DEPARTMENT OF METALLURGY AND MATERIAL ENGINEERING STUDIES Content of Master's Degree in Metallurgy and Material Engineering Sciences with Thesis					
COURSE CODE	**COURSE NAME AND CONTENTS**	**T**	**A**	**C**	**ECTS**
GEI701	**Scientific Research Techniques and Scientific Ethics**	**3**	**0**	**3**	**8**
Purpose and Content	This course aims to be able to know how a process in a scientific research proceeds and how a scientific report must be prepared. Fundamental concepts and information about the science, the structure of scientific research, scientific methods and different ideas on these methods, data acquisition methods (quantitative and qualitative), registration, analysis, interpretation and reporting of datas.				
MME704	**Advanced Material Science**	**3**	**0**	**3**	**8**
Purpose and Content	Material science and engineering, classifications of materials, principles of materials selection, atomic structure, atomic bonding crystal lattice structure; structure of atoms, periodical table, atomic bonding, lattice parameters, coordination number, atomic number of lattice, basic cubic structures, face centered cubic structures, body centered cubic structures, hexagonal structures, close packet crystal structures, crystallographic direction, crystal defects; point defects, line defects (dislocations), surface defects (twins, stacking fault, grain boundary), an important of dislocations, mechanical test applied for materials; tensile strength test, compression test, fatigue test, charpy v-notch test, hardness test, rupture test, diffusion, solidification and strengthening by grain refinement; definitions and principles, mechanism of diffusion, nucleation, growing, solidification, cooling curves, solidification and solid solution hardening; phase and, solubility limit, solid solution hardening, phase rule, segregation, binary phase and iron cementite diagram, cupper and nickel systems, Sn–Bi systems, eutectic reactions, eutectoid reactions, peritectic reactions, lever rule, ferrous alloy; steels, heat treatments for steel, cast iron, non ferrous alloys; aluminum alloys, cupper alloys, magnesium alloys, titanium alloys				
MME705	**Structure And Properties Of Materials**	**3**	**0**	**3**	**8**
Purpose and Content	To teach the relationship between the structure and properties of materials to students and to develop skills of designing new materials. Electron structure of atoms, cyrstallography, derivative crystal structures, crystal defects, chemical bonds, electrical, magnetic and thermal properties of materials.				
MME706	**Advanced Corrosion**	**3**	**0**	**3**	**8**

Purpose and Content	To have students gained knowledge about corrosion types and their mechanisms, protection methods from corrosion, selection of appropriate materials and design. Corrosion theory, Corrosion and thermodynamic, Electrochemical rules, Passivasion, Corrosion rates, Types of Corrosion, Corrosion in various environments (atmosphere, marine, in soil), Protection methods from corrosion, Anodic, Cathodic, Inhibitors, Material selection and design to prevent corrosion.				
MME708	**Powder Production Methods and Sintering**	**3**	**0**	**3**	**8**
Purpose and Content	This course aims to teach the meaning and usage of powder metallurgy in Turkey and the world to graduate students. Introduction to powder metallurgy, powder production techniques, Characterisation of powders, blending and mixing, Lubrication, compaction and sintering, Full density processing				
MME709	**Metal casting Techniques**	**3**	**0**	**3**	**8**
Purpose and Content	The purpose of this course is to give detailed knowledge to the graduate students about advanced metal casting techniques. Introduction to casting. Production of parts by casting methods in industry. Sand mold casting. Permanent mold casting. Shell mold casting. Die casting. Continuous casting. Centrifugal casting. Vacuum and gravity casting. Investment casting methods. New devolopments of casting methods. Comparison and various materials production by different casting processes.				
MME710	**Surface Analysis Techniques**	**3**	**0**	**3**	**8**
Purpose and Content	To teach students how to explain the fundamental principles and techniques used in materials characterization and to have students gain skills of application and interpreting in solutions of characterization problems. X-ray diffraction, working principles of optical microskope, scanning electron microscope (SEM), transmission electron microscope (TEM), image formation, electron diffraction, scanning tuneling microscope and atomic force microskope, x-ray floresans (XRF), energy dispersive x-ray spectroscopy (EDS), wavelength dispersive x-ray spectroscopy (WDS), x-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), secondary ıon mass spectrometry (SIMS) and Rutherford backscattering spectrometry (RBS).				
MME713	**Mechanical Behavior of Materials**	**3**	**0**	**3**	**8**
Purpose and Content	To teach students determine behavior of materials according to forces on materials and to design materials according to working environment. Stress and strain tensors, elastic behavior, yield criteria and yield surfaces, deformation in single and polycrytals, work hardening, multiaxial stress state, strengthening, high temperature behavior of materials, fracture and fatigue properties of materials.				
MME714	**High Temperature Deformation**	**3**	**0**	**3**	**8**

