(It will be applied from 2016-2017 Fall)

İZMİR INSTITUTE OF TECHNOLOGY
GRADUATE SCHOOL OF ENGINEERING AND SCIENCES
DEPARTMENT OF MATERIAL SCIENCE AND ENGINEERING
CURRICULUM OF THE M.S. PROGRAM IN MATERIAL SCIENCE AND ENGINEERING

The Materials Science and Engineering M.S. Program is a jointly operated interdisciplinary program. The Curriculum is supported by the graduate courses available at the Departments of Civil Engineering, Chemical Engineering, Food Engineering, Mechanical Engineering, Electrical Engineering, Chemistry, Physics, and Biology as well as MSE coded courses.

Core Courses		**Credit**
MSE 500	M.S. Thesis	(0-1)NC
MSE 598	**Research Seminar***	**(0-2)NC**
MSE 8XX	Special Studies	(8-0)NC

*All M.S. students must register Research Seminar course until the beginning of their 4th semester.

Credit

In addition, at least 3 of the following courses must be taken.

		Credit
MSE 501	Fundamentals of Materials Science and Engineering	(3-0)3
MSE 502	Physical Properties of Materials	(3-0)3
MSE 503	Materails Science And Engineering Thermodynamics	(3-0)3
MSE 508	Glass Science and Technology	(3-0)3
MSE 509	Atomistic Simuulation of Materials I	(3-0)3
MSE 510	Scanning Probe and Electron Microscopy	(3-0)3
MSE 511	Kinetic	(3-0)3
MSE 512	Solid State Physics	(3-0)3
MSE 513	Materials Microstructure	(3-0)3
MSE 514	Molecular Aspects of Soft Materials	(3-0)3
MSE 515	Quantum Mechanics for Materials Science and Engineering	(3-0)3
MSE 516	Nanomaterials and Surface Engineering	(3-0)3
MSE 517	Spectroscopic Methods of Materials Characterization	(3-0)3
ME 507	Analytical Techniques in Material Science	(3-0)3
CE 501	Advanced Analytical Methods in Engineering	(3-0)3
MSE 518	**Electroceramic Materials**	**(3-0)3**
MSE 519	**Atomistic Simulation of Materials-II**	**(3-0)3**
MSE 520	**Transport in Nanostructures**	**(3-0)3**

Elective Courses		**Credit**
MSE 580	Special Topics in Materials Science and Engineering	(3-0)3

Total credit (min.)   : 21
Number of courses with credit (min.): 7

Students in interdisciplinary programs register for the 8XX course in the department of their advisors.

Remaining credit requirements may be met by taking related courses in other departments and other interdisciplinary graduate programs.

(It will be applied from 2016-2017 Fall)
İZMİR INSTITUTE OF TECHNOLOGY
GRADUATE SCHOOL OF ENGINEERING AND SCIENCES
DEPARTMENT OF MATERIAL SCIENCE AND ENGINEERING
CURRICULUM OF THE M.S. PROGRAM IN MATERIAL SCIENCE AND ENGINEERING

COURSE DESCRIPTIONS

Credit

MSE 500   M.S. Thesis   (0-1)NC
A research topics which can be experimental and/or theoretical has to be pursued. An M.S. thesis is prepared at the end of this work. It should fulfill the requirements set by the İzmir Institute of Technology Graduate School.

MSE 501   Fundamentals of Materials Science and Engineering   (3-0)3
Fundamentals of materials, atomic bonding, crystal structures, non-crystalline structures, defects, diffusion, mechanical properties, microstructure, phase diagrams, heat treatment.

MSE 502   Physical Properties of Materials   (3-0)3
Mechanical properties of materials, electrical properties of materials, thermal properties of materials, optical properties of materials, magnetic properties of materials

MSE 503   Materials Science and Engineering Thermodynamics   (3-0)3
Advanced thermodynamic treatment of inorganic materials. Application of the laws of thermodynamics to the chemical behaviour of materials. Multicomponent systems, phase and chemical reactions equilibrium. Thermodynamics of phase transformations. Introduction to the surface thermodynamics.

MSE 508   Glass Science and Technology   (3-0)3
The course will provide the student with the fundamental concepts towards the understanding of glass forming principles, composition, bulk and surface structure and properties of inorganic glasses. The student will also learn the traditional and advancing technologies used for glass making.

MSE 509   Atomistic Simuluation of Materials I   (3-0)3
In this course, the students will be introduced with the basic concepts in modeling and simulation of materials; and they will make a fast introduction to the applications of density functional theory, which is one of the leading methods in quantum mechanical modeling of materials. Approximately half of the lectures will be reserved for hands-on tutorials.

MSE 510   Scanning Probe and Electron Microscopy   (3-0)3
General aspects of electron optics, Electron beam generation, Electron–specimen interactions, Scanning electron microscopy, Transmission electron microscopy, transmission electron microscopy, Field ion microscopy, probe techniques, tunneling microscopy, Atomic force microscopy, Other scanning probe techniques.

