(It will be applied from 2016-2017 Fall)

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

The Environmental Engineering M.S. Program in is a jointly operated interdisciplinary program. The Curriculum is supported by the graduate courses available at the Departments of Civil Engineering, Chemical Engineering, Mechanical Engineering, Chemistry, Molecular Biology and Genetics and other departments as well as ENV coded courses.

Core Courses
ENV 500	M.S. Thesis	(0-1)NC
ENV 591	**Technical Writing, Research Methods and Ethics**	**(0-2)NC**
ENV 598	Research Seminar*	(0-2)NC
ENV 8xx	Special Studies	(8-0)NC

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

In addition, at least one course must be taken from the following 3 areas.
1. *GROUP*
CHE 505	Transport Phenomena I	(3-0)3
CHE 533	Mass Transport in Environmental Engineering	(3-0)3

2. *GROUP*
CHEM 515	Environmental Chemistry	(3-0)3
CHEM 577	Interfacial Phenomena	(3-0)3

3. *GROUP*
CE 501	Advanced Analytical Methods in Engineering	(3-0)3
CE 502	Advanced Numerical Methods in Engineering	(3-0)3
CHEM 513	Chemometrics	(3-0)3
FE534	Multivariate Statistical Analysis for Engineers	(3-0)3

Elective Courses
ENV 580	Special Topics in Environmental Engineering	(3-0)3
ENV 502	*Environmental Biotechnology*	*(3-0)3*
ENV 503	*Sustainable Energy and Environment*	*(3-0)3*

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

In addition to ENV coded courses, elective courses are selected from related courses in other departments and other interdisciplinary graduate programs to meet credit requirements.

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COURSE DESCRIPTIONS

ENV 580   Special Topics in Environmental Engineering   (3-0)3
Directed group study of special topics in environmental engineering.

ENV 598   Research Seminar   (0-2)NC
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.

ENV 591   Technical Writing, Research Methods and Ethics   (0-2)NC
Literature survey, critical review, research study design, conveying results of a study, research publication system, manuscript preparation, seminar preparation, ethical issues in research, ethical issues in publishing.

ENV 500   M.S. Thesis   (0-1)NC
A research topic which can be experimental and/or theoretical has to be pursued. It should fulfill the requirements set by the İzmir Institute of Technology Graduate Program.

CHE 505   Transport Phenomena I   (3-0)3
Transport by molecular motion. A review of viscosity. Thermal conductivity. Diffusivity. Transport in laminar flow in one dimension. Momentum, energy and shell balances. Equations of change in isothermal, nonisothermal and multi component systems. Transport in laminar flow with two independent variables.

CHE 533   Mass Transport in Environmental Engineering   (3-0)3
Mass transport equations of environmental engineering processes. Equations of sorption kinetics in continuos flow reactors. Transport equations of fixed film exchange. Electrodialysis. Biological processes. Fixed culture processes and suspended culture processes.

CHEM 515   Environmental Chemistry   (3-0)3
Reaction thermodynamics, ionic and oxidation-reduction equilibria, and reaction kinetics as related to natural aquatic and pollution control processes.

CHEM 577   Interfacial Phenomena   (3-0)3
The course will start off with a concise mention of chemical thermodynamics to elucidate the basic terminology.A discussion on the thermodynamics of liquid system will be covered so as to include van der walls, electrostatic and steric forces.Surfaces at solids will be examined as a prelude to more detailed analysis of various processes taking place at solid-liquid, liquid-liquid, solid-gas and liquid-gas interfaces, wetting, flotation and detergency will be included to emphasize how the phenomena studied applies to practical systems.

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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 Laplace transforms.

CE 502   Advanced Numerical Methods in Engineering   (3-0)3
Numerical methods for solving non-linear equations. Finite difference method for solving elliptic, parabolic and hyperbolic equations in one and two dimensions. Irregular regions. Derivative boundary conditions. Rayleigh-Ritz method. Finite element method for solving elliptic, parabolic and hyperbolic equations in two dimensions.

CHEM 513   Chemometrics   (3-0)3
A survey of chemometrics, providing sufficient statistical background for chemist. The topics covered include probability, statistics, sampling estimation, multivariate regression analysis, optimization and experimental design, data analysis and signal processing.

FE 534   Multivariate Statistical Analysis for Engineers   (3-0)3
The course will cover the statistical tools for the analysis of process data. Basics of matrix algebra, statistics and graphical techniques to describe data, normal distribution, test of normality, hypothesis testing will be introduced first. The methods to compare several multivariate population means will be included. Techniques that are used for modeling and monitoring multivariate processes will be covered; linear regression, principal component analysis, factor analysis, discrimination and clustering analysis will be given to model and classify process data, and also to monitor and diagnose the process. Students who want to take this course should be familiar to a software to perform required matrix operations.

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

ENV 502 Environmental Biotechnology   (3-0)3
Microorganisms in the nature readily conduct many different types of conversion processes that are vital in the operation of biosphere. Environmental biotechnology is a rather new and very dynamic domain that aims at utilizing microbial processes for treatment purposes. In order to understand the microbial processes, one needs to deconstruct the microbial ecology responsible for those processes. At this point, the relationship between phylogeny and function within microbial community should be elucidated through employing recent advances in molecular techniques such as FISH, MAR, SIP, metagenomics, and proteomics. Moreover the means to manipulate microbial communities and pure cultures in order to conduct desired process (treatment, energy production) will be discussed.

ENV 503 Sustainable Energy and Environment   (3-0)3
Estimation and evaluation of energy resources will be covered following the relationship between sustainable energy and sustainable development. Local, regional and global environmental effects of energy and sustainability metrics for energy systems will be investigated. Fossil fuels, nuclear power, and renewable energy resources will be addressed in terms of developed technology and sustainability metrics. Sustainability model applications will be discussed over current scientific literature.