COURSE IDENTIFICATION FORM

Course Code and Name: VIBRATION ANALYSIS AND PREDICTIVE MAINTENANCE OF ROTATING MACHINES MKM-5007	Department of : DEPARTMENT OF MECHANICAL ENGINEERING / MECHANICAL ENGINEERING

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç.Dr.Gökhan Kahraman	**Mail : gokhankahraman@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	They should evaluate the results of vibration analysis with various calculations and appropriate sensors so that they can detect malfunctions of rotary motion machines in advance.	
Course Goals	•	
Course Learning Outs and Proficiencies	• 1. Learns the working order of rotary machines 2. Learns the causes and damages of vibration in rotating machines. 3. Learns vibration related problems and calculations. 4. Learns vibration measurement and evaluation methods.	
Course Basic and Auxiliary Contexts	•	
Methods of Give a Lecture	FACE TO FACE	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Introduction of rotary machine systems
2	Malfunctions and effects that may occur in rotating machine systems
3	Vibration standards and calculation methods in rotary machines
4	Sources of vibration and its harmful effects
5	Being able to detect the malfunction of the rotating machine with predictive maintenance methods
6	Being able to detect the malfunction of the rotating machine with predictive maintenance methods
7	Being able to detect the malfunction of the rotating machine with predictive maintenance methods
8	Sensors and devices used in predictive maintenance methods
9	MIDTERM
10	Ability to interpret vibration levels of rotary machines
11	Ability to interpret vibration levels of rotary machines
12	Example problems and solution methods related to vibration analysis
13	Example problems and solution methods related to vibration analysis
14	Example problems and solution methods related to vibration analysis

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5008 Viscous Fluid Flow				**Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	There are no prerequisites.						
Instructor						**Mail :** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	This course is designed to introduce the students to the properties and behavior of fluids, to explain the governing equations in different coordinate systems, to give analytical solution of the governing equations for practical fluid flow problems and to introduce the basic concepts of boundary layers and turbulent flows.						
Course Goals	• To provide the ability to model viscous flow events. • To provide the ability to solve and analyze viscous flow events analytically.						
Course Learning Outs and Proficiencies	• Be able to explain fluid properties and basic flow phenomena • Ability to describe fluid systems • Ability to develop an understanding of the physical laws and basic equations governing fluid mechanics • Ability to simplify generalized conservation equations for application to specific flow problems • Ability to describe boundary and initial conditions for solution of the governing equations • Ability to solve and analyze the mathematical model associated with a physical fluid-flow system • Ability to solve error analyze for numerical solution • Be able to recognize the flow regimes and their characteristics						

Course Basic and Auxiliary Contexts	• Viscous Fluid Flow , White, F.M. , 3th Edition, Mc Graw-Hill, 2005 • Viscous Flow , Sherman, F. S. , Mc Graw-Hill, 1990. • Transport Phenomena, 2nd Edition, Bird R.B., Stewart W.E., Lightfoot E.N., John Wiley, 2006
Methods of Give a Lecture	Face to face

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	**Subjects**
1	Introduction, definition of fluid properties and basic flow phenomena
2	Eulerian vs. Lagrangian frame of reference, substantial derivative, fluid kinematics
3	Derivation of the conservation equations in Cartesian coordinates
4	Derivation of the conservation equations in Cartesian coordinates
5	Stress tensor, Constitutive equations
6	The Navier-Stokes equations in Cartesian coordinates
7	Derivation of the conservation equations in Curvilinear coordinate systems
8	Non-dimensional forms of the equations
9	Midterm Exam
10	Exact solutions of the Navier-Stokes equations in Cartesian and Curvilinear coordinates
11	Solutions of the Navier-Stokes equations for unsteady flows
12	Basic description, characteristics, and concepts of turbulent flow
13	Boundary layers, separation, transition
14	Laminar and turbulent boundary layers

COURSE IDENTIFICATION FORM

Course Code and Name: ADVANCED HEAT TRANSFER-I MKM-5009	Department of : DEPARTMENT OF MECHANICAL ENGINEERING / MECHANICAL ENGINEERING

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç.Dr.Gökhan Kahraman	**Mail :gokhankahraman@munzur.edu.tr Web :**
Course Assistant		**Mail : Web :**
Groups / Classes		
Course Aim	Introduction to heat and mass transfer problem; Heat transfer types and classification; Introduction to the heat conduction, heat convection and radiation; Fundamentals and physical principles of heat and mass transfer; Relationship with the other engineering disciplines; Application of heat and mass transfer in engineering; Discussion of engineering problems and their solutions.	
Course Goals	•	
Course Learning Outs and Proficiencies	1 Understand fundamentals of heat and mass transfer 2 Understand the 2D and 3D heat and mass transfer principles 3 Understand heat convection and mass diffusion principles	
Course Basic and Auxiliary Contexts	•	
Methods of Give a Lecture	Face to face	

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Introduction to heat and mass transfer problem
2	Definition of conservation equations and their classifications
3	Introduction to heat conduction
4	Introduction to two dimensional heat conduction
5	Definition of transient heat conduction
6	Overview of heat conduction problem
7	Introduction to heat convection problem
8	Definition of boundary layer
9	Mid-Term
10	Definition of convective heat transfer for external flow
11	Definition of convective heat transfer for channel flow

12	Introduction to natural convection problem
13	Overview of heat convection problem
14	Introduction to radiation heat transfer

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5011 / Computational Fluid Dynamics (CFD)				**Department of :** Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall / Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	None						
Instructor	Assoc. Prof. Erhan FIRAT					**Mail :** efirat@munzur.edu.tr **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	Familiarization of the student with the fundamentals of computational fluid dynamics (CFD) and introduction of the student to the use of a CFD program.						
Course Goals	• Familiarize the student with the meshing techniques and boundary conditions used in computational fluid dynamics simulations. • Familiarize the student with the commercial computational fluid dynamics (CFD) code, FLUENT						
Course Learning Outs and Proficiencies	• Understand the importance of a high quality, good resolution mesh. • Apply appropriate boundary conditions to computational domains. • Understand how to apply CFD to basic engineering problems.						
Course Basic and Auxiliary Contexts	• J.C. Tannehil, D.A. Anderson, and R.H. Pletcher, Computational Fluid Mechanics and Heat Transfer , 2nd Edition, Taylor & Francis, 1997 • H. Versteeg and W. Malalasekra, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2007 • J.D. Anderson, Jr., Computational Fluid Dynamics: The Basic with Applications, McGraw Hill, Inc., 1995 • ANSYS, Inc. (2013) ANSYS Fluent User's Guide, Release 15.0. • ANSYS, Inc. (2013) ANSYS Fluent Theory Guide, Release 15.0.						
Methods of Give a Lecture	Lecture and Demonstration						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	**X**	**50**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	What is CFD?
2	Equations of motion, solution path and additional equations of motion
3	Mesh generation, mesh independence test and time independence test
4	Boundary conditions used in flow simulations
5	Steps to create a basic geometry and mesh using GAMBIT
6	Generation of flow geometry and mesh in a two-dimensional channel using GAMBIT
7	Generation of flow geometry and mesh in a two-dimensional mixing elbow using GAMBIT
8	Generation of external flow geometry and mesh around a two-dimensional cylinder using GAMBIT
9	Generation of flow geometry and mesh in a three-dimensional pipe using GAMBIT
10	Introduction to FLUENT
11	Introduction to FLUENT
12	Simulation of steady flow in a two-dimensional cylinder (Re=50)
13	Simulation of unsteady flow in a two-dimensional cylinder (Re=150)
14	Simulation of steady flow over a two-dimensional NACA 4412 airfoil (Re=200000)

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5014 Advanced Technology Materials				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Doç. Dr. Yahya TAŞGIN				**Mail : yahyatasgin@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	This course aims to introduce advanced technology materials, emphasize their advantages over conventional materials, and provide students with techniques for determining selection criteria, especially in order to meet technological requirements in engineering designs. In addition to their lightness, composite materials, which are widely used in many areas today due to their high strength (specific strength and specific modulus), are aimed to provide students with techniques for determining selection criteria, especially in order to meet technological requirements in engineering designs.						
Course Goals	Introduction to Advanced Technology Materials (grouping and innovation), comparison with conventional materials, Advanced Composites; Solution of the rule of mixture with Halpin-Tsai equations, Analysis of fiber geometry, Lamination theories, multi-layered sheet structures and honeycomb aviation applications (aircraft and helicopter wing applications, Hybrid composites, hybrid fabrics, Cominglated structures and duplex systems and their applications Smart materials; Shape Memory Effect (SME) and martensitic transformation analyses, orthodontic applications, neurosurgical applications, engineering applications (sensors etc.), single and double-sided memory methods, piezoelectric, dielectric, magnetostrictive, pH sensitive, temperature sensitive Halochromic etc. smart materials and their areas of use Engineering Plastics; hybrid thermoplastics, polyolefin cominglated types, production and use in places subject to internal pressure vessels, for example in hydrogen storage tanks, Biocompatible dental plastics, PMMA, PEEK etc. types, Behavior of zirconia-supported types in environments with changing pH properties, aromatic hydrocarbons fibers, PA matrix ballistic panel application containing S-Glass, fast impact analysis, new materials with negative poissons ratio (Auxetic materials), Advanced Ceramics; functional and structural classification, electronic ceramics (magnetic, dielectric etc.), piezoelectric ceramics, superconducting ceramics, bioceramics (dentures, bones, dental ceramics etc.) etc. Nano Materials; nano-dimensional mathematics and models, carbon nanotubes and tube geometry analysis, nanotube applications (Clean						

	room dust collector nano filters etc.), nano particles and their applications and their applications.
Course Learning Outs and Proficiencies	Students learn about the grouping and innovation of advanced technology materials and compare them with conventional materials. Students learn about the areas where advanced materials are used. Students gain the ability to think that there are materials in a system that have features that conventional materials cannot meet. Students gain knowledge about functional system design. Students understand the applications of advanced technology materials in different engineering fields and professional groups.
Course Basic and Auxiliary Contexts	• Yuqing, W., Han, D., Yong, G. (Eds.), "Advanced Steels", Metallurgical Industry Press., Springer, 2011, ISBN: 978-3-642-17664-7. • Strong, A., B., "Fundamentals of Composites Manufacturing, Materials, Methods and Applications", SME, 2010, Second Edition, ISBN: 0-87263-854-5, Society of Manufacturing Engineers, Michigan. • Agarwal, B., D., Broutman, J., L., Chandrashekhara, K., "Analysis and Performance of Fiber Composites", John Wiley, 2010. • Bronzino, J., D., "The Biomedical Engineering Handbook" Second Edition, CRC Pres, IEE Pres, 2010, Vol 1, ISBN: 0-8493-0461-8, Vol 2, ISBN: 0-8493-0462-8. • Grellman, W., "Polymer Testing", Carl HanserVerlag, 2010, ISBN: 1-56990-410-3, München, Germany. • Addington, D., M., Daniel, L., S., "Smart materials and new technologies : for the architecture and design professions", Architectural Press, Boston, 2005, ISBN-ISSN: 0750662255.
Methods of Give a Lecture	giving face-to-face lectures

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		

	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	• Introduction to Advanced Technology Materials (grouping and innovation), comparison with conventional materials,
2	• Advanced Composites; Solution of the rule of mixture with Halpin-Tsai equations, Analysis of fiber geometry,
3	• Advanced Composites; Multi-layered sheet structures and honeycomb aviation applications (aircraft and helicopter wing applications), Hybrid composites, hybrid weavings, Cominglated structures and duplex systems and applications, carbon fiber, aramid fiber and boron fiber reinforced composites, fiber production,
4	• Smart Materials; Shape Memory Effect (SME) and martensitic transformation analyses, orthodontic applications, implants, neurosurgical applications, engineering applications (sensors etc.),
5	5• Smart Materials; single and double-sided memory methods, piezoelectric, dielectric, magnetostrictive, pH sensitive, temperature sensitive Halochromic etc. smart materials and their areas of use + Distribution of Homework Topics
6	• Engineering Plastics; hybrid thermoplastics, polyolefin cominglated types, production and use in places exposed to internal pressure vessels, such as hydrogen storage tanks,
7	• Engineering Plastics; Biocompatible plastics such as contact lenses, implants, dental plastics, PMMA, PEEK etc. types, Behaviors of zirconia-supported types in environments with changing pH properties, high temperature plastics,
8	• Engineering Plastics; aromatic hydrocarbon fibers, Broken S-glass (including S-Glass) PA matrix ballistic panel application, fast impact analyses, New materials with negative poissons ratio (Auxetic materials)
9	• MIDTERM EXAM
10	• Advanced Ceramics; functional and structural classification, electronic ceramics (magnetic, dielectric, etc.), piezoelectric ceramics, superconducting ceramics, bioceramics (dentures, bones, dental ceramics, etc.), etc.,
11	• Nanomaterials; nanoscale mathematics and models, carbon nanotubes and tube geometry analysis, nanotube applications (clean room dust collector nanofilters, etc.), nanoparticles and applications (antibacterial, antiviral, etc.),
12	• Nanocomposites; general properties, areas of use, dental fillings, conductive plastics, semiconductor plastics, etc. + Homework Presentations
13	• Advanced metallic materials; Titanium Alloys (Grade 1 – 5 types, alpha-beta alloys, heat treatments, texture analysis), High temperature alloys (Heat Resistant Alloys; High nickel alloys, Rene95, Nimonic90 and applications with excessive creep loading such as turbine blades) + Homework Presentations
14	• Advanced metallic materials; Co-Cr-Mo alloys intra-bone implant applications, Aluminum lithium alloys and aviation applications, Microalloyed steels, Dual phase stainless steels, Maraging steels etc. + Homework Presentations
15	• Topic Repetition and Applications

COURSE IDENTIFICATION FORM							
Course Code and Name:MKM5016/Surface Engineering				**Department of : Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Asst. Prof. Dr. Ali Kemal ASLAN				**Mail : akaslan@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	The aim of this course is to provide information about the definition, importance and characteristics of the surfaces of engineering materials; to teach surface modifications made to material surfaces; and to ensure that appropriate surface modifications can be decided for the solution of specific problems encountered in engineering applications.						
Course Goals	• Providing information about the importance, characteristics and properties of engineering surfaces. • Understanding of 2D and 3D surface parameters. • Teaching the modification processes performed on engineering surfaces. • Understanding the surface coating technologies • To teach the subjects of Tribology, Friction, Wear and Lubrication on Engineering Surfaces. • Understanding of Biomedical Surfaces, Coatings and Surface Modification Techniques. • To understand the characterization techniques of surface modification processes. • Teaching Metrology of Engineering Surfaces, Profile and Area Measurements and imaging techniques.						
Course Learning Outs and Proficiencies	• Gain knowledge about Surface Engineering concepts and applications. • Gain knowledge about surface coating technologies • Be able to offer solution suggestions for improving the tribological properties of a system. • Be able to characterize modified surfaces. • Be able to recognize biotribological systems and offer solutions to the problems of these systems.						