Purpose and Content	To introduce deformatin mechanisms effective at high temperatures, to introduce mechanical tests which determine high temperature deformation chracteristics of materials, to correlate the relationships between creep behavior and stres and microstructure, to introduce high temperature materials and temperature range they are used. Types of time dependent plastic deformation. Creep and the factors which influences creep. The effects of stress. Temperature and microstructure on creep. Deformation mechanisms of creep. Deformation mechanism maps. The effect of hot working on mechanical properties. Thermo- mechanical treatments. Superplasticity. Material selection for high temperature applications.				
MME721	**Surface Hardening Methods**	**3**	**0**	**3**	**8**
Purpose and Content	To have students gained detailed information about Hardening methods which aplied to steels. Compitiple steel selection to surface hardenning process .Hardenning with flame and induction carburring nitrurring, carbonitrurring and another chemical methods.				
MME731	**Nondestructive Testing Methods**	**3**	**0**	**3**	**8**
Purpose and Content	This course aims to have students equipped with knowledge on application methods of Material test. Within the scope of this course, material testing methods, sample preparation, material defects and industrial application of testing methods are covered.				
MME733	**Nanotechnology and Its Applications**	**3**	**0**	**3**	**8**
Purpose and Content	To teach fundamentals of nanotechnology, the types, production methods, and characterization methods of nanoparticles, application and impacts of nanotechnology in our life. This course basicly covers the definition and history of nanotechnology, the physical, chemical and optical properties of systems at nanoscales, production techniques and characterization methods, types of nanoparticles and nanostructured materials used in every day life, and potential advantages and risks of nanotechnology.				
MME734	**Biodegradable Metallic Implant Materials**	**3**	**0**	**3**	**8**
Purpose and Content	Purpose of this course is to give knowledge about general properties of biodegradable implant materials based on magnesium alloys especially used in biomedical applications. To give general knowledge about biomaterials. Application in the fields of bioceramic, biopolymer and metallic biomaterials. General knowledge about biodegradable implant materials. To give knowledge production and general properties of magnesium alloys. Investigation of corroion and mechanical properties of magnesium alloys as a biodegradable materials.				
MME736	**Advanced Polymer Chemistry And Polymer Electronics**	**3**	**0**	**3**	**8**

Purpose and Content	This course aims to develop an understanding the chemical interactions during polymerization reaction. Introduction to polymer science, classification of polymers, polymerization degree, polymerization reactions and polymer synthesis, condensation and free radical polymerization reactions, chemical and physical properties of polymers, charcaterization tehcniques of polymers, stereochemistry of polymer structures, forces between polymer chains, structure property relations, polymer composites with specific fillers. The recent advances in the design of synthetic and natural polymeric materials for				
MME740	**Traditional Ceramics**	**3**	**0**	**3**	**8**
Purpose and Content	To teach raw materials of the ceramics and characterisations of them. To realize ceramic production processes and effect of the processing parameters on the properties of the final products. To explain the structure and applications of ceramic glazes. To gain ability of the quality control and ability of eliminating the production faults of the traditional ceramics. Definition and applications of traditional ceramics. Characterisation of the raw materials of the traditional ceramics and definition of the traditional ceramic compositions. Ceramic processes and parameters of them. Structure and applications of the glazes. Quality control and elimination of the production faults of the traditional ceramics.				
MME741	**Cement-Based Composites**	**3**	**0**	**3**	**8**
Purpose and Content	To teach definition, classification and application of cement-based composites. To teach the microstructure of cement-based composites. To explain the interaction between microstructure and final properties of cement-based composites. To gain ability of the composition design of cement-based composites for specific applications. Definition and application of cement-based composites. Mix design of binders. Organic and inorganic cement admixtures. Fillers and aggregates. Fiber reinforcements. Production of cement-based composites. Performance in service conditions.				
MME742	**Matlab for Materials Engineering**	**3**	**0**	**3**	**8**
Purpose and Content	The main purpose of the course is; To provide widespread information on the Matlab program in practice. To teach the rules of the Matlab program, their foundation, program control and flow diagrams, preparation and use of functions. Algorithms and flow charts, introduction to Matlab programming environment. Introducing constants, variables and mathematical expressions in Matlab. Introduction of the Matlab editor (M-file). Introduction of control structures, repetitive structures and sequences used in Matlab, file management in Matlab and creating sub-functions, drawing graphics in Matlab are the topics to be covered in the course.				
MME743	**Laboratory Accreditation and Quality**	**3**	**0**	**3**	**8**