MSE 511   Kinetic   (3-0)3
The concept of kinetic. The solution of kinetic data. Chemical kinetic. Rate theories. Diffusion in solids, liquids and gases. Homogenization, carburization, decarburization, solid-gas reactions, oxidation, nitriding, dissolution in solids and liquids, precipitation in solids and liquids and deformation kinetic.

(It will be applied from 2016-2017 Fall)
MSE 512   Solid State Physics   (3-0)3
Basics of quantum mechanics, crystal structures, bonding in solids, Fourier analysis of periodic functions, reciprocal lattice and crystal diffraction, lattice vibrations, phonon heat capacity,   free and non interacting electrons, electrons in periodic potential, semiconductors.

MSE 513   Materials Microstructure   (3-0)3
Crystallography, crystal structures and the effect of symmetry on properties. The structure of amorphous materials. The nature and kinetic of microstructural transformations in materials. Homogenous and heterogeneous nucleation. The defects and dislocations in crystals.

MSE 514   Molecular Aspects of Soft Materials   (3-0)3
Molecules and Molecular Compounds, Single molecules, Macromolecules, Supramolecules, Self-assembly.

MSE 515   Quantum Mechanics for Material Science and Engineering   (3-0)3
Background for Quantum Mechanics, photoelectric effect, and de Broglie waves, The Bohr model and Electron diffraction, Probability and uncertainty, wave functions and the schrödinger wave equation, potential wells; potential barriers and tunnelling, the harmonic oscillator, hydrogen atom, zeeman effect, electron spin, m any electron atoms and the exclusion principle, X-ray spectra

MSE 516   Nanomaterials and Surface Engineering   (3-0)3
"Nanomaterials," is an interdisciplinary introduction to processing, structure, and properties of materials at the nanometer length scale. The course will cover recent breakthroughs and assess the impact of this burgeoning field. Specific nanofabrication topics include epitaxy, beam lithographies, self- assembly, biocatalytic synthesis, atom optics, and scanning probe lithography. The unique size-dependent properties (mechanical, thermal, chemical, optical, electronic, and magnetic) that result from nanoscale structure will be explored in the context of technological applications including computation, magnetic storage, sensors, and actuators.

MSE 517   Spectroscopic Methods of Materials Characterization   (3-0)3
Atomic structure and bonding in solids. Crystal structures of materials. Imperfections in solids. Diffusion. Mechanical Properties of Metals. Testing of mechanical properties. Dislocations and strengthening mechanisms. Failure. Phase diagrams. Phase transformations, development of microstructure and alteration of mechanical properties.

MSE 580   Special Topics in Material Science and Engineering   (3-0)3
Directed group study topics in material science and engineering.

MSE 598   Research Seminar   (0-2)NC
The first two weeks of the course, effective oral/written reporting scientific results will be explained. Ethical and unethical behavior in science and scientific studies will be discussed. Moreover, awareness of the students about scientific plagiarism will be created. A seminar must be given by each student on his/her research area which is graded by academic member of staff. The topic of the seminar can be decided by the student and his/her supervisor.

ME 507   Analytical Techniques in Material Science   (3-0)3
Study of the mechanical, thermomechanical, physical and microstructural characterization of materials. Materials system include metals, ceramics, polymers, composites and surfaces and interfaces in these systems. Applications to mechanical property characterization. Fracture and fractography. Surfaces and interfaces. Dynamic mechanical analysis of polymeric materials. Optic and scanning electron microscopy. Polymer molecular structure determination and durability experiments.

(It will be applied from 2016-2017 Fall)
CE 501   Advanced Analytical Methods in Engineering   (3-0)3
Heat flow. The method of separation of variables. Fourier series. Nonlinear partial differential equations. The method of characteristics. Fourier and Lap lace transforms.

MSE 518   Electroceramic Materials   (3-0)3
In this course, electronic, magnetic and electrochemical properties of ceramic materials with different electronics applications will be covered; focusing on the correlation of these physical properties to the crystal and defect structure as well as microstructure. In particular, tailoring the functional properties for a specific application will be emphasized by using representative materials in different applications.

MSE 519   Atomistic Simulation of Materials-II   (3-0)3
In this course, the students will be introduced with the concepts in modeling and simulation of materials. Computation of elastic, vibrational, thermal, optical and magnetic properties of materials will be reviewed using state-of-the-art tools. Approximately half of the lecture hours will be reserved for computations.

MSE 520   Transport in Nanostructures   (3-0)3
In this course, the students will be introduced with the fundamental concepts of the nano-scale transport. They will learn about the basics of electronic, spintronic and thermal transport at the quantum limit. Transport regimes ranging from ballistic transport to diffusive transport and localization regimes will be visited. Recent advances in the literature will be addressed.

MSE 8XX   Special Studies   (8-0)NC
Graduate students supervised by the same faculty member study advanced topics under the guidance of their advisor.