Course Basic and Auxiliary Contexts	• Coatings Tribology, Second Edition_ Properties, Mechanisms, Techniques and Applications in Surface Engineering-Elsevier Science • Handbook of Thin-Film Deposition Processes and Techniques_ Materials Science of Thin Films - Deposition and Structure-Elsevier (2002) • Surface Coating and Modification of Metallic Biomaterials-Woodhead Publishing (2015)
Methods of Give a Lecture	Face to face

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assesment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan	
Week	**Subjects**
1	Introduction, Basic concepts of surface engineering, Surface engineering classification
2	Characteristic properties of engineering surfaces, Metrology of engineering surfaces, profile and area measurements.
3	Visualization systems of engineering surfaces
4	Manufacturing of engineering surfaces, Surface treatment by removing material, Surface treatment by adding material, Carburizing, Nitriding, Anodizing, Surface modification processes using liquid and gas baths
5	Surface modification by ion bombardment
6	Surface treatment by chemical vapor deposition (CVD) method
7	1. Quiz
8	Surface treatment by physical vapor deposition method, Thermal evaporation techniques, magnetron sputtering techniques
9	Laser surface modification processes
10	Basic concepts of biotribology, biological surfaces, artificial joint implants
11	Biomedical coating techniques, application areas
12	Evaluation of tribological and corrosion effects of biomedical coatings, design and evaluation of in-vivo and in-vitro experimental systems processes
13	Student literature reviews and presentations.
14	Final Examination

COURSE IDENTIFICATION FORM							
Course Code and Name:MKM5017/ Ceramic Coatings in Engineering				**Department of : Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Asst. Prof. Dr. Ali Kemal ASLAN				**Mail : akaslan@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	The aim of this course is to teach the classification, characteristics and production methods of ceramic coatings applied to the surfaces of engineering materials; to understand the determination and application of the appropriate ceramic coating type and method in problem solving in surface engineering applications.						
Course Goals	• To teach the definition, classification and characteristics of ceramic materials. • To understand the deposition methods of ceramic coatings. • To provide information about the morphology, microstructure and mechanical properties of ceramic thin film coatings. • To be able to select the appropriate ceramic thin film coating component and appropriate coating methods in solving different problems encountered in engineering applications.						
Course Learning Outs and Proficiencies	• Having information about ceramic thin film coatings.Gain knowledge about surface coating technologies • Understanding the thin film coating techniques used in surface engineering applications • Be able to develop thin film coating solutions to improve the tribo-corrosive properties of a system. • Be able to characterize and evaluate the microstructure, adhesion, wear and corrosion resistance of ceramic thin films.						
Course Basic and Auxiliary Contexts	• Ceramic Coatings – Applications in Engineering, Ed. by Feng Shi, Intech open Science (2012) • Coatings Tribology, Second Edition_ Properties, Mechanisms, Techniques and Applications in Surface Engineering-Elsevier Science (2009)						

Methods of Give a Lecture	Face to face

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assesment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Engineering ceramics, general concepts, classification
2	Ceramic thin film production techniques, Physical vapor deposition methods
3	Ceramic thin film depoisition by chemical vapor deposition method
4	Production of ceramic thin films by micro arc oxidation (MAO) method
5	Ceramic thin deposition by sol-gel and electrophoretic techniques
6	Characteristics of nitride, carbide and oxide ceramic films
7	Characteristics of nitride, carbide and oxide ceramic films
8	1. Quiz
9	Single transition element ceramic thin film coatings, tribological, mechanical properties
10	Ceramic thin film coatings with two or more transition elements and their tribological and mechanical properties
11	Nitrocarbide ceramic thin film coatings with a single transition element and evaluation of their tribological and mechanical properties
12	Nitrocarbide ceramic thin film coatings with two or more transition elements and evaluation of their tribological and mechanical properties
13	Student literature reviews and presentations.
14	Final Examination

COURSE IDENTIFICATION FORM							
Course Code and Name:MKM5018/ Systematic Construction				**Department of : Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Asst. Prof. Dr. Ali Kemal ASLAN				**Mail : akaslan@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	The aim of this course is to provide the ability to systematically design the construction and shaping principles of engineering systems.						
Course Goals	• To understand systematic construction processes • To teach conceptual and objective design concepts • To be able to evaluate Technical; Aesthetic; Safety and Economic Factors in Construction • To be able to perform system analysis in construction with modeling and simulation						
Course Learning Outs and Proficiencies	• Be able to analyze the engineering system constructively • To be able to define systematic construction processes. • Systematic design skills will be developed.						
Course Basic and Auxiliary Contexts	• Sistematik Konstrüksiyon Ders Notları-2017", Yrd. Doç. Dr. C. Oktay Azeloğlu • Mühendislik Tasarımı - Sistematik Yaklaşım", Prof. Dr. Hüseyin Börklü						
Methods of Give a Lecture	Face to face						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assesment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to construction systematics, basic concepts.
2	Sample Research Methods in Construction; Original Construction in Limited Conditions
3	Systematic construction processes, product planning, clarification of technical assignment
4	Introduction to the conceptual design process, clarification of the basic principle
5	Creation and analysis of function structures.
6	Solution methods, creation of solution options.
7	Objective design processes
8	1. Quiz
9	Reliability Analysis in Construction; Risk Management in Construction; Safety in Construction
10	Modeling and Simulation in Construction; System Analysis in Construction
11	Expert Systems in Construction; Production Systems in Construction
12	Systematic Construction application examples
13	Systematic Construction application examples
14	Final Examination

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5020 Machine Design				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)	-						
Instructor	Ass. Prof. Aybars MAHMAT					**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	It is to understand the machine design processes and to develop engineering design skills. It is to provide the basic information required when making a machine project.						
Course Goals	Basic principles, design types, standard series, general shaping rules, tolerances, points to be considered in the design of parts to be shaped by casting, points to be considered in the design of parts to be joined by welding, points to be considered in the design of parts to be obtained by machining, shaping of shafts, hubs and shaft-hub connections, types of bearings and arrangement of bearings, importance of lightness and light machine elements, importance of sealing in design, design of sealing elements, low-cost designs, analysis of different designs.						
Course Learning Outs and Proficiencies	• Knows the basic concepts of machine design. • Designs machine parts produced according to casting, welding and machining. • Knows how to place shafts. • Knows how to design sealing elements						
Course Basic and Auxiliary Contexts	• Tezcan Şekercioğlu, Makine Tasarımı Temel İlkeler, 2. Baskı, Birsen Yayınevi, İstanbul, 2023.						
Methods of Give a Lecture	FACE TO FACE						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to machine design
2	• Shaping and sizing
3	• Design from a casting perspective
4	• Design from a machining perspective
5	• Design from a welding perspective
6	• Design from a welding perspective
7	• Midterm exam
8	• Design of shaft hub connections
9	• Design from a bearing perspective
10	• Design from a bearing perspective
11	• Design from a bearing perspective
12	• Design of bolted connections, design from a lightness perspective
13	• Design from a corrosion perspective, design from a sealing perspective
14	• Final exam

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5023 NUMERICAL CONTROL APPLICATIONS IN MACHINING				Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	5	Turkish	Optional

Prerequisite (s)		
Instructor	Assoc. Prof. Dr. Salih AĞAR	**Mail : salihagar@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	To provide information about Numerically Controlled (SD) machine tool equipment and the structure of part programs used in these machines.	
Course Goals	The ability to comment on machining operations performed with SD machines in many industrial sectors is provided.	
Course Learning Outs and Proficiencies	1. Explains the development of SD machines up to the present day. 2. Compares the place of SD machines in the manufacturing sector with classical machines and comments on the differences. 3. Explains the equipment, movement mechanisms and control systems of SD machines by comparing them with classical machines. 4. Explains the logic of part processing in SD machines by combining programming logic with knowledge, skills and experience.	
Course Basic and Auxiliary Contexts	Sayısal Denetimli Takım Tezgahları, Prof. Dr. Mustafa AKKURT, Birsen yayınları.	
Methods of Give a Lecture	Face to face	

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	SD Machine tools general description
2	SD Machine tools motion elements, control circuits, power units
3	General construction of numerically controlled machines
4	Coordinate systems in programming process, control types
5	Part programming in turning processes
6	G Codes, interpolations, general structure of CAM programs and introduction of UniGraphics program
7	Tool compensation in turning processes
8	Repetitive operations (cycles) in turning processes and program examples
9	MIDTERM EXAM
10	Part programming in milling processes
11	Tool compensation in milling processes (Radius, length compensation)
12	Zero shift, tool path programming with Unigraphics CAM
13	Basics of repetitive operations in milling processes
14	Program examples

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COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5024 Metal Matrix Composites				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Doç. Dr. Yahya TAŞGIN				**Mail : yahyatasgin@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	In recent years, the use of composite materials instead of traditional materials has increased in applications requiring high and durable service conditions due to the increasing demand. In the scope of this course, metal matrix composite materials, especially with their high specific strength, which have replaced conventional materials, will be introduced. Areas of use, production technologies and the effects of matrix/reinforcement interface properties on the behavior of composite materials will be covered.						
Course Goals	Introduction to Metal Matrix Composite materials. Application areas of Metal Matrix Composite materials. Manufacturing techniques of Metal Matrix Composites. Micromechanical analysis of Metal Matrix Composites. Machinability. Reinforcement element – matrix interface. Machinability of Metal Matrix Composites.						
Course Learning Outs and Proficiencies	Classify composite materials. Recognize the metal matrix and the reinforcement phases used in the production of Metal Matrix Composite Materials. Have information about interfaces.						
Course Basic and Auxiliary Contexts	Clyne T.W., Withers P.J., “An Introduction Metal Matrix Composites”, Cambrige University Pres,1993 Newaz G.M “Metal Matrix composites: Application and processing” Zverich : Trans Tech Pub, 1995						
Methods of Give a Lecture	giving face-to-face lectures						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**

	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	• Atomic structure and periodic table
2	• Metallic alloy theories
3	• Metallic alloy theories
4	• Crystal structures and size analysis of intermetallic phases
5	• Microscopic phase equilibrium in alloys
6	• Alloy standards and applications in the world.
7	• Molten aluminum preparation methods and aluminum alloy melting experiments
8	• Aluminum alloys and their applications in industry
9	• MIDTERM EXAM
10	• Copper and copper alloy preparation techniques and their applications in industry
11	• Zinc and zinc alloy preparation techniques and their applications in industry.
12	• Magnesium and magnesium alloy preparation techniques and their applications in industry.
13	• Titanium and titanium alloy preparation techniques and their applications in industry
14	• Student project presentations, discussion and evaluation
15	• MAKE-UP EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5025 Mechanics of Composite Material				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Assoc. Prof. Dr. Yılmaz KISMET Assoc. Prof. Dr. Akar DOĞAN					**Mail : ykismet@munzur.edu.tr** **Web : www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	Master's degree						
Course Aim	What is composite material, classification of composites, applications in land, sea and aerospace fields, and learning the properties of the components of composite materials, matrix and reinforcement phases and gaining the knowledge needed to determine the mechanical properties that should be considered in engineering design.						
Course Goals	Course content, general concepts of composite materials, tensile, flexural and impact analyses of composite materials, explanation of stiffness and toughness mechanisms, macromechanical analysis of single ply laminates, explanation of isotropic, anisotropic and orthotropic composites, determination of plane stress and strain relations and engineering constants in composites, stiffness and compatibility matrices for orthotropic materials, Strength of orthotropic materials, fracture theories and damage analysis, micromechanical analysis of laminae (mass and volume ratios, density, thermal expansion coefficients), calculation of elastic moduli, macromechanical analysis of layered laminae, lamina code, stress-strain relations of layered laminae, elastic constants of layered laminae and design of layered laminae by damage analysis.						
Course Learning Outs and Proficiencies	- Defines the basic concepts related to composite materials. - Understands the engineering knowledge required for the design of composite materials. - Learns to determine the micromechanical properties of composite materials. - Learns to form stress-strain relations of composite materials. - Gains the ability to apply the knowledge about the mechanics of composite materials to engineering problems.						
Course Basic and Auxiliary Contexts	• Autar K. Kaw, Mechanics of Composite Materials, ISBN-10: 0-8493-1343-0, Taylor& Francis Group, 2006, USA. • Robert M. Jones, Mechanics of Composite Materials, ISBN-1-56032-712-X, Taylor&Francis Inc., 1999, USA. Ronald F. Gibson, Principles of Composite Material Mechanics, Second Edition, ISBN: 978-0824753894,CRC Press, 2011,USA.						

Methods of Give a Lecture	Lecture, application, analysing, question-answer, discussion

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Midterm	**X**	**50**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	General information about composite materials
2	Properties of matrix and reinforcement phases in composite materials
3	Production techniques of composite materials
4	Mechanical tests applied for composites (tensile, bending, impact, etc.)
5	Isotropic, anisotropic, orthotropic composites
6	Determination of plane stress and strain relations and engineering constants in composite materials
7	Determination of macromechanical properties of laminates
8	Stiffness and elasticity matrices for composite materials
9	Midterm Exam
10	Determination of micromechanical properties of laminates
11	Calculation of modulus of elasticity and shear moduli of layered composites
12	Stress-strain relations of layered laminates
13	Elasticity constants of layered laminates
14	Damage analysis and design of layered laminates

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5030 Design of mechatronic systems				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)	-						
Instructor	Ass. Prof. Aybars MAHMAT					**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The aim of this course is to have students design realistic solutions and perform performance analyses for a current mechatronic problem defined by stakeholders, using the knowledge and skills they have gained in previous courses and methods applied in product development in the industry. .						
Course Goals	Problem definition, transformation of requirements determined by stakeholders into technical specifications, literature review, determination of required technical and material resources, definition of mechanical, electrical, computer and other subsystems if any, effective teamwork, creation of a work plan, presentation of project proposals, implementation and evaluation of designs, evaluation of alternative designs, documentation of results obtained with technical documentation, design presentation.						
Course Learning Outs and Proficiencies	• Students gain the ability to design a complex system, process, device or product under realistic constraints and conditions to meet specific requirements. • Students effectively use information technologies in the mechatronic system design process to ensure efficient work and communication. • Students present their work and results in the mechatronic system design process in a clear and understandable manner by using effective oral and written communication, presentation and effective report writing skills. • Students gain knowledge about business applications such as project management, risk management and change management and apply these methods in mechatronic system design processes.						

	• Students gain knowledge about the universal and societal effects of engineering applications on health, environment and safety and the problems reflected in the field of engineering of the age and shape their designs in light of this knowledge.
Course Basic and Auxiliary Contexts	• C. Coulston, R. Ford, Design for Electrical and Computer Engineers, Ed. 1, McGraw-Hill, 2007 Y. Haik, • S. Sivaloganathan, T. M. Shahin, Engineering Design Process, Ed. 3, CL Eng., 2017
Methods of Give a Lecture	FACE TO FACE

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	• Problem formulation, definition, scope and stakeholder requirements
2	• Literature and patent review
3	• Current existing solutions
4	• Technical requirements determination and analysis
5	• Examination of mechatronic system components
6	• Subsystem analysis
7	• Midterm exam
8	• Examination of considerations in subsystem design

9	• Subsystem analysis and design
10	• Design comparison analysis and design verification
11	• Integration of systems
12	• Verification of the entire design
13	• Revision of designs
14	• Final exam

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5031 - TEMPERATURE MEASUREMENT AND CONTROL OF THERMAL SYSTEMS				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)	-	
Instructor	Ass. Prof. Cihad FİDAN	**Mail :cihadfidan@munzur.edu.tr** **Web :www.munzur.edu.tr**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	Teaching students various methods of temperature measurement and control algorithms.	
Course Goals	The basic terms of measurement, the fundamental laws of thermodynamics, are heat transfer and fluid mechanics, temperature scales, classification of thermometers, thematic thermometers, optical thermometers, computer-controlled measurement and control information.	
Course Learning Outs and Proficiencies	1) Obtains basic measurement and control information. 2) Understands the terms associated with temperature. 3) Learns information about different temperature scales. 4) The optimal temperature gains the ability to select the measurement and control system. 5) It understands the mechanism of different temperature measurement systems. 6) Designed a computer-controlled temperature measurement and control. 7) He can analyze errors.	
Course Basic and Auxiliary Contexts	1) Temperature Measurement, L. Michalski, K. Eckersdorf, J. McGhee, John Wiley & Sons. 2) Temperature measurement & Control, J.R Leigh, Peter Peregrinus Ltd. 3) Advanced Temperature Measurement and Control, G. K. McMillan, International Society of Automation. 4) Instrumentation Reference Book, B.E. Noltingk, Butterworths & Co.	