Purpose and Content	The aim of this course is to introduce to the student to the management systems of the test and calibration laboratory and to gain the basic requirements of the ISO 17025 standard. Students gain the ability to work as Laboratory Supervisors within the scope of this course. This course includes basic concepts of laboratory management, documentation of laboratory management systems, staff and laboratory equipment, quality control studies, laboratory records and reports, requirements of ISO 17025 standard and ISO 9001 standards.				
MME744	**Method Validation and Measurement Uncertainty**	**3**	**0**	**3**	**8**
Purpose and Content	The aim of this course is to provide the student with the knowledge to design a validation plan for an experimental method, to apply it, to evaluate the results and to calculate the measurement uncertainty of the methods. This course includes method validation techniques applied in the laboratory and/or to confirm the suitability of the newly developed test method, the quality control studies required for the confirmation of the reliability of the results in the laboratories and the measurement uncertainty calculations affecting the laboratory results.				
MME745	**Production and Features of Railway Eguipment**	**3**	**0**	**3**	**8**
Purpose and Content	The aim of lesson : Introducing fasteners, rail and wheel production methods used in railways. Introduction of microstructure mechanical properties based on product standards for all these railway equipment. Product introducing standards and introducing new methods and materials used. Course content: Selection of railway fasteners, selection of rail materials, train wheel material selection and production, steel types used as rail and train wheel materials. Quality standards, microstructural, physical and mechanical properties, production methods and properties of the steels used.				
MME797	**MSc Seminar**	**0**	**2**	**0**	**6**
Purpose and Content	To gain oral presentation and discussion skills. To determine the objectives of the thesis study, to create the road map of the study. Presentation of thesis work				
MME798	**MSc Field of Specialization**	**4**	**0**	**0**	**4**
Purpose and Content	The Specialization Area course is a theoretical course proposed by a faculty member to share their knowledge, experience, and expertise in their scientific field with graduate students under their supervision. This course aims to educate students on scientific ethics, instil a strong work discipline, teach research methods in the current literature, and provide guidance on conducting research, following, and evaluating the literature. The course also focuses on establishing and implementing the scientific foundations of the student's thesis/exhibition/project work.				
MME799	**MSc Thesis Research**	**0**	**1**	**0**	**26**

Purpose and Content	In this course, the student is responsible for creating the thesis content, conducting research, analyzing and summarizing individuals, writing the thesis and presenting it within the framework of academic rules. In this intended thesis, detailed information and basic principles regarding academic publications will be discussed and applied.				
MMM7098D	**Course Specialised Field**	**4**	**0**	**0**	**4**
Purpose and Content	Course Specialised Field is a theoretical course proposed by a faculty member to share their knowledge, experience, and expertise in their scientific field with graduate students under their supervision. This course aims to educate students on scientific ethics and instil a strong work discipline.				
MMM799	**Master's Thesis Study**	**0**	**1**	**0**	**26**
Purpose and Content	The Thesis Course is a practical class designed for graduate students under the supervision of a faculty member. It includes guidance on various aspects of their thesis work, such as literature review, methodology, fieldwork, and laboratory research. This course provides the necessary information and direction for the students to prepare their theses following the "Graduate Thesis Writing Guidelines and Templates," as well as guidance on defending and submitting their theses.				
MMM7098T	**Thesis Specialised Field**	**4**	**0**	**0**	**4**
Purpose and Content	The Thesis Course is a practical class designed for graduate students under the supervision of a faculty member. It includes guidance on various aspects of their thesis work, such as literature review, methodology, fieldwork, and laboratory research. This course provides the necessary information and direction for the students to prepare their theses following the "Graduate Thesis Writing Guidelines and Templates," as well as guidance on defending and submitting their theses.				