Lecturer(s)	Assoc. Prof. Dr. Ali Can KAYA					
Assistant(s)	M.Sc. Mustafa Hakan Sandık					
Work Placement						

Recommended or Required Reading	
Books / Lecture Notes	• Chee Kai Chua, Kah Fai Leong 3D Printing and Additive Manufacturing: Principles and Applications (Fourth Edition) World Scientific Publishing, 2014

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	• Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer International Publishing, 2020 • Kenneth G. Cooper, Rapid Prototyping: Technology Selection and Application Marcel Dekker, 2001
Other Sources	• Lecture Slides

Additional Course Material	
Documents	
Assignments	1
Exams	1 Midterm exam, 1 final exam

Course Composition		
Mathematics und Basic Sciences	10	%
Engineering	50	%
Engineering Design	10	%
Social Sciences		%
Educational Sciences		%
Natural Sciences	30	%
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	30
Quiz		
Assignments		
Attendance		
Recitations		
Projects	1	30
Final Exam	1	40
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	6	84
Self-Study			
Assignments			
Presentation / Seminar Preparation	2	12	24
Midterm Exam			

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Recitations			
Laboratory			
Projects	1	60	60
Final Exam			
		Total Work Load	**168**
		ECTS Points (Total Work Load / Hour)	**6**

Learning Outcomes	
1	Understand the principles and applications of rapid prototyping and additive manufacturing.
2	Compare major RP processes like SLA, FDM, and PBF.
3	Select suitable materials and methods for specific applications.
4	Design components optimized for 3D printing.
5	Operate RP equipment and manage the fabrication workflow.
6	Identify and minimize typical printing defects.
7	Use simulation tools for part analysis (e.g., ABAQUS CAE).
8	
9	
10	
11	
12	

Weekly Content	
1	Introduction to Rapid Prototyping and Additive Manufacturing
2	History, Applications, and Advantages of RP
3	Vat Photopolymerization – Principles and Processes
4	Photopolymers: Chemistry, Materials, and Process Modeling
5	Extrusion-Based Systems (FDM): Process and Materials
6	Powder Bed Fusion (SLM, SLS, EBM): Overview and Workflow
7	Powder Properties, Melt Pool Dynamics, and Common Defects
8	Midterm Project Review / Presentation (or Midterm Exam)
9	Reverse Engineering and 3D Scanning
10	Introduction to Finite Element Modeling (FEM)
11	Introduction to ABAQUS CAE and Simulation Setup
12	Topology Optimization: Concepts and Tools

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13	Design for Additive Manufacturing (DFAM): Guidelines and Best Practices
14	Final Project Fabrication & Presentation / Course Review
15	

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7
1	5	5	5	5	4		
2	5	5	5	5	4		
3	5	5	5	5	4		
4	5	5	5	5	4		
5	5	5	5	5	4		
6	5	5	5	5	4		
7	5	5	5	5	4		
8							
9							
10							
11							
12							

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	Ali Can Kaya
Date of Compilation:	11..05.2025