Methods of Give a Lecture	FACE TO FACE

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Basic terms for measurement and control
2	The basic laws of thermodynamics, heat transfer and fluid mechanics
3	Temperature scales
4	Introduction to temperature measurement, classification of thermometers
5	Glass thermometers
6	Experimental studies
7	Dilation thermometers, bimetal thermometers
8	Liquid-filled thermometers, steam-pressure thermometers
9	MIDTERM EXAM
10	Gas thermometers, temperature readings
11	Thermocouples and computer-controlled measurement
12	Resistance thermometers, quartz thermometers, fiber optic thermometers, ultrasonic thermometers.
13	Semiconductor thermometers, Piranometers

14	• Final exam

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5035 Boundary Layer Theory				**Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	There are no prerequisites.						
Instructor						**Mail :** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	To investigate boundary layer flows in fluid mechanics, aerodynamic and heat transfer.						
Course Goals	• To get sufficient knowledge on boundary layer parameteres, skin frictions, drag and lift coefficients on flat surfaces.						
Course Learning Outs and Proficiencies	• Understand the conversation equations and boundary layer parameters • Determine the average velocity and temperature values • Learn the friction and drag coefficients • Analysis the Blasius and Falkner-Skan equations • Obtained the knowledge about convective heat transfer						
Course Basic and Auxiliary Contexts	• Akışkanlar Mekaniği, Umur, H. • Çözümlü Akışkanlar Mekaniği Problemleri, Umur, H. • Fluid Mechanics, White, F.W. • Boundary-Layer Theory, Schlichting, H. • Convective Heat and Mass Transfer, Kays, W.M., M.E. Crawford						
Methods of Give a Lecture	Face to face						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Momentum and energy equations for cartesian coordinates
2	Momentum and energy equations for cylindrical coordinates
3	Solutions of conversation equations
4	Applications of conversation equations
5	Boundary layer parameters
6	Velocity and temperature profiles of full developed flows
7	Average velocity and temperature values
8	Friction and drag coefficients
9	Midterm Exam
10	Momentum integral and energy equations
11	Analytic solutions
12	Blasius and Falkner-Skan equations
13	Convective heat transfer
14	Applications of convective heat transfer

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5039 Part design for casting				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)	-						
Instructor	Ass. Prof. Aybars MAHMAT					**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The aim of this course is to share with students the latest developments in casting technique and the purposes these developments serve. One of the aims is to offer solutions to the main technical and social problems encountered in casting technique.						
Course Goals	• Sharing developments in casting technique • Minimizing problems in casting technique						
Course Learning Outs and Proficiencies	• Be able to summarize the factors that should be considered in casting design • Be able to create a casting and mold model using a computer casting simulation program • Be able to evaluate the results of a computer casting simulation program • Be able to determine the necessary casting stages and flow chart for a specific part						
Course Basic and Auxiliary Contexts	• Döküm Teknolojisi- Ahmet ARAN						

Methods of Give a Lecture	FACE TO FACE

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction, typical flow chart in foundries
2	• Classification of casting processes
3	• Patterns, cores and molds
4	• Solidification of metals and alloys
5	• Solidification process
6	• Molding and melting equipment
7	• Midterm exam
8	• Riser design
9	• Filling the mold
10	• Gating design
11	• Gating design optimization
12	• Casting process planning
13	• Optimization of casting parameters
14	• Final exam

COURSE IDENTIFICATION FORM

Course Code and Name:INDUSTRIAL SLIDING BEDS AND APPLICATION AREAS MKM-5041	Department of : DEPARTMENT OF MECHANICAL ENGINEERING / MECHANICAL ENGINEERING

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç.Dr. Gökhan KAHRAMAN	**Mail : gokhankahraman@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	Recognizes industrial sliding bearings, makes calculations and will have information about faults.	
Course Goals	•	
Course Learning Outs and Proficiencies	• 1 Learning the working principle of plain bearings. 2 Learning the calculations of plain bearings 3 Learning about the failures in the sliding bearings and the precautions to be taken to prevent these failures	
Course Basic and Auxiliary Contexts	•	
Methods of Give a Lecture	Face to Face	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Identification of plain bearings
2	Calculations of plain bearings and their equations
3	Problem solving with plain bearings
4	Calculation and calculation of hydrostatic systems
5	Problem solving about hydrostatic systems
6	Description of the properties of oils used in hydrodynamic and hydrostatic systems and appropriate oil selection methods
7	Detection of hydrodynamic and hydrostatic systems according to their location
8	Detection of hydrodynamic and hydrostatic systems according to their location
9	exam
10	Sliding bearings and white metals
11	Types of sliding bearings used in today's technology
12	Temperature and shaft oscillation problems in sliding bearings

13	Sliding bearing problems and dimensioning
14	Sliding bearing problems and dimensioning

COURSE IDENTIFICATION FORM							
Course Code and Name:MKM5042/ Characterization of Coatings				**Department of : Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Asst. Prof. Dr. Ali Kemal ASLAN				**Mail : akaslan@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The purpose of this course is to teach the definitions, basic concepts and properties of surface coatings applied to the surfaces of engineering materials in order to improve various tribological, corrosion and mechanical properties; to understand the detection and evaluation of wear, scratch, corrosion and mechanical properties of coatings.						
Course Goals	• To understand the relationship between tribological, corrosive and mechanical properties and surface modification, • To teach the basic concepts and terminology related to surface coatings and coating techniques, • To learn the standards used in coating characterization • Teaching wear, adhesion, phase analysis, morphological examination, coating characterization techniques.						
Course Learning Outs and Proficiencies	• Understanding the basics of surfaces and interfaces • Understanding of thin film characterization techniques • To understand and evaluate the characterization techniques used to determine the tribological, mechanical, physical and morphological properties of thin films.						
Course Basic and Auxiliary Contexts	• Thin film growth: Physics, materials science and applications, Edited by Zexian Cao, Woodhead Publishing Limited, 2011, SBN 978-1-84569-736-5 (print); ISBN 978-0-85709-329-5 (online) • Materials Science of Thin Films Deposition and Structure (Second Edition, Milton Ohring 2002 by Academic Press						
Methods of Give a Lecture	Face to face						

Assesment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Introduction, basic concepts of Surface Engineering, surface coatings
2	Overview of surface coating processes, triobological, mechanical, physical requirements
3	Surface coating types, Thick coatings, Thin Film Coatings
4	Classification of surface coating techniques
5	Morphological examination and interpretation of thin film coatings using SEM, FESEM, TEM.
6	Phase analysis of thin film coatings, phase analysis with XRD and GI-XRD techniques
7	Characterization of electrical and optical properties of thin film coatings
8	1. Quiz
9	Characterization of adhesion of coatings to substrate, Standards - Scratch test, conducting the test and interpretation of results.
10	Analysis of film failures in scratch experiments
11	Determination and interpretation of normal load, friction coefficient, critical load values in scratch tests
12	Characterization of wear behavior of coatings-Wear tests- Pin-On-Disc, Ball-On-Disc wear tests
13	Characterization of wear and corrosion behavior of coatings-Tribocorrosion experiments, conducting the experiment and interpretation of the results
14	Final Examination

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5043 Machine Design Principles-II				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)		-					
Instructor		Ass. Prof. Aybars MAHMAT				**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim		Engineering activities are generally classified as design, manufacturing and operation.Design is the most important human endeavor in every period and is one of the fields with the highest added value. Especially the low energy and material density and high information density cause this field to pass into the control of developed countries. In parallel with the developing manufacturing sector in our country, the design sector also needs to be developed. One of the most important tools for this is to increase the weight of design education in our universities. The main purpose of this course is to systematically convey design to our students in every aspect. To systematically provide engineering candidates with the concepts of functional design, design in terms of strength, design in terms of ease of use, transportation, recycling, energy usage rate, energy recovery, artistic, tribological and manufacturing design and to prepare the infrastructure for the transition from the position of a manufacturing country to the position of a designer country.					
Course Goals		• Design Concept, Components of Design • Design Stages, • Design Tools Systematically Transferred to Engineer Candidates.					
Course Learning Outs and Proficiencies		• Creates design infrastructure and components • Selects and uses design tools • Develops design algorithm • Designs experiments • Designs machine tools • Uses solution search methods in design					

Course Basic and Auxiliary Contexts	• Pahl G. (çeviren: Börklü H.R.), Mühendislik Tasarımı, Sistematik yaklaşım, Hatipoğlu, 2007. • Andrew D. Dimarogonas, Machine Design, John Wiley, 2001. Soydan Y. Ulukan L., Triboloji, Tagem, 2012.
Methods of Give a Lecture	FACE TO FACE

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction of the course, transfer of the methodology. Obtaining student suggestions and expectations. Functional design, design in terms of strength, design in terms of ease of use, transport, recycling, energy usage rate, energy recovery,
2	• Introduction of the course, transfer of the methodology. Obtaining student suggestions and expectations. Functional design, design in terms of strength, design in terms of ease of use, transport, recycling, energy usage rate, energy recovery,
3	• Explanation of design stages with examples, determination of needs and requests, definition of homework, determination of physical etc. principles, pre-shaping, calculations, controls, final shaping, prototype, model, test, analysis, modification and implication
4	• Brief review of physical principles used in design (friction, gravity etc.), Measurement system design, Application: Design of an element or system that will provide measurement of temperature in a room, all stages and selection of engineering materials.
5	• Machine elements: Definition, classification, shaping and strength criteria. Screws (joining, motion transmission, material transmission, adjustment, etc.), Flywheels (energy accumulation, energy storage, motion balancing, energy balance

6	• Concept of safety and reliability in design. Safety coefficient and its optimum determination; Strength and Strain concepts
7	• Midterm exam
8	• Identification of manufacturing needs and implementation of a design suitable for the type of need
9	• Drive systems and applications: Mechanical drive, Hydraulic drive, Pneumatic drive, Electrical drive, Electro-Mechanical, Electro-Hydraulic, Electro-Pneumatic, Electro-Hydro-Mechanical drive, etc.
10	• Experimental design, design of experimental components, design of experimental set, design of measurement system, design of experimental philosophy, obtaining experimental results, analysis of experimental results, interpretation of experimental results.
11	• Solution search methods in design and application (Brain Storming)
12	• Use of computers in design, use of sensors in design, selection of motor, selection of transmission organs, selection of speed/torque changing system, etc. Application
13	• Analysis and synthesis of designs made
14	• Final exam

COURSE IDENTIFICATION FORM							
Course Code and Name:MKM5046/ Advanced Manufacturing Processes				**Department of : Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor		Asst. Prof. Dr. Ali Kemal ASLAN				**Mail : akaslan@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	The aim of this course is to teach modern manufacturing techniques, to understand that parts that cannot be produced with traditional manufacturing techniques can be produced with advanced manufacturing techniques, to understand the basic principles of modern manufacturing techniques, and to provide skills for application.						
Course Goals	• Teaching advanced manufacturing techniques • Being able to design for manufacturing with modern manufacturing technologies • Understanding additive manufacturing. • Teaching the right manufacturing method selection for part manufacturing						
Course Learning Outs and Proficiencies	• To have knowledge about modern manufacturing methods. • To be able to compare traditional and modern manufacturing methods. • To be able to choose the right manufacturing method in terms of shape-size-surface precision, manufacturability and technological level of a part.						
Course Basic and Auxiliary Contexts	• Kalpakjian, S. and Schmid, S.R. 2022. Manufacturing Engineering & Technology (8th Ed.). Pearson. ISBN-13: 978-1292422244 • J. Dawim, Nontraditional Machining Processes, Springer, 2013 Handbook of Thin-Film Deposition Processes and Techniques_ Principles, Methods, Equipment and Applications-William Andrew (2002) • Groover, M.P. 2019. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems (7th Ed.). Wiley. ISBN-13: 978-1119475217						
Methods of Give a Lecture							

	Face to face

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assesment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Traditional manufacturing methods, advantages-disadvantages
2	Modern manufacturing technologies
3	Electrical abrasion processing, electron bombardment processing
4	Laser beam processing, plasma arc processing
5	Chemical processing techniques, electrochemical machining, electrochemical grinding, deburring, honing
6	Ultrasonic processing
7	Electro-Hydrolic Processing
8	1. Quiz
9	Powder Metallurgy
10	Surface Coating, Magnetic vibration forming
11	Introduction to additive manufacturing, rapid prototyping
12	Additive manufacturing techniques: EBM, LBM, FDM, SLM, DMLS, SLS
13	Additive manufacturing techniques: Powder Bed Fusion, Powder Fed Fusion, Laser Cladding, Laser Based Additive Manufacturing
14	Final Examination

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Lisansüstü Eğitim Enstitüsü Müdürlüğü

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5047 Mathematical Methods in Engineering				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Erdem IŞIK					**Mail : erdem@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	To remind/provide basic mathematical knowledge. To ensure that students can establish a connection between mathematics and engineering problems with the help of appropriate examples.						
Course Goals	• To provide students with the basic mathematical knowledge that they may need in their graduate courses.						
Course Learning Outs and Proficiencies	1. Students will learn mathematical modeling of mechanical engineering problems. They will learn the solution methods of boundary value and initial value problems included in these models. 2. Non-linear equations will be learned. 3. Fourier transform will be learned. 4. Numerical integration and derivative will be learned. 5. Students will be able to write a program using these titles						
Course Basic and Auxiliary Contexts	İleri Mühendislik Matematiği K. A. Stoud and Dekter J. Booth, 1992; Yüksek Mühendislik Matematiği John Bird, 2004						
Methods of Give a Lecture	giving face-to-face lectures						

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction and Basic Concepts
2	• Vectors
3	• Matrices
4	• Linear Equations
5	• Nonlinear Equations
6	• Differential Equations
7	• Differential Equations
8	• Solution of Differential Equations with Laplace Transform
9	• MIDTERM EXAM
10	• Solution of Differential Equations with Laplace Transform
11	• Fourier Transform
12	• Finite Differences, Numerical Differentiation, Numerical Integral
13	• Numerical Solution of Differential Equations
14	• Numerical Solution of Differential Equations
15	EXAM

T.C.
MUNZUR ÜNİVERSİTESİ
Lisansüstü Eğitim Enstitüsü Müdürlüğü

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5050 Heat and Mass Transfer				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Erdem IŞIK					**Mail : erdem@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	To comprehend the principles of heat transfer. To be able to design heat and mass transfer processes through heat and mass transfer simulation.						
Course Goals	To comprehend the principles of heat transfer. To comprehend heat and mass transfer processes through heat and mass transfer simulation.						
Course Learning Outs and Proficiencies	1. They will understand the importance of heat and mass transfer 2. They will reinforce their heat transfer knowledge, learn the relevant laws and be able to apply them 3. They will be able to offer practical solutions to heat and mass transfer problems 4. They will have information about application areas 5. They will be able to design heat and mass transfer processes and systems						
Course Basic and Auxiliary Contexts	Incropera, F. P., DeWitt, D. P., Bergman, T. L., and Lavine, A. S. 2007; Isı ve Kütle Geçişinin Temelleri, John Wiley, USA. Öztürk, A. ve Yavuz, H., 1995; Uygulamalarla Isı Geçişi: Tanıtım ve Işınım, Çağlayan Yayınevi, İstanbul						
Methods of Give a Lecture	giving face-to-face lectures						

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction. Heat Conduction. Heat Convection. Heat Radiation. Mass Transfer. Mass Transfer.
2	• Concentration Definitions. Fick's Law. Concentrations at Interfaces.
3	• Fick's Law. Mass Diffusion Coefficient. Conservation of Composition Principle.
4	• Mass Transfer Equation. Mass Transfer for a Static Medium with No Homogeneous Chemical Reactions.
5	• Applications.
6	• Static Medium with Catalytic Surface Reactions. Uniform Flux Reciprocal Diffusion.
7	• Evaporation in a Tube. Mass Transfer with Homogeneous Chemical Reactions. Applications.
8	• Transient Diffusion. Numerical Analysis. Applications.
9	• MIDTERM EXAM
10	• Convective Mass Transfer. Dimensional Analysis. Physical Significance of Dimensionless Parameters. Applications.
11	• Convective Mass Transfer. Concentration Boundary Layer. Heat and Mass Transfer Analogy.
12	• Convection Heat and Mass Transfer. Applications.
13	• Radiation. Black Body Radiation. Environmental Radiation.
14	• Shape Factor. Net Radiation Between Surfaces.
15	EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5051 Numerical Methods in Heat Transfer and Fluid Mechanics				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç. Dr. Erdem IŞIK	**Mail : erdem@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	To transfer the necessary numerical methods for heat-fluid systems. To ensure that they use them in the numerical solution of heat-fluid problems.	
Course Goals	To transfer the necessary numerical methods for heat-fluid systems. To make them understand their use in the numerical solution of heat-fluid problems.	
Course Learning Outs and Proficiencies	1. Solves initial and boundary value problems using various numerical methods. (RungeKutta method, Finite differences and “shooting” method). 2. Knows the classification of elliptic, parabolic and hyperbolic equations and the physical events they express. 3. Develops finite difference formulation using Taylor series expansion. 4. Solves parabolic equations with explicit and implicit methods. 5. Solves elliptic equations with iterative methods.	
Course Basic and Auxiliary Contexts	Kundu, P.K. ,Cohen, I.M. (2008). Fluid Mechanics, Amsterdam: Academic Press. White, F. M. (2006). Viscous Fluid Flow, N.Y.: McGraw-Hill Higher Education	
Methods of Give a Lecture	giving face-to-face lectures	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to numerical methods in heat-fluid phenomena. An overview of the governing equations in fluid mechanics and heat transfer and their physical meanings.
2	• Numerical solution of initial value problems.
3	Numerical solution of linear and nonlinear boundary value problems: Finite difference and shooting methods. Thomas algorithm. Fin problem, natural convection on vertical plate
4	Numerical solution of linear and nonlinear boundary value problems: Finite difference and shooting methods. Thomas algorithm. Wing problem, natural convection on vertical plate
5	Kısmi diferansiyal denklemlerin sınıflandırılması: Eliptik, parabolik ve hiperbolik denklemler ve bunlarla ilişkili başlangıç ve sınır koşulları Numerical solution approaches: Finite differences, finite volumes, finite elements. Finite difference formulations: Taylor series approximation, finite difference equations
6	Parabolic partial differential equations: Explicit methods; FTCS method, Richardson and DuFortFrankel methods. Stability analysis. Implicit methods; Crank-Nicolson method
7	Multidimensional parabolic equations. Approximate factorization. ADI method. Stability and consistency analysis of finite difference equations. Unsteady heat-flow problems
8	Elliptic partial differential equations: Jacobi, Gauss-Seidel and SOR iteration methods. Study of differential boundary conditions. Steady heat-flow problems
9	• MIDTERM EXAM
10	Elliptic partial differential equations: Jacobi, Gauss-Seidel and SOR iteration methods. Study of differential boundary conditions. Steady heat-flow problems
11	Formulation of vorticity-stream function, boundary conditions for vorticity. Cavity flow, flow over step
12	Introduction to numerical methods in heat-fluid phenomena. An overview of the governing equations in fluid mechanics and heat transfer and their physical meaning.
13	Numerical solution of initial value problems.
14	Finite difference and shooting methods. Thomas algorithm. The fin problem, natural convection on a vertical plate
15	EXAM

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM 5052 Heat Conduction				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Erdem IŞIK					**Mail : erdem@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	1. To provide advanced understanding of conduction heat transfer theory, 2. To teach analytical and numerical methods used in solving heat conduction problems in engineering applications						
Course Goals	To be able to calculate heat conduction in engineering problems.						
Course Learning Outs and Proficiencies	1. Gains knowledge about the principles of heat transfer, its importance, and application areas in engineering and mechanical engineering. 2. Can solve conduction heat transfer problems in 1-dimensional and multi-dimensional systems in the steady state. 3. Learns heat conduction analysis methods in 1-dimensional and multi-dimensional systems in the transient state. 4. Gains knowledge about fin applications and can calculate heat transfer on finned surfaces. 5. Can design systems with conduction heat transfer problems.						
Course Basic and Auxiliary Contexts	1. M.Kılıç, A.Yiğit. Isı Transferi, 4. Baskı, Alfa Aktüel, Bursa,2010. 2.V.S. Arpacı. Conduction Heat Transfer, Addison Wesley, USA,1966. 3. S.Kakaç, Y.Yener. Heat Conduction, Hemisphere Publishing Corporation, USA, 1985.						
Methods of Give a Lecture	giving face-to-face lectures						

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Basic Concepts and Definitions in Conduction Heat Transfer
2	• General Differential Equation of Heat Conduction, Boundary Value Problems
3	• One-Dimensional Heat Conduction in Cartesian Coordinates in Steady State
4	• One-Dimensional Heat Conduction in Cylindrical Coordinates in Steady State
5	• One-Dimensional Heat Conduction in Spherical Coordinates in Steady State
6	• Differential equations for extended surfaces
7	• Heat transfer from surfaces with a series of fins
8	• Sample Question Solution
9	• MIDTERM EXAM
10	• Two and Three-Dimensional Heat Conduction in Steady State: Analytical, Graphical and Numerical Solution Methods.
11	• Systems with negligible internal heat resistance in transient regime
12	• Systems with negligible convection resistance in transient regime
13	• Systems with finite conduction and convection resistance in transient regime
14	• Sample Question Solution
15	EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5053 Heat Convection				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç. Dr. Erdem IŞIK	**Mail : erdem@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	To provide students with detailed information about convection heat transfer. To provide them with the ability to solve engineering problems involving convection heat transfer.	
Course Goals		
Course Learning Outs and Proficiencies	1. Understand and apply the equations that govern heat transfer problems 2. Have a comprehensive knowledge of convection heat transfer 3. Solve, analyze and discuss engineering heat transfer problems	
Course Basic and Auxiliary Contexts	Kakaç,S. And Yener, Y., 1995. Convective Heat Transfer, Boca Raton, CRC Press. Burmeister, L.C., 1993, Convective Heat Transfer, John Wiley Arpacı, V.S. and Larsen, P.S., 1984, Convection Heat Transfer, Prentice-Hall, Inc. New Jersey. Kays, W.M. and Crawford, M.E., 1980, Convective Heat and Mass Transfer, McGraw-Hill, Inc. Bejan, A., 1995, Convection Heat Transfer, John Wiley&Sons Inc. New York.	
Methods of Give a Lecture	giving face-to-face lectures	

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		

	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Fundamental principles of heat transfer; Principles of heat transfer by convection
2	• Conservation equations
3	• Heat transfer in laminar forced external flows: Similarity solution of hydrodynamic and thermal boundary layer
4	• Heat transfer in laminar forced external flows: Similarity solution of hydrodynamic and thermal boundary layer
5	• Heat transfer in laminar forced external flows: Integral solution of hydrodynamic and thermal boundary layer
6	• Heat transfer in laminar forced external flows: Integral solution of hydrodynamic and thermal boundary layer
7	• Heat transfer in turbulent forced external flows
8	• Heat transfer in laminar and turbulent forced internal flows
9	• MIDTERM EXAM
10	• Heat transfer in laminar and turbulent forced internal flows
11	• Natural convection
12	• Natural convection
13	• Heat transfer in condensation
14	• Heat transfer in boiling
15	EXAM

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5054 Advanced Fluid Mechanics				**Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	There are no prerequisites.						
Instructor						**Mail :** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	Teaching the basic concepts of advanced fluid mechanics.						
Course Goals	• To provide basic information about fluid dynamics • To show the basic equations and applications of fluid dynamics • To provide information about dimensional analysis • To introduce the concept of viscous flows and boundary layers • To show the use of this information in solving engineering problems.						
Course Learning Outs and Proficiencies	• Learning basic information about advanced fluid mechanics, • Learning basic conservation equations and their applications, • Understanding the concept of dimensional analysis and dimensionless equations, • Understanding viscous flow properties and the concept of boundary layers, • Learning general properties of turbulent flow, • Learning the derivation of conservation equations for compressible fluids.						
Course Basic and Auxiliary Contexts	• Munson, B.R., Young, D.F., Okiishi, T.H., Fundamentals of fluid mechanics, John Wiley, 2002. • Akışkanlar Mekaniği Temelleri ve Uygulamaları, Yunus A. Çengel, John M.Cimbala, Çeviri Editörü: Tahsin Engin, Halil Rıdvan Öz,Hasan Küçük, Şevki Çeşmeci, 2006. • Fox and McDonald, Intoduction to Fluid Mechanics, Jhon Wiley and Sons Inc., 5.edition, 1998.						
Methods of Give a Lecture	Face to face						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Fundamental concepts in fluid dynamics.
2	Conservation of mass and momentum equations and their applications.
3	Conservation of energy equation and its applications.
4	Dimensional analysis and analogy.
5	Buckingham PI theorem and its applications.
6	Fundamentals of modeling.
7	Nondimensionalization of conservation equations.
8	Compressible flow concept and compressible flow applications.
9	Midterm Exam
10	Viscous flows and boundary layer concept.
11	Solution of boundary layer equations.
12	Turbulence and turbulent flow investigation.
13	Compressible flows.
14	Derivation of conservation equations for compressible flows.

COURSE IDENTIFICATION FORM

Course Code and Name: DESIGN OF HEAT EXCHANGERS MKM-5055	Department of :DEPARTMENT OF MECHANICAL ENGINEERING / MECHANICAL ENGINEERING

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç.Dr.Gökhan KAHRAMAN	**Mail : gokhankahraman@munzur.edu.tr Web :**
Course Assistant		**Mail : Web :**
Groups / Classes		
Course Aim	This course surveys the principle concepts and methods of thermal design of heat exchangers. Topics include classification of heat exchangers, overview of heat exchanger design methodology, basic thermal design theory for recuperators, additional considerations for thermal design of recuperators, thermal design theory for regenerators, heat exchanger pressure drop analysis, surface basic heat transfer and flow friction characteristics, heat exchanger surface geometrical characteristics, heat exchanger design procedures, heat exchanger thermodynamic modeling and analysis, flow maldistribution and header design, fouling and corrosion in heat exchangers, heat pipe physics, types, design principles and applications.The class assumes the students have received prior graduate classes in heat transfer. Emphasis is placed on being able to formulate and solve typical heat exchanger design problems of engineering importance.	
Course Goals	•	
Course Learning Outs and Proficiencies	1 Determine necessary physical variables and properties to generate mathematical models of heat exchanger design and analysis problems in engineering. 2 Model engineering heat exchanger design and analysis problems with differential and integral control volume approaches. 3 Solve engineering heat exchanger design and analysis problems with analytical and numerical methods.	

Course Basic and Auxiliary Contexts	•
Methods of Give a Lecture	Face to face

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Classification of Heat Exchangers. Overview of Heat Exchanger Design Methodology.
2	Basic Thermal Design Theory for Recuperators: Formal Analogy between Thermal and Electrical Entities. Heat Exchanger Variables and Thermal Circuit. The Efficiency-Number of Transfer Units Method.
3	The Mean Temperature Difference Method. Solution Methods for Determining Heat Exchanger Effectiveness. Heat Exchanger Design Problems.

4	Additional Considerations for Thermal Design of Recuperators: Longitudinal Wall Heat Conduction Effects. Nonuniform Overall Heat Transfer Coefficients. Extended Surface Exchangers. Shell-and-Tube Exchangers.
5	Thermal Design Theory for Regenerators: The Efficiency-Number of Transfer Units Method.
6	Heat Exchanger Pressure Drop Analysis: Extended Surface Heat Exchanger Pressure Drop. Regenerator Pressure Drop. Tubular Heat Exchanger Pressure Drop. Plate Heat Exchanger Pressure Drop. Pressure Drop Associated with Fluid Distribution Elements.
7	Surface Basic Heat Transfer and Flow Friction Characteristics: Dimensionless Groups. Experimental Techniques for Determining Surface Characteristics. Heat Transfer and Friction Factor Correlations. Influence of Superimposed Free Convection. Influence of Superimposed Radiation.
8	Heat Exchanger Surface Geometrical Characteristics: Tubular Heat Exchangers. Tube-Fin Heat Exchangers. Plate-Fin Heat Exchangers. Shell-and-Tube Exchangers with Segmental Baffles.
9	Midterm Exam
10	Heat Exchanger Design Procedures: Plate-Fin Heat Exchangers. Tube-Fin Heat Exchangers. Plate Heat Exchangers. Shell-and-Tube Heat Exchangers. Heat Exchanger Optimization.
11	Thermodynamic Modeling and Analysis: Modeling a Heat Exchanger Based on the First Law of Thermodynamics. Irreversibilities in Heat Exchangers. Energy, Exergy, and Cost Balances in the Analysis and Optimization of Heat Exchangers. Performance Evaluation Criteria Based on the Second Law of Thermodynamics.
12	Flow Maldistribution and Header Design: Geometry & Operating Condition Induced Flow Maldistributions. Mitigation of Flow Maldistribution. Header and Manifold Design.
13	Fouling and Corrosion: Fouling and its Effect on Exchanger Heat Transfer and Pressure Drop. Phenomenological Considerations of Fouling. Fouling Resistance Design Approach. Prevention and Mitigation of Fouling. Corrosion in Heat Exchangers.
14	Heat Pipes: Hydrodynamics and Heat Transfer at Single-Phase Flow through Porous Media. Thermohydrodynamics at Vaporization inside Capillary-Porous Structures. Heat and Mass Transfer at Vaporization on Surfaces with Capillary-Porous Coverings.

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5057 Advanced Measurement Technique				Department of : Department of Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)	-						
Instructor	Ass. Prof. Aybars MAHMAT					**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The purpose of this course is to teach advanced optical, mechanical and electrical measurement techniques in postgraduate education.						
Course Goals	Error and uncertainty analysis. Properties of X, γ and laser (Laser) beams, their acquisition methods and application areas. Obtaining ultrasonic waves by piezoelectric method and application method to material inspection. Mathematical model of speed and acceleration measurement and working principle of these measurement tools. Control of table movement in CNC machines by photoelectric and magnetic methods. Working principle of surface roughness tools working by piezoelectric and inductive methods and measurement of surface roughness. Liquid depth, flow rate etc. measurement techniques using LVDT (Linear Variable Diffraction Transformer) circuits. Measurement of stresses in materials such as metal, concrete, asphalt with inductive sensors and special strain-gages.						
Course Learning Outs and Proficiencies	• Creates multi-dimensional heat conduction formulations. • Obtains time-dependent heat conduction. • Creates solution methods using numerical and graphical methods. • Makes stable heat conduction formulations in different geometries. • Solves heat conduction problems in different geometries.						
Course Basic and Auxiliary Contexts	• AKKUŞ, N., Temel Endüstriyel Ölçme Tekniği (Marmara Üniversitesi) • SAĞLAM, H.; İleri Ölçme Teknikleri (Selçuk Üniversitesi) • GENCELİ, O.F.; Ölçme Tekniği, (İ.T.Ü. Makine Fakültesi) • GENCELİ, O.F.; Optik Ölçme Metodları, (İ.T.Ü. Makine Fakültesi)						

	• DAĞSÖZ, A.K.; Teknikte Sıcaklık Ölçülmesi, (İ.T.Ü. Makine Fakültesi) • BİNİCİ, İ.; Endüstriyel Ölçme ve Kalibrasyon (Marmara Üniversitesi) • GÜR, A.K.; Ölçme ve Kontrol • AY, İ; DEMİRCİOĞLU, K.; Ölçme Tekniği (Balıkesir Üniversitesi) • YILDIRIM, O.; Ölçme Tekniği (İTÜ)
Methods of Give a Lecture	FACE TO FACE

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Error and uncertainty analysis. Properties of X, γ and laser (Laser) beams, their acquisition methods and application areas.
2	Obtainment of ultrasonic waves by piezoelectric method and application method to material inspection.
3	Obtainment of ultrasonic waves by piezoelectric method and application method to material inspection.
4	Mathematical model of speed and acceleration measurement and working principle of these measurement tools.
5	Control of table movement in CNC machines by photoelectric and magnetic methods.
6	Working principle of surface roughness tools working with piezoelectric and inductive methods and measurement of surface roughness
7	• Midterm exam

8	Working principle of surface roughness tools working with piezoelectric and inductive methods and measurement of surface roughness.
9	Measurements of liquid depth, flow rate etc. using VDT (Linear Variable Diffraction Transformer) circuits.
10	Measurement of stresses in materials such as metal, concrete, asphalt with special strain-gages.
11	• Integration of systems
12	• Verification of the entire design
13	• Revision of designs
14	• Final exam

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5058 Advanced Thermodynamics				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Erdem IŞIK					**Mail : erdem@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	1. Reinforcement of knowledge about the basic principles and concepts of thermodynamics 2. Gaining the ability to analyze and design a thermodynamic system or process						
Course Goals	The objectives of this course are - to reinforce the students grasp of classical thermodynamics, - to present topics in classical thermodynamics that are often not adequately covered in undergraduate courses • such as availability analysis and 2nd law efficiency.						
Course Learning Outs and Proficiencies	1. Understand the fundamentals of thermodynamics. 2. Understand energy, energy transfer and general energy analysis. 3. Understand gas power cycles. 4. Recognize vapor and combined power cycles. 5. Recognize refrigeration cycles. 6. Recognize chemical reactions						
Course Basic and Auxiliary Contexts	Mühendislik Yaklaşımıyla Termodinamik (Yunus ÇENGEL) Advanced Engineering Thermodynamics (A.BEJAN)						
Methods of Give a Lecture	giving face-to-face lectures						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Thermodynamics Summary; First Law of Thermodynamics
2	• Second Law of Thermodynamics; Entropy; Second Law Analysis
3	• Brayton Cycle; Brayton Cycle with Regenerative
4	• Ideal Reaction Cycles; Thermodynamic Property Relations; Gas Mixtures
5	• Mole and Mass Ratio of a Gas Mixture
6	• Mole and Mass Ratio of a Gas Mixture
7	• P-V Behavior of a Gas Mixture
8	• Properties of a Gas Mixture
9	• MIDTERM EXAM
10	• Gas-Vapor Mixtures and Air Conditioning
11	• Dry and Atmospheric Air
12	• Specific and Relative Humidity of Air
13	• Chemical Reactions; Fuels and Combustion
14	• Theoretical and Real Combustion Processes
15	EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5059 Advanced Composite Materials				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Yılmaz KISMET Assoc. Prof. Dr. Akar DOĞAN				**Mail : ykismet@munzur.edu.tr** **Web :www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		Master's degree					
Course Aim	Classification of composites, properties of matrix and reinforcement phases, investigation of the effects of thermal expansion differences. Defining the properties of matrix and reinforcement materials by classifying composites. Determination of differences depending on thermal expansion. Explanation of fracture mechanisms, mechanical properties and toughness mechanisms of composites and calculation and interpretation of these properties. Interfacial properties and thermal stresses in composite materials, thermal shock parameters and load-stress behaviour of composites with the addition of reinforcement phase.						
Course Goals	Introduction, Definition and diversity of composites, Matrix and reinforcing elements, Composite material production techniques, Thermal, mechanical and physical analyses of composites, Griffith theory of fracture, Crack propagation mechanisms, Linear elastic fracture mechanics, Fatigue crack growth.						
Course Learning Outs and Proficiencies	- Explain the classification of composites. - Will be able to explain the determination of the properties of matrix and reinforcement/filler phases. - Will be able to determine the thermal expansion differences and effects of matrix/reinforcement phases. - Will be able to explain fracture and toughness mechanisms and mechanical properties of composites. - Will be able to know composites used in many fields in industry. - Will be able to explain interface properties and thermal stresses in composites. - Will be able to explain thermal shock parameters and load-stress behaviour of composites. - Will be able to explain stress-strain behaviour of composites with reinforcement phase addition.						

Course Basic and Auxiliary Contexts	• Autar K. Kaw, Mechanics of Composite Materials, ISBN-10: 0-8493-1343-0, Taylor& Francis Group, 2006, USA.
Methods of Give a Lecture	Face to face (Lecture, practice, analysing, question-answer, discussion)

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Classification of composites
2	Properties of matrix and reinforcement phases in composite materials
3	Effects of thermal expansion differences in composite materials
4	Fracture Strength of Composites
5	Mechanical properties of composites
6	Toughness mechanisms of composites
7	Composite material applications in industry
8	Interfacial properties and thermal stresses
9	Midterm Exam
10	Thermal shock parameters
11	Load-stress behaviour of ceramics with reinforcing phase addition
12	Fibre reinforced polymers and their properties
13	Carbon, Kevlar and glass fibre reinforced thermoplastics and applications
14	Polymer matrix composite materials with natural and synthetic fillers

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5064 Mechanical Properties of Polymers				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Yılmaz KISMET Assoc. Prof. Dr. Akar DOĞAN				**Mail : ykismet@munzur.edu.tr** **Web :www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		Master's degree					
Course Aim	Polymers recognition, classification. According to the physical structure of polymers groups of thermoplastics, thermosets and elastomers to be informed about. Learning the production areas of polymeric materials. Especially for thermoplastics, extrusion, injection moulding, blow moulding, vacuum moulding production methods and their applications in industry. To make mechanical, thermal and morphological analyses of polymer and polymer matrix composites. Performing mechanical tests such as fluidity, tensile-compression, bending, impact, abrasion. To determine the effects of reinforcing elements used in polymers on mechanical properties.						
Course Goals	Starting from polymer structure and synthesis methods, classification of polymeric materials, properties, application areas of these materials, injection, extrusion, rolling, blow moulding, casting, moulding, vacuuming etc. production methods will be explained. Mechanical, thermal, physical analysis and characterisation methods for polymer and polymer matrix composites will be explained.						
Course Learning Outs and Proficiencies	1. Define polymers and polymer types. 2. Form and interpret polymer matrix structures. 3. Know the usage areas of polymers in industry. 4. Learn the production of thermoplastic and thermosetting materials in extrusion and injection moulding machines. 5. Recognise other forming methods 6. will be able to make, evaluate and interpret the analyses to be applied to the produced materials. 7. learn mechanical analyses of materials (tensile-compression, bending, impact, etc.).6 To acquire knowledge of topics associated with Professional practices and methods presented during the lectures in the class						

Course Basic and Auxiliary Contexts	1) Michaeli W.: *Einführung in die Kunststoffverarbeitung*, 5. Auflage, Carl Hanser Verlag München Wien, 2006. 2) Elsner P., Eyerer P., Hirth T.: *Kunststoffe – Eigenschaften und Anwendungen*, 7., neu bearbeitete und erweiterte Auflage, Springer Verlag Berlin Heidenberg, 2008. 3) Stitz S., Keller W.: *Spritzgießtechnik, Verarbeitung – Maschine – Peripherie*, 2. Auflage, Carl Hanser Verlag Münschen Wien, 2004. 4) Kaiser W.: *Kunststoffchemie für Ingenieure*, Carl Hanser Verlag Münschen Wien, 2006.
Methods of Give a Lecture	FACE TO FACE (lecture, practice, analysing, question-answer, discussion)

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Structure and classification of polymers Defining the application areas of polymeric materials in industry
2	Thermoplastic polymers and their structures
3	Thermosetting polymers and their structures
4	Elastomers and elastomer synthesis
5	Mechanical and thermal analysis methods for polymers
6	Laboratory work (Newtonian flows and non-Newtonian flows, viscosity measurement methods)
7	Homogeneous mixing of thermoplastics in extrusion, granule production and injection moulding techniques
8	Laboratory work (extrusion and production with plastic enejction)
9	MIDTERM EXAM
10	Pressing and blow moulding techniques and vacuuming methods for thermoplastic and thermosetting polymers
11	Investigation of mechanical and thermal properties of polymers

12	Laboratory work (tensile-compression, three-point bending analyses)
13	Laboratory work (melt flow analysis and TGA analyses)
14	Defining the application areas of polymeric materials in industry

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5066 Tribology				**Department of : Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)		-					
Instructor		Ass. Prof. Aybars MAHMAT				**Mail :aybarsmahmat@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The general purpose of the Tribology course is to teach students the general useful basic concepts and principles related to Tribology (friction, wear and lubrication). To introduce Tribological systems that can be encountered in engineering applications and to have information about wear protection (minimization) methods. To determine the principles of Tribology and to introduce the concepts of friction, wear and lubrication, to teach and introduce theoretical basic information and development strategies within the scope of basic technological expectations with examples in application areas.						
Course Goals	Introduction, the subject of tribology and its importance in engineering, surface forms in tribology, roughness analysis and measurement techniques, formation of fluid film in bearings, generalized Reynolds equation covers thermal and elastic effects, (THD) Thermo Hydrodynamics, (EHD) Elasto Hydrodynamics, solution methods, application to hydrodynamic and hydrostatic bearings, hydrodynamic instability, friction and wear theories, types of friction and wear, classification, bearings operating in dry and semi-fluid friction zones, lubricants and lubrication techniques, friction and wear measurement methods, friction and wear experiments, friction and wear data bank contents.						
Course Learning Outs and Proficiencies	1. The basic laws and concepts of tribology and their historical development, use and discussion of technical terminology 2. Measurement techniques will be used appropriately. 3. Friction and wear theories will be applied to bearings. 4. Fluid film formation will be applied in hydrodynamic and hydrostatic bearings. 5. Will be able to create a tribological system model for friction and wear experiments.						

Course Basic and Auxiliary Contexts	1) Modern Tribology Handbook, B. Bhuscan, CRC Pres LLC, 2001. 2) Tribology: friction and wear of engineering materials, I.M. Hutchings, 1992. 3) Tribology in machine design, T.A. Stolarski, 2000. 4) Encyclopedia of tribology, C. Kajdas, S.S.K. Harvey E. Wilusz, 1990. 5) Engineering Tribology 3rd Edition, G. W. Stachowiak, A. W. Batchelor, Elsevier, September 2005. •
Methods of Give a Lecture	FACE TO FACE

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Introduction, the subject of tribology and its importance in engineering
2	Thermo Hydrodynamics, Elasto Hydrodynamics, solution methods
3	Thermo Hydrodynamics, Elasto Hydrodynamics, solution methods
4	Application of THD and EHD methods to Hydrodynamic and Hydrostatic bearings, hydrodynamic instability
5	Formation of fluid film in bearings, generalized Reynolds equation, thermal and elastic effects
6	Experimental studies
7	Interpretation and presentation of studies
8	Working in dry and semi-liquid friction zone
9	MIDTERM EXAM
10	Friction and wear theories, types of friction and wear, classification
11	Lubricants and lubrication technique

12	Methods of friction and wear measurement
13	Friction and wear experiments, friction and wear data bank
14	• Final exam

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5068 - ENERGY USE AND SAVING				**Department of : Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)		-					
Instructor		Ass. Prof. Cihad FİDAN				**Mail :cihadfidan@munzur.edu.tr Web :www.munzur.edu.tr**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	Providing technical, practical and economic solutions of energy use in industrial facilities and residential and non-residential buildings. The teaching of energy efficiency and savings in industry and everyday life, the building up of energy efficiency awareness with energy management,						
Course Goals	Financial analysis on energy resources, national energy production and consumption, energy policy, power generation and other application facilities, energy-intensive industries, industry and housing, energy saving capabilities, energy recovery, waste heat recovery techniques, heat isolation materials, storage of energy, new or specific processes and facilities with the potential for energy conservation, energy control systems, energy management and accounting, energy saving devices and methods.						
Course Learning Outs and Proficiencies	1) A chronological summarization of work on energy savings and efficiency 2) Discussing how to make more efficient use of electric power 3) Discussing methods to increase energy efficiency in thermal systems 4) Classifying works on energy conservation in buildings 5) Analysis of national and international laws and regulations in the field of energy conservation and efficiency						
Course Basic and Auxiliary Contexts	1) Y. Yaman, "Energy Savings and Renewable Energy Sources", Birsen Publishing House, 2007. ISBN: 97897514610 2) S. Doty, W.C. Turner, "Energy Management Handbook", 7th Edition, 2009. ISBN: 081736104						
Methods of Give a Lecture	FACE TO FACE						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Basic concepts and definitions
2	Energy use, energy savings and energy efficiency concepts
3	Energy efficiency in pressurized air systems
4	Energy efficiency in lighting
5	Energy efficiency in electrical systems
6	Energy efficiency in electrical systems
7	Energy efficiency in electrical systems
8	Energy efficiency in electrical systems
9	MIDTERM EXAM
10	Analysis of the energy efficiency of buildings
11	Heating systems in buildings
12	Lighting in buildings, electrical appliances
13	Ventilation and air conditioning systems in buildings
14	• Final exam

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5070 Heat and Sound Insulation				**Department of Mechanical Engineering**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	There are no prerequisites.						
Instructor						**Mail :** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	To learn basic concepts of heat and sound insulation.						
Course Goals	• Introduce heat and sound insulation materials • To understand heat and sound insulation standards • To provide the ability to make heat and sound insulation calculations.						
Course Learning Outs and Proficiencies	• To know basic concepts of heat transfer • To understand the requirements of isolation • To know Insulation material properties and use their place • According to relevant standards of insulation to prepare report • Heat insulation and convenient to be able to advise • Insulation can calculate the amount of energy to be gained • To understand the importance of basic sound and vibration data • Vibration and noise impact on the people to know						
Course Basic and Auxiliary Contexts	• Isı Yalıtımı, Kemal AlLTINIŞIK, Nobel yayın Dağıtım, 2006. • Binalarda ve Tesisatta Isı Yalıtımı, Hikmet KARAKOÇ, Ecvet BİNYILDIZ, Orhan TURAN, ODE Teknik Yayınları No:G-20. • İzolasyon Isı-Ses-Yangın, İzocam • Endüstriyel Gürültü Kontrolu, Nevzat ÖZGÜVEN, Türkiye Makine Mühendisleri Odası, 1984.						

Methods of Give a Lecture	Face to face

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Introductions, course description, the importance of heat insulation and energy saving
2	Isolation-related concepts, standards and regulations related
3	Insulation materials, features, usage areas
4	The importance of thermal insulation in buildings
5	TS 825 Standard and the scope of the applicable limits by region
6	Condensation and condensation control
7	Thermal insulation report preparation
8	Installation of thermal insulation
9	Midterm Exam
10	Application examples and calculations
11	Sound and vibration-related concepts
12	Sound insulation applications
13	Presentation and discussion of student projects
14	Presentation and discussion of student projects

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5073 Artificial Neural Networks and Engineering Applications				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç. Dr. Erdem IŞIK	**Mail : erdem@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	To teach students techniques based on Artificial Neural Networks and other learning methods and practical applications; To show the applications of Artificial Neural Networks in the field of engineering.	
Course Goals	To make students understand Artificial Neural Networks and their engineering applications.	
Course Learning Outs and Proficiencies	At the end of this course, the student; 1. Learns the basic concepts, techniques, mathematics and software infrastructure of Artificial Neural Networks and gains the ability to apply them. 2. Gets to know and gains the ability to use the most used ANN tools (ANN in Matlab) today. Develops projects in areas such as Prediction, Classification and Recognition from real life. 3. Develops intelligent software; understands how machines can learn. Makes effective ANN designs. 4. Becomes able to follow developing research topics in the field of Artificial Neural Networks; Prepares short seminars on this subject and makes presentations. Gains experience in reading and writing articles.	
Course Basic and Auxiliary Contexts	Elmas Ç., (2007), Yapay Zeka Uygulamaları, Seçkin Yayıncılık. Haykin, S., (1998), Neural Networks: A Comprehensive Foundation (2nd Edition), Prentice-Hall. Nabiyev V. (2005). Yapay Zeka: Problemler, Yöntemler, Algoritmalar, Seçkin. Russell, S.J. And Norvig, P., (2003). Artificial Intelligence : A Modern Approach, Second Edition, Prentice-Hall.	
Methods of Give a Lecture	giving face-to-face lectures	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**

	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to Artificial Neural Networks (ANN): Concept of ANN. Importance of Artificial Neural Networks. ANN Software. Application and Business Areas.
2	• Artificial Intelligence: Definition, Importance, Objectives, Subjects, Application Areas, Study and Research Areas of Artificial Intelligence. Artificial Intelligence Languages.
3	• Fundamentals of Artificial Neural Networks: Artificial Neuron and Components. Types of Activity Functions. Biological Neuron. Biological Nervous System. Comparison of Human Brain and ANN.
4	Tek Katmanlı Algılayıcılar: Perceptron ve ADALINE Örnekleri. XOR Problemi ve Çok Katmanlı Modellere Duyulan Gereksinim
5	Multilayer Perceptrons (MLP). Forward-driven Networks. Backpropagation. Machine Learning. Supervised and Unsupervised Learning. Prediction, Classification and Clustering with ANN
6	• LVQ, SOM and some other ANN Models. ANN Design.
7	• ANN in MATLAB. ANN Applications
8	• Fuzzy Logic, Combined Artificial Neural Networks
9	• MIDTERM EXAM
10	• Genetic Algorithms, Crossover, Mutation, Elitism
11	• Swarm Intelligence Algorithms
12	• Clustering algorithms
13	• Radial basis networks
14	• Classification algorithms
15	EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5075 Fracture Mechanics				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Assoc. Prof. Dr. Yılmaz KISMET Assoc. Prof. Dr. Akar DOĞAN					**Mail : ykismet@munzur.edu.tr** **Web : www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	Master's degree						

Course Aim	Fracture Mechanics is a subject that concerns 3 different engineering disciplines: 1) Design Engineer, from the design of fracture resistant structures; 2) Materials Engineer, responsible for providing appropriate mechanical properties and improving the properties of materials; 3) The Control Engineer is responsible for investigating the presence of defects that may jeopardise the function of the structure at the end of manufacture and during the operation of the structure. For this reason, it is important to examine the behaviour under load of structures containing defects in the above-mentioned engineering disciplines.
Course Goals	Basic concepts of mechanics, Fracture in metals, Theoretical bond strength, Stress concentration, Griffith theory of fracture, Crack nucleation, crack propagation mechanisms, Linear elastic fracture mechanics, Fracture toughness parameters, Fracture toughness tests, Fatigue and crack growth.
Course Learning Outs and Proficiencies	1. Will be able to make safe sizing calculations. 2. Will be able to calculate the fracture strength of materials. 3. Will be able to make fracture resistant design. 4. Will be able to make damage analysis. 5. Will be able to present the studies to be done and will be able to gain literature.
Course Basic and Auxiliary Contexts	1) Principles of Fracture Mechanics / R.J. Sanford / Prentice Hall / 2003 2) Strength and Fracture of Engineering Solids / D.K. Felbeck, A.G. Atkins / Prentice Hall. İnc. / 1996 3) Mechanical Behavior of Materials / N.E. Dowling / Prentice Hall. / 1993 4) Mechanical Metallurgy / G.E. Dieter / Mc Graw-Hill / 1988 5) Introduction to Fracture Mechanics / K. Hellan / Mc Graw-Hill / 1984

Methods of Give a Lecture	Lecture, application, analysing, question-answer, discussion

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Midterm	**X**	**50**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Definition, importance and history of fracture mechanics
2	Fracture in metals; fracture types, variables affecting fracture
3	Theoretical bond strength
4	Stress concentration
5	Fracture toughness parameters
6	Linear elastic fracture mechanics
7	Griffith theory of fracture, crack propagation mechanisms
8	Relationships between fracture toughness parameters
9	MIDTERM EXAM
10	Relationships between fracture toughness parameters
11	Fracture toughness tests
12	The importance of K in practice
13	Fracture toughness tests
14	Fatigue fracture

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5076 Finite Element Method				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)		
Instructor	Assoc. Prof. Dr. Yılmaz KISMET Assoc. Prof. Dr. Akar DOĞAN	**Mail : akardogan@munzur.edu.tr** **Web : www.munzur.edu.tr**
Course Assistant		**Mail :** **Web :**
Groups / Classes	Master's degree	
Course Aim	The aim of this course is to give finite element formulation, modeling and solution methods to solve engineering problems numerically.	
Course Goals	• The primary objective of this course is to have students who successfully complete the course be able to solve the mechanical and thermal analysis of complex structures using finite element methods • The second goal of this course is to enable students who take this course to have the ability to use packaged programs.	
Course Learning Outs and Proficiencies	• Ability to define engineering problems • Classification of engineering problems (one-dimensional, two-dimensional, three-dimensional) • Ability to model the engineering problem • Ability to solve an engineering problem using a finite element package program. • Ability to evaluate the results from finite element modeling	
Course Basic and Auxiliary Contexts	• Introduction to Finite Element in Engineering, Tirupathi R. Chandrupatla, Ashok D. Belegundu	
Methods of Give a Lecture	In this course, theoretical information about the formulation of finite elements, modeling of the problem and solution methods are given. Numerical examples will be solved for a better understanding of the theory. Homework will be given during the year using the package program.	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Midterm	**X**	**50**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Introduction, stress and equilibrium, boundary conditions, strain-displacement relationship, stress-strain relationship.
2	Potential energy and balance. One-dimensional problems, finite element modeling
3	Coordinates and shape function, potential energy approximation
4	Creation of global stiffness matrix and load vector.
5	Quadratic shape functions, temperature effects.
6	Truss systems, plane truss systems, three-dimensional truss systems
7	Two-dimensional problems using triangular elements with constant strain, finite element modeling
8	Problem modeling and boundary conditions
9	Midterm
10	Axis-symmetric bodies subjected to axial loading, axial-symmetrical loading and formulation
11	Finite element modeling, problem modeling and boundary conditions
12	Two- and three-dimensional analysis solutions using a package program
13	Two- and three-dimensional analysis solutions using a package program
14	Project presentations

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5077 Advanced Kinematics of Mechanisms				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)		
Instructor	Assoc. Prof. Dr. Yılmaz KISMET	**Mail : ykismet@munzur.edu.tr** **Web :www.munzur.edu.tr**
Course Assistant		**Mail :** **Web :**
Groups / Classes	Master's degree	
Course Aim	To increase the ability to solve problems related to engineering applications by giving techniques for solving problems related to motion and force that may be encountered in theory and design. To solve by establishing mathematical models of mechanisms. To provide an understanding of the functioning of existing models.	
Course Goals	Advanced kinematic and dynamic analysis of planar, spatial and robotic manipulators. Computer analysis of planar and spatial mechanisms.	
Course Learning Outs and Proficiencies	1. Define and solve design problems in a scientific way 2. Will be able to analyse and synthesise mechanisms. 3. Will be able to develop methods for the solution of mechanisms.	
Course Basic and Auxiliary Contexts	1) C. H. Suh, C. W. Radcliffe, Kinematics and Mechanisms Design, J. Wylie Publ. 2) R. L. Norton, Design of Machinery, McGraw-Hill. 3) E. Söylemez, Mekanizma Tekniği, Prestij Ajans Matbaacılık.	
Methods of Give a Lecture	Face to face (Lecture, practice, analysing, question-answer, discussion)	

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		

	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Overview of the theory of mechanisms.
2	Vector and complex number methods in kinematic analysis of planar mechanisms.
3	Matrix methods in kinematics, rigid body finite-rotation matrices. Cartesian, Euler and arbitrary axis rotation matrices. Euler angles and Euler parameters.
4	Rigid body displacement matrices. Screw motion matrix. Coordinate transformations.
5	Relationship between rotation and displacement matrices. Differential rotation and displacement matrices.
6	Relative velocity and acceleration analyses. Applications.
7	Overview of the theory of mechanisms.
8	Kinematic analysis of volumetric mechanisms. RSSR, RRSS and RCCC mechanisms.
9	MIDTERM EXAM
10	Rigid body guide mechanisms. Centre points curve. Circle points curve. Function generating mechanisms.
11	Trajectory generating mechanisms. Optimum synthesis of mechanisms and application examples.
12	Differential geometry of motion
13	Cam design according to clamping angle criterion.
14	Waiting mechanisms.

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5080 Optimization Techniques				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional

Prerequisite (s)		
Instructor	Doç. Dr. Erdem IŞIK	**Mail : erdem@munzur.edu.tr** **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	To understand basic linear and nonlinear optimization methods, To be able to formulate optimization problems correctly To be able to apply optimization methods to engineering problems To be able to solve a complex problem	
Course Goals	To apply optimization methods to engineering problems	
Course Learning Outs and Proficiencies	1. Defining and classifying the optimization problem 2. To understand basic linear and nonlinear optimization methods 3. To be able to formulate a design problem in the most effective and accurate way as an optimization problem 4. To be able to decide on the most appropriate optimization method for an optimization problem 5. To reach a result by solving the optimization problem	
Course Basic and Auxiliary Contexts	1. Introduction to Optimization, P. Pedregal, Springer, 2003. 2. Numerical Optimization, J. Nocedal, S. J. Wright, Springer, 2nd Edition,2006. 3. Engineering Optimization Theory and Practice, S. S. Rao, Wiley, 4th Edition, 2009.	
Methods of Give a Lecture	giving face-to-face lectures	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to Optimization: Definition of optimization problem, classification of optimization problems, basic information about optimization techniques.
2	• Mathematical Background (Maximum and minimum of functions, convex and concave functions)
3	• Classical Optimization Techniques-1: Single Variable Optimization, Multivariable Unconstrained Optimization
4	• Classical Optimization Techniques-2: Multivariable Equality Constrained Optimization, Direct Substitution, Constrained Variation and Lagrange Multipliers Methods
5	Classical Optimization Techniques-3: Multivariable Inequality Constrained Optimization, Kuhn-Tucker Conditions, Characterization of Constraint, Convex Programming Problem.
6	• Linear Programming 1: Linear Programming Applications, Standard Form of Linear Programming Problem, Pivoting.
7	• Linear Programming 2: Simplex Algorithm
8	• Determination of Optimal Point, Possible Solution, Improvement of Non-Optimal Basic Possible Solution, Two Phases of Simplex Method.
9	• MIDTERM EXAM
10	• Non-Linear Programming 1: One-Dimensional Minimization Methods, Elimination Methods (Fibonacci, Golden Section, Bisection), Comparison of Methods.
11	• Non-Linear Programming 2: Interpolation Methods (Quadratic and Cubic Interpolation), Direct Methods (Newton, Quasi-Newton, Secant Methods)
12	• Non-Linear Programming 3: Unconstrained Optimization Techniques, Convergence Rate, Scaling of Design Variables
13	• Direct Search Methods (Random jumping, Random walk, Grid Search, Univariate, Simplex methods)
14	• Indirect Search Methods (Steepest Descent, Fletcher-Reeves Methods)
15	EXAM

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5081 Exergy Analysis of Thermal Systems				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Erdem IŞIK					**Mail : erdem@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	Engineering systems will be calculated and examined with the help of the first and second laws of thermodynamics. Exergy, which is the most useful work that can be obtained from any system, will be defined. Exergy equations will be established for all engineering open/closed thermal systems. Optimum operating conditions of the systems will be demonstrated with examples.						
Course Goals	To be able to calculate exergy in thermal systems.						
Course Learning Outs and Proficiencies	1. Define exergy analysis for open and closed systems in Engineering Thermal Systems. Contributions to Program Outcomes 1. Define and apply advanced Mechanical Engineering concepts 2. Formulate and solve advanced engineering problems 3. Model, simulate and design dynamic systems 4. Access scientific knowledge 2. Determine optimum operating conditions by establishing exergy equations for each system. Contributions to Program Outcomes 1. Define and apply advanced mechanical engineering concepts 2. Formulate and solve advanced engineering problems 3. Model, simulate and design dynamic systems 4. Access scientific knowledge Assessment Type 5. Written Exam 6. Homework 3. Solve exergy sample problems for different thermal systems. Contributions to Program Outcomes 1. Define and apply advanced mechanical engineering concepts 2. Formulate and solve advanced engineering problems 3. Model, simulate and design dynamic systems 4. Access scientific knowledge						

	Assessment Type 5. Written Exam 6. Homework
Course Basic and Auxiliary Contexts	1-Ekserji Analizi, H. Yüncü, ODTÜ, ODTÜ Basım İşliği, Ekim 2010, 1. Baskı. 2-Fundamentals of Engineering Thermodynamics, M.J. Moran and H.N. Shaphiro, Second Edition, John Wiley and Sona, New York, 1992. 3-Exergy Analysis, H. YÜNCÜ ODTÜ, ODTÜ Basım İşliği, Ekim 2010, 1.Baski. 4- Termodinamik, Y. ÇENGEL ve Michael A. Boles, 2011 İzmir Güven Kitapevi, 5. Baskı. 5- The Exergy Method of Thermal Plant Analysis, T.J. Kotas,, Basic and Applied Thermodynamics, P.K. NAG. Third Edition, John Wiley, P.F. Chester 1992.
Methods of Give a Lecture	giving face-to-face lectures

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	• Introduction to basic concepts of thermodynamics, thermodynamic properties, steady state, steady flow properties
2	Application of the first law of thermodynamics for closed/open systems.
3	Application of the second law of thermodynamics for closed/open systems.
4	Introduction to exergy, environment, dead state, limited dead state, kinetic and potential energy related exergy.
5	Reversible work and irreversibility, explanation of second law efficiency.

6	Thermo mechanical exergy, exergy transfer, exergy of a mass, exergy transfer by work and heat.
7	Determination of flow exergy for closed/open systems, establishment of basic exergy equations.
8	Exergy decrease principle and exergy destruction.
9	MIDTERM EXAM
10	Sample exergy applications for closed systems.
11	Sample exergy applications for open systems.
12	Turbine, pump, compressor, nozzle, heat exchanger, mixer, energy storage systems, etc. exergy balance and second law efficiency for steady-flow systems
13	Chemical exergy, exergy analysis for combustion chambers, thermoeconomics and exergy cost.
14	Exergy analysis for air conditioning and ventilation systems
15	EXAM

COURSE INTRODUCTION FORM

Course Code and Name: MKM5082 Pressure Sintering Techniques				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective
Prerequisites							
Instructor	Doç. Dr. Ertuğrul ÇELİK			**E-mail: ecelik@munzur.edu.tr** **Web :**			
Course Assistant				**Email :** **Web :**			
Groups Classes							
Purpose of the Course	The aim of this course is to teach students both theoretical and practical fundamentals of pressure sintering techniques. Sintering processes are considered to be one of the most critical stages of powder metallurgy and an in-depth understanding of the techniques used in these processes will enable students to use this technology effectively. Pressure sintering, unlike traditional sintering processes, produces denser and higher strength materials by applying pressure. This course aims to provide students with information on different sintering techniques, equipment and materials used and to integrate this information into industrial applications . In addition, energy-saving sintering methods in sustainable production processes will be emphasized.						
Course Objectives	- To teach the effective use of pressure sintering methods in engineering applications. - To make a detailed analysis of different sintering techniques and learn how to use these techniques in industrial applications . - To understand the properties of the materials used in the sintering process and the effects of these materials on the process parameters. - To understand the basic stages of the pressure sintering process and examine the effects of parameters such as sintering temperature, pressure and time on material properties. - To teach students the importance of sintering processes in terms of energy efficiency and sustainable production. - To learn to analyze the mechanical properties of sintered materials and examine the methods to improve these properties. - To learn new technologies such as advanced sintering techniques, vacuum and plasma sintering. - To provide students with information about modern equipment used in the sintering process and to provide them with the ability to use these equipment in practice. - To introduce students to innovative applications of sintering processes and to provide them with the skills to meet future industrial needs.						

Course Learning Outcomes and Competencies	- Students will be able to understand the place and importance of pressure sintering processes in engineering applications. - They will be able to evaluate how sintering techniques can be used to improve material properties. - They will be able to understand the types of materials used in sintering processes and the effects of these materials on production processes. - They will be able to learn the advantages of sintering technologies in terms of energy efficiency and sustainable production. - Students will be able to analyze the mechanical and thermal properties of sintered materials and examine the methods of improving these properties. - They will be able to evaluate the advantages and disadvantages of these techniques by making a comparative analysis of different sintering techniques. - They will be able to understand the theoretical and practical basis of advanced sintering techniques. - They will be able to learn the operation of the equipment used in the sintering process and how to integrate this equipment into production processes . - Students will have information about how to optimize sintering processes in industrial applications.
Basic and Auxiliary Resources of the Course	- German , R.M. , " Powder Metallurgy Science ", 2nd Edition, MPIF. -Suryanarayana , C. , " Mechanical Alloying and Milling ", CRC Press . - Campbell , J ., " Castings ", Butterworth-Heinemann .
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.

		If yes, please mark (X)	**Percentage (%) Contribution to the Overall Average**
Evaluation Criteria	**1. Midterm Exam**	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab , Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan	
Week	**Subjects**
1	1. History and basic principles of pressure sintering techniques
2	2. Materials used in sintering processes
3	3. Comparison of different sintering methods
4	4. Stages of the pressure sintering process
5	5. Pressure sintering equipment and technologies used
6	6. Effect of pressure, temperature and time on the sintering process
7	7. Effects on material properties in pressure sintering
8	8. Midterm Exam
9	9. Advanced sintering techniques: Vacuum and plasma sintering
10	10. Mechanical and thermal properties of sintered materials
11	11. Sintering in terms of energy efficiency and sustainability
12	Industrial applications of pressure sintering
13	13. Future technologies: Innovations and sintering processes
14	14. General review and student presentations

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5083 Scientific Research Techniques and Ethics				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Salih AĞAR				**Mail : salihagar@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	Introduction of ethical and scientific research methods is the holistic evaluation of scientific ethical values, individual, social and legal aspects.						
Course Goals	To have knowledge about ethical values in scientific research. To have knowledge about ethical issues to be considered while preparing theses, articles and papers.						
Course Learning Outs and Proficiencies	1. Understanding ethical rules in scientific research, 2. Identifying behaviors that violate scientific ethics, 3. Learning about legislation related to scientific ethics						
Course Basic and Auxiliary Contexts	Karagöz, Yalçın. "Bilimsel araştırma yöntemleri ve yayın etiği." (2017).						
Methods of Give a Lecture	Face to face						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Introduction to ethics in science and scientific research methods,
2	Ethics and rules in scientific research,
3	Behaviors contrary to scientific ethics,
4	Behaviors contrary to scientific ethics,
5	Ethics education in educating scientists,
6	Ethical responsibilities of scientists,
7	Science, society and ethical relations,
8	Ethical principles in scientific publications, Ethics in scientific knowledge production, Plagiarism and ethics, Survey ethics in field research, Legal regulations related to ethics by YÖK, TÜBİTAK and universities.
9	Midterm Exam
10	Ethics in scientific knowledge production, Plagiarism and ethics, Survey ethics in field research, Legal regulations related to ethics by YÖK, TÜBİTAK and universities.
11	Plagiarism and ethics,
12	Survey ethics in field research,
13	Legal regulations related to ethics by YÖK, TÜBİTAK and universities.
14	Legal regulations related to ethics by YÖK, TÜBİTAK and universities.

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5088 / Advanced Numerical Methods in Engineering				**Department of :** Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall / Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)	None	
Instructor	Assoc. Prof. Erhan FIRAT	**Mail :** efirat@munzur.edu.tr **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	The aim of this course is to revise the undergraduate course on numerical methods and to give an introduction to finite-difference and finite-volume methods for solving partial differential equations.	
Course Goals		
Course Learning Outs and Proficiencies	• Apply numerical methods to obtain approximate solutions to mathematical problems • Choose, formulate and implement appropriate numerical methods for solving science and engineering problems that are formulated as partial differential equations • Review and describe application areas where finite difference and finite volume methods are used	
Course Basic and Auxiliary Contexts	• İbrahim Uzun, Nümerik Analiz, 5. Baskı, Beta Yayımcılık, 2012, İstanbul. • Richard L. Burden, J. Douglas Faires, Numerical Analysis, 9th Edition, Brooks/Cole, Cengage Learning, 2011. • James F. Epperson, An Introduction to Numerical Methods and Analysis, 2nd Edition, John Wiley & Sons, 2013. • Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 6th Edition, McGraw-Hill, New York, 2010. • James Stewart, Calculus Early Transcendentals, 6th Edition, Thomson Brooks/Cole, 2008. • H. Versteeg and W. Malalasekra, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2007	
Methods of Give a Lecture	Lecture, Question and answer, Discussion	

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Problem solving methods in engineering
2	Roots of equations
3	Roots of equations
4	Methods for solving linear algebraic systems
5	Methods for solving linear algebraic systems
6	Curve fitting – Least-squares regression
7	Curve fitting – Interpolation
8	Curve fitting – Interpolation
9	Numerical differentiation
10	Numerical differentiation
11	Numerical integration
12	Numerical integration
13	Finite difference – Elliptic equations
14	Finite difference – Parabolic equations

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5090 / Flow Visualization				**Department of :** Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall / Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)	None	
Instructor	Assoc. Prof. Erhan FIRAT	**Mail :** efirat@munzur.edu.tr **Web :**
Course Assistant		**Mail :** **Web :**
Groups / Classes		
Course Aim	This course introduces students to the field of flow visualization. Fluid motion can be made visible through several techniques. The aim of this course is to give an overview of the fundamental techniques for flow visualization and describe a number of applications of these techniques.	
Course Goals	• To familiarize the student with various flow visualization techniques • To acquaint the student with experimental flow visualization equipment	
Course Learning Outs and Proficiencies	• The student can select flow visualization techniques appropriate for particular applications	
Course Basic and Auxiliary Contexts	• Lim, T.T., Smits, A.J., 2012. Flow Visualization: Techniques and Examples, Imperial Collage Press, London, 444s • Merzkirch, W., 1987. Flow Visualization, Academic Press, 266s • Yang, W.-J., 2001. Handbook of Flow Visualization, CRC Press, 696s • Samimy, M., Breuer, K.S., Leal, L.G., Steen, P.H., 2003. A Gallery of Fluid Motion, Cambridge University Press, 118s • Van Dyke, M., 1982. An Album of Fluid Motion. The Parabolic Press, 176s	
Methods of Give a Lecture	Lecture, Question and answer, Discussion	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination	**X**	**50**
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Flow visualization concepts
2	Flow visualization concepts
3	Fluid dynamics phenomena
4	Fluid dynamics phenomena
5	Techniques applied at the wall (Surface oil flow)
6	Techniques applied at the wall (Tuft, minituft)
7	Techniques applied at the wall (Based on mass transfer)
8	Techniques applied at the wall (Based on heat transfer)
9	Techniques applied away from the wall (Smoke-wire)
10	Techniques applied away from the wall (Smoke injection)
11	Techniques applied away from the wall (Hydrogen bubble)
12	Techniques applied away from the wall (Dye injection)
13	Techniques applied away from the wall (Particle image velocimetry)
14	Flow visualization data recording

COURSE IDENTIFICATION FORM

Course Code and Name: MKM5091 Advanced Strength of Materials				Department of : Mechanical Engineering			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Akar DOĞAN Assoc. Prof. Dr. Yılmaz KISMET				**Mail : akardogan@munzur.edu.tr** **Web :www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		Master's degree					

Course Aim	The course is aimed for engineers to build upon elementary concepts of strength analysis and processes that have been master's in undergraduate study. Stress analysis is part of the design process which strives to ensure that each element of a given system will not fail to meet the structural requirements of the design throughout the specified life of the system. Subjects will cover problems which closely resemble simple models which have known closed-form solutions to complex problems which are not easily adaptable to various classical techniques. Properties of structural materials; analysis of stress and strain inloaded members, mechanical behavior of materials, fixed beams in bending, fixed beams continuous beams, torsion of noncircular shafts, statically indeterminate structures, rotational stresses, struts and columns and energy merthods will be handled throughout the course.
Course Goals	The aim of this course is to have students who have successfully completed the course, to be able to classify stress types and to solve strength problems using energy methods. In addition, it is to provide a more detailed examination of the basic strength problems learned in undergraduate education.
Course Learning Outs and Proficiencies	1 To command advanced and applied knowledge in the area of material behavior and their mechanics and their applications in structural engineering. 2 To conduct independent and original study ranging from gathering of information to proposing, creating, documenting the study, and its resolution and/or elucidation. 3 To develop the ability to critique and synthesize literature, review results and to apply this knowledge in developing new ideas; in designing and evaluating scientific investigations; and in assessing, interpreting and understanding data.

	4 To demonstrate mastery of the subject matter at a deeper theoretical and applied level beyond the fundamental knowledge gained in the undergraduate courses. 5 To present scientific results in both written and oral format through the practice of performing class lectures, presentations, and reports. 6 To acquire knowledge of topics associated with Professional practices and methods presented during the lectures in the class
Course Basic and Auxiliary Contexts	Ansel C. Ugural, Saul K. Fenster, Advanced Strength and Applied Elasticity, 6th Edition, Pearson Education, 2020.
Methods of Give a Lecture	This course will be covered theoretically and will be supported by various visual presentations and videos. In addition, students will be given a project assignment and will be asked to present it.

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction Analysis of Stress
2	Analysis of Stress
3	Strain Analysis and Elasticity Problems
4	Strain Analysis and Elasticity Problems
5	Engineering Materials
6	Mechanical Properties of Materials

7	Bending of Beams
8	Torsion of Noncircular / Prismatic Shafts
9	Midterm
10	Thick Walled Cylinders and Rotating Disks
11	Beams on Elastic Foundations
12	Applications of the Energy Method
13	Stability of Columns
14	Project presentations

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MUNZUR UNIVERSITY
Directorate of Graduate Education Institute

COURSE INTRODUCTION FORM

Course Code and Name: MKM5092 Unconventional Manufacturing Methods				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective
Prerequisites							
Instructor	Assoc. Prof. Dr. Ertuğrul ÇELİK			**E-mail: ecelik@munzur.edu.tr** **Web :**			
Course Assistant				**Email :** **Web :**			
Groups Classes							

Purpose of the Course	The aim of this course is to teach the theoretical and practical aspects of non-traditional manufacturing methods, to examine the advantages and application areas of these methods and to provide the ability to use innovative manufacturing techniques in engineering solutions. Students will be taught how to apply techniques such as micro-manufacturing, laser machining and chemical processing.
Course Objectives	- To teach the basic principles and application areas of unconventional manufacturing methods. - To learn the techniques used in micro and nano-sized manufacturing processes. - To discover energy-saving and environmentally friendly methods in manufacturing. - To learn new manufacturing techniques as alternatives to traditional methods and to gain the ability to apply them.
Course Learning Outcomes and Competencies	- Be able to make complex designs using unconventional manufacturing methods. - Be able to understand the advantages and difficulties of new manufacturing techniques. - Be able to plan and implement micro and nano-sized production processes. - Be able to use advanced techniques in terms of innovation and sustainability in manufacturing processes.
Basic and Auxiliary Resources of the Course	- McGeough, JA, “Advanced Methods of Machining”, Springer. - Jain, VK, “Introduction to Micromachining”, Narosa Publishing House.
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.

Evaluation Criteria		**If yes, please mark (X)**	**Percentage (%) Contribution to the Overall Average**
	1. Midterm Exam	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab, Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan

Week	Subjects
1	1. Introduction to unconventional manufacturing methods: Basic concepts
2	2. Laser processing techniques and application areas
3	3. Electrical discharge machining (EDM) and wire erosion methods
4	4. Chemical processing techniques
5	5. Micro manufacturing and application areas
6	6. Nano manufacturing techniques
7	7. Laser micro and nano machining processes
8	8. Midterm Exam
9	9. Basic principles of microfabrication technologies
10	10. Unconventional manufacturing methods and application areas
11	11. Energy-saving manufacturing methods
12	12. Environmentally friendly manufacturing methods
13	13. Project presentations and evaluations
14	14. General review and evaluation

COURSE IDENTIFICATION FORM

Course Code and Name: MKM 5093 CUTTING TOOL TECHNOLOGY				Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Salih AĞAR				**Mail : salihagar@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	1. To increase knowledge on cutting tool technologies 2. To gain the ability to select and apply cutting tools in accordance with international standards, according to the chip removal methods and the structure of the material to be shaped. 3. To be able to design special tools for chip removal processes 4. To be able to determine tool material and geometry according to the workpiece material and workpiece form and to make special designs.						
Course Goals	1. Learning cutting tool types and their areas of use in detail 2. Choosing which cutting tools to use in manufacturing processes 3. Choosing the optimum processing parameters						
Course Learning Outs and Proficiencies	1. To have knowledge about the cutting tools used in the machining methods where the machining quality can be provided in the shortest time and most economically. 2. To be able to choose the most suitable tool for the process by knowing the tool geometries and materials. To be able to determine the tool cost required for the process.						
Course Basic and Auxiliary Contexts	Cutting Tool Technology, Industrial Handbook, Smith, Graham T., 2008, Springer						
Methods of Give a Lecture	Face to face						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	Definition and Terminology of Machining Process
2	Classification of Cutting Tools
3	Orthogonal and Oblique Machining Tools
4	Cutting Tool Geometry
5	Cutting Tool Geometry
6	Cutting Tool Materials
7	Cutting Tool Materials
8	Properties, Standards and Areas of Use of Turning Tools and Milling Tools
9	MIDTERM EXAM
10	Properties, Standards and Areas of Use of Drilling Tools and Grinding Wheels
11	Special Tool Designs
12	Coating Technologies
13	Industrial Applications and Current Developments
14	Course achievement presentations

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM 5094 METAL FORMING THEORY				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Salih AĞAR				**Mail : salihagar@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	1. The purpose of this course is to provide students with an advanced understanding of the mechanics of metal forming.						
Course Goals	1. Theory and calculations of shaping engineering materials using machining and plastic forming methods						
Course Learning Outs and Proficiencies	1. The student will understand the fundamentals of plasticity. 2. The student will specialize in basic metal forming techniques, forging, drawing and rolling techniques.						
Course Basic and Auxiliary Contexts	Mikell P. Groover, Fundamentals of Modern Manufacturing, Materials, Processes and Systems.						
Methods of Give a Lecture	Face to face						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	LEMENTS OF PLASTICITY THEORY: Yield diagrams, True Stress and Strain diagrams, yield onset criterion for ductile metals, Von Mises criterion, Tresca criterion
2	FUNDAMENTALS OF METAL FORMING: Classification of forming processes, mechanics of metal forming - section method, determination of yield stress, temperature in metal forming: hot, cold, warm working, strain rate effect, metallurgical structure, friction and lubrication
3	FORGING PROCESS: Classification of forging operation, forging devices, forging strain, open die-closed die pressing, forging defects
4	FORGING PROCESS: Classification of forging operation, forging devices, forging strain, open die-closed die pressing, forging defects
5	ROLLING OF METALS: Classification of rolling mill rolls, hot and cold rolling forces and geometrical relations in rolling, simplified analysis of rolling force, defects in rolled products, hot and cold rolling theory, torque and power calculation.
6	ROLLING OF METALS: Classification of rolling cylinders, hot and cold rolling forces and geometric relations in rolling, simplified analysis of rolling force, defects in rolling products, hot and cold rolling theory, torque and power calculation.
7	ROD, TUBE AND WIRE DRAWING PROCESSES: Rod and wire drawing process, drawing dies, analysis of wire drawing process, consecutive drawing process, residual stresses in rods, wire and thin tube drawing. Errors occurring in drawing process and thin tube drawing.
8	ROD, TUBE AND WIRE DRAWING PROCESSES: Theoretical calculations of rod and wire drawing process
9	MIDTERM EXAM
10	SHEET METAL FORMING PROCESS: Introduction, forming methods, cutting, part removal, striking, bending, springback, elimination of springback, winding, drawing, forming by stretching, re-drawing, back-drawing, drawing defects, elements determining drawing rates.
11	SHEET METAL FORMING PROCESS: Introduction, forming methods, cutting, part removal, hitting, bending, springback, elimination of springback, winding, plastering, stretching forming, re-plastering, plastering errors, elements determining plastering rates.

12	HIGH ENERGY RATE FORMING (HERF): Introduction to HERF, method advantages, explosive forming, electrical erosion and electromagnetic currents forming, rubber forming.
13	HIGH ENERGY RATE FORMING (HERF): Introduction to HERF, method advantages, explosive forming, electrical erosion and electromagnetic currents forming, rubber forming.
14	Course outcome presentations

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Directorate of Graduate Education Institute

COURSE INTRODUCTION FORM

Course Code and Name: MKM5095 Advanced Computer Aided Design				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective
Prerequisites							
Instructor	Doc. Dr. Ertuğrul ÇELİK			**E-mail: ecelik@munzur.edu.tr** **Web :**			
Course Assistant				**Email :** **Web :**			
Groups Classes							
Purpose of the Course	The aim of this course is to teach the use of advanced computer aided design (CAD) tools and to provide skills for modeling and analyzing complex engineering designs. It is aimed for students to make design and simulation processes more efficient by using CAD software.						
Course Objectives	- Learning to use advanced CAD software effectively. - Modeling and simulating complex geometries in a computer environment . - Understanding the role of CAD software in producing solutions to engineering problems . - Learning and gaining application skills in CAD integration with manufacturing processes.						
Course Learning Outcomes and Competencies	- Be able to model complex geometries using CAD software. - Be able to make technical drawings and designs suitable for production processes. - Be able to simulate designs and analyze the results. - Be able to use CAD software to develop innovative engineering designs.						
Basic and Auxiliary Resources of the Course	- Zeid , I ., “Mastering CAD/CAM”, McGraw-Hill . -Farin , G. , “ Curves and Surfaces for CAGD” by Morgan Kaufmann .						
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.						

Evaluation Criteria		**If yes, please mark (X)**	**Percentage (%) Contribution to the Overall Average**
	1. Midterm Exam	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab , Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan

Week	Subjects
1	1. Introduction to CAD software: Basic concepts
2	2. Modeling complex geometries: Advanced surface and solid modeling
3	3. Material properties used in CAD designs
4	4. CAD and engineering design: Principles and applications
5	5. Simulation techniques: Analysis in CAD software
6	6. Designs optimized with CAD software
7	integration with production processes
8	8. Midterm Exam
9	9. CAD solutions to real world problems
10	Integration of CAD software with 3D printing and prototyping
11	11. Data management and design updates in CAD software
12	12. Advanced simulation techniques
13	13. Project presentations and student evaluations
14	14. General review and evaluation

COURSE INTRODUCTION FORM

Course Code and Name: MKM5096 Advanced Welding Techniques				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective
Prerequisites							
Instructor	Doc. Dr. Ertuğrul ÇELİK			**E-mail: ecelik@munzur.edu.tr** **Web :**			
Course Assistant				**Email :** **Web :**			
Groups Classes							

Purpose of the Course	The aim of this course is to teach the basic principles of advanced manufacturing methods and to introduce students to the diversity of modern manufacturing processes. One of the important goals of the course is to increase the use of innovative techniques that emerge in the manufacturing industry with developing technology in engineering solutions. In particular, it focuses on advanced techniques such as laser processing, additive manufacturing (3D printing), microfabrication and micro/ nanoscale manufacturing methods, which are widely used in the industry but provide higher precision, speed and efficiency than traditional methods. The main objective of the course is to provide students not only with practical knowledge and skills of current techniques, but also with an understanding of critical aspects of advanced manufacturing techniques such as sustainability, energy efficiency and environmental impacts. Thus, students can produce innovative solutions in the industry and learn how to integrate these techniques into today's manufacturing processes . In this context, the course also aims to provide theoretical and practical knowledge about advanced manufacturing methods used in the production of new generation materials (composites , ceramics, metal alloys).
Course Objectives	• **Mastery of Advanced Manufacturing Techniques :** Students will be taught the basic principles of advanced manufacturing methods such as additive manufacturing, micro manufacturing and laser processing. It is aimed for them to understand the applied processes of these techniques and use them actively in engineering projects. • **Industrial Application Knowledge:** To provide students with an understanding of the industrial applications of advanced manufacturing processes and how these techniques are used in various engineering

	disciplines. Thus, students gain the competence to work with innovative techniques when they enter the industry. • **Energy Efficiency and Environmental Awareness:** To introduce the energy efficiency and environmentally friendly features of advanced manufacturing methods. Students will be provided with awareness of sustainable manufacturing by understanding the environmental impacts of these techniques. • **Materials Knowledge and Selection:** To have knowledge about different materials (composite, ceramic, metal alloys) used in advanced manufacturing processes. Students will be able to select materials in the manufacturing process and evaluate the advantages and difficulties of these materials. • **Problem Solving and Implementation Skills:** Students will be encouraged to produce innovative solutions to problems they may encounter during the development of engineering designs. This course aims to provide students with problem solving skills and optimizing the design and manufacturing process. • **Adapting to New Technologies:** To provide knowledge on adapting to current manufacturing trends such as smart factories, robotic systems and Industry 4.0 . Students will be able to develop functional solutions by adapting to these technologies in the future labor market.
Course Learning Outcomes and Competencies	• Ability to learn advanced manufacturing techniques practically. • Developing innovative products using additive manufacturing processes. • Ability to understand and apply micro and nano level manufacturing techniques. • Evaluate the advantages and limitations of advanced manufacturing methods.
Basic and Auxiliary Resources of the Course	• Groover , M. P ., “Fundamentals of Modern Manufacturing ”, Wiley . • Gibson , I. , Rosen , DW, “ Additive Manufacturing Technologies”, Springer .
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.

Evaluation Criteria		**If yes, please mark (X)**	**Percentage (%) Contribution to the Overall Average**
	1. Midterm Exam	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab , Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to advanced manufacturing methods: Definitions and basic concepts
2	• Additive manufacturing processes: Principles and areas of application
3	• Micro manufacturing and microfactory techniques
4	• Laser processing techniques and laser technology
5	• Energy efficiency and environmentally friendly manufacturing methods
6	• Manufacturing of composite materials
7	• Advanced metal forming techniques
8	• Midterm exam
9	• Ceramic and glass manufacturing techniques
10	• Micro and nano processing methods
11	• Automation and robotics applications
12	• Smart factories and Industry 4.0
13	• Project presentations and evaluations
14	• General review and evaluation

COURSE INTRODUCTION FORM

Course Code and Name: MKM5097 Advanced Welding Techniques				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective
Prerequisites							
Instructor	Doc. Dr. Ertuğrul ÇELİK			**E-mail: ecelik@munzur.edu.tr** **Web :**			
Course Assistant				**Email :** **Web :**			
Groups Classes							
Purpose of the Course	The aim of this course is to teach advanced welding techniques, examine the advantages and application areas of modern welding methods, investigate the weldability properties of various materials and provide information about automatic welding systems. It also focuses on how new methods can be applied in the light of developments in welding technologies.						
Course Objectives	- To teach the theoretical and practical foundations of advanced welding methods. - To analyze the weldability properties of various materials . - To learn automatic welding systems and robotic welding processes. - To provide the ability to solve metallurgical and mechanical problems that arise during welding.						
Course Learning Outcomes and Competencies	- Will be able to learn different advanced welding techniques in practice. - Will be able to evaluate the suitability of various materials for welding processes. - Will be able to use automatic welding systems and robotic welding techniques. - Will be able to analyze the negativities that may occur during welding and produce solutions.						
Basic and Auxiliary Resources of the Course	- Messler , R. W. , " Principles of Welding : Processes , Physics , Chemistry , and Metallurgy ", Wiley . - Kou , S ., " Welding "Metallurgy ", Wiley .						
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.						

Evaluation Criteria		**If yes, please mark (X)**	**Percentage (%) Contribution to the Overall Average**
	1. Midterm Exam	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab , Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan

Week	Subjects
1	1. Introduction to advanced welding techniques: Basic concepts and definitions
2	2. Gas welding methods and application areas
3	3. Laser and plasma welding methods
4	Weldability properties of different materials
5	5. Weld seam quality and non-destructive testing methods
6	6. Introduction to automatic welding systems
7	7. Robotic welding systems: Advantages and challenges
8	8. Midterm Exam
9	9. Metallurgical problems: Cracks, deformations and prevention methods
10	Weldability of aluminum and stainless steels
11	11. Techniques and parameters used in high power welding processes
12	12. Analysis of mechanical properties of welded joints
13	13. Project presentations and evaluations
14	14. General review and evaluation

COURSE INTRODUCTION FORM

Course Code and Name: MKM5098 Advanced Powder Metallurgy				**Department of Mechanical Engineering**			
Semester	**Theoretical Hours**	**Application Time**	**Total Hours**	**Credit**	**ECTS**	**Language of Instruction**	**Type: Compulsory/Elective**
FALL/SPRING	3	0	0	0	6	Turkish	Elective

Prerequisites		
Instructor	Doc. Dr. Ertuğrul ÇELİK	**E-mail: ecelik@munzur.edu.tr** **Web :**
Course Assistant		**Email :** **Web :**
Groups Classes		
Purpose of the Course	The aim of this course is to teach the theoretical and practical fundamentals of powder metallurgy processes, to examine the effects of powder metallurgy on production processes and methods for improving material properties. It focuses on the production of high performance materials with advanced powder metallurgy techniques.	
Course Objectives	- To teach the basic principles and production processes of powder metallurgy . - To understand the relationship between powder production and sintering techniques. - To learn advanced powder metallurgy techniques for the production of high-performance materials. - To discover new materials and techniques used in powder metallurgy .	
Course Learning Outcomes and Competencies	- Understand powder metallurgy processes and their effects on production. - Produce high performance materials with different powder metallurgy techniques . - Evaluate sintering methods used in powder metallurgy. - Improve material properties using advanced powder metallurgy applications.	
Basic and Auxiliary Resources of the Course	- German , R.M. , “ Powder Metallurgy Science ”, MPIF. -Thümmler , F. , Oberacker , R., “ Introduction to Powder “Metallurgy ”, Springer .	
Method of Teaching the Course	Theoretical lectures, case studies, article reviews, student presentations and in-class discussions.	

Evaluation Criteria		**If yes, please mark (X)**	**Percentage (%) Contribution to the Overall Average**
	1. Midterm Exam	x	**30**
	2. Midterm Exam		
	3. Midterm Exam		
	4. Midterm Exam		
	Oral Exam		
	Practical Exam (Lab , Project etc.)	x	**20**
	Final Exam	x	**50**

Semester Course Plan

Week	Subjects
1	1. Introduction to powder metallurgy : Basic concepts
2	2. Powder production methods and classifications
3	3. Powder characterization : Size, shape, and surface properties
4	4. Sintering processes and parameters
5	5. Mechanical alloying and sintering technologies
6	Materials used in powder metallurgy
7	7. Advanced sintering techniques: Hot isostatic pressing and plasma sintering
8	8. Midterm Exam
9	9. Mechanical properties of materials produced by powder metallurgy
10	10. High-performance materials: Composites and alloys
11	11. New technologies and applications
12	12. Application areas of sintered materials
13	13. Project presentations and evaluations
14	14. General review and evaluation

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM5099 Non-Ferrous Metals and Alloys				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Yahya TAŞGIN					**Mail : yahyatasgin@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	This course is an introduction to alloys and alloying. Other topics covered in the course are alloys, atomic structure, periodic table, application of chemical bonding theories in metals, valence bonding, chemical bonding in metals and alloys, metallic alloy theories, crystal structures and dimensional analysis of intermetallic phases, alloy standards and applications, aluminum, copper, zinc, titanium and nickel alloys.						
Course Goals	The nonferrous metals and alloys course is an important course that engineering candidates should take to learn how to alloy. In light of other engineering courses, this course; 1. Alloying theories, structural elements of alloys 2. Atomic structure, Crystal structure of alloys 3. Alloying theories 4. Solid solution alloys. Limited solution alloys. Intermediate solution alloys. Substituting solid solution alloys. 5. Metastable phases, intermetallic compounds, covalent compounds 6. Aluminum alloys and preparation techniques, copper-based alloys and preparation techniques, zinc alloys and other nonferrous alloying systems (Magnesium, Nickel, Titanium, etc.)						
Course Learning Outs and Proficiencies	Students who successfully pass this course will learn; 1. Non-ferrous metals and alloys: Physical and mechanical properties of aluminum, copper, zinc, magnesium, titanium, nickel metals and alloys. Production and recycling economy of these alloys 2. Standards of non-ferrous metals and alloys 3. Intermetallic compounds 4. Design of non-ferrous metals and alloys.						
Course Basic and Auxiliary Contexts	Kundu, P.K. ,Cohen, I.M. (2008). Fluid Mechanics, Amsterdam: Academic Press. White, F. M. (2006). Viscous Fluid Flow, N.Y.: McGraw-Hill Higher Education						

Methods of Give a Lecture	giving face-to-face lectures

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	Subjects
1	• Atomic structure and periodic table
2	• Metallic alloy theories
3	• Metallic alloy theories
4	• Crystal structures and size analysis of intermetallic phases
5	• Microscopic phase equilibrium in alloys
6	• Alloy standards and applications in the world.
7	• Molten aluminum preparation methods and aluminum alloy melting experiments
8	• Aluminum alloys and their applications in industry
9	• MIDTERM EXAM
10	• Copper and copper alloy preparation techniques and their applications in industry
11	• Zinc and zinc alloy preparation techniques and their applications in industry.
12	• Magnesium and magnesium alloy preparation techniques and their applications in industry.
13	• Titanium and titanium alloy preparation techniques and their applications in industry
14	• Student project presentations, discussion and evaluation
15	• MAKE-UP EXAM

COURSE IDENTIFICATION FORM							
Course Code and Name: MKM 5100 Phase Transformation Theories				**Department of : MECHANICAL ENGINEERING / MECHANICAL ENGINEERING DEPARTMENT**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	6	Turkish	Optional
Prerequisite (s)							
Instructor	Doç. Dr. Yahya TAŞGIN					**Mail : yahyatasgin@munzur.edu.tr Web :**	
Course Assistant						**Mail : Web :**	
Groups / Classes							
Course Aim	The aim of this course is to understand the basic thermodynamics of phase transformations in the production of engineering materials, to examine diffusion-based or independent transformations, and to provide students with the idea of using or preventing phase transformations in practice.						
Course Goals	1-Gibbs Free Energy Concept, Equilibrium State 2- Phase Transformation Concept, Classification of Phase Transformations, Liquid-Solid Transformations 3- Recrystallization Concept and Recrystallization Steps, Deformation Energy 4- Recrystallization Kinetics, Recrystallization Applications, Secondary and Dynamic Recrystallization, 5- Supersaturated Solid Solutions 6- Continuous and Discontinuous Precipitation Types, GP Regions, Transition Precipitates and Equilibrium Precipitates, 7- Alloys Hardened by Continuous Precipitation and Mechanisms of Strength Increase in Precipitation 8- Formation of Single Phase Equilibrium Precipitates, Effect of Diffusion Rate on Equilibrium Precipitation Shape, Pearlite and Pearlitic Transformations, 9- Effect of Transformation Rate on Eutectoid Morphology and Properties, Eutectoid Transformation Kinetics, 10- Obtaining TTT Diagrams Its Formation and Importance, Discontinuous Transformations 11- Diffusion Controlled Growth of Equilibrium Precipitates, 12- Definition of Martensite, Crystallography of Martensitic Transformations 13- Bain Distortion, Martensitic Transformations in Steels, 14- Types of Martensite						

Course Learning Outs and Proficiencies	1) Understands the fundamental phase transformations and the importance of phase transformations in material production and application. 2) Understands the concepts of deformation, stored energy and mechanisms, recrystallization. 3) Understands the principles of precipitation hardening and the technological importance of light alloy production. 4) Understands the effects of parameters in diffusional transformations in steels on microstructure and properties. Uses TTT, CCT diagrams. 5) Understands the mechanisms of shear transformations in steels and nonferrous alloys, understands the kinetics of martensite and bainitic transformations. 6) Understands the mechanisms of shear transformations in steels and nonferrous alloys.
Course Basic and Auxiliary Contexts	1) John. D. Verhoeven, Fundamentals of Physical Metallurgy, John Wiley & Sons, New York, 1975. 2) David A. Porter, Kenneth E. Easterling, Mohamed Y. Sherif, Phase Transformations in Metals and Alloys, 3rd Ed., Taylor&Francis Group, Florida, 2009
Methods of Give a Lecture	giving face-to-face lectures

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**40**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**60**

Semester Course Plan

Week	**Subjects**
1	• Atomic structure and periodic table
2	• Metallic alloy theories
3	• Metallic alloy theories

4	• Crystal structures and size analysis of intermetallic phases
5	• Microscopic phase equilibrium in alloys
6	• Alloy standards and applications in the world.
7	• Molten aluminum preparation methods and aluminum alloy melting experiments
8	• Aluminum alloys and their applications in industry
9	• MIDTERM EXAM
10	• Copper and copper alloy preparation techniques and their applications in industry
11	• Zinc and zinc alloy preparation techniques and their applications in industry.
12	• Magnesium and magnesium alloy preparation techniques and their applications in industry.
13	• Titanium and titanium alloy preparation techniques and their applications in industry
14	• Student project presentations, discussion and evaluation
15	• MAKE-UP EXAM