İZMİR INSTITUTE OF TECHNOLOGY GRADUATE SCHOOL OF ENGINEERING AND SCIENCES GRADUATE PROGRAMS AT THE DEPARTMENT OF ENERGY ENGINEERING

GRADUATE CIRRICULUM

MS. in Energy Engineering

Core Courses

ENE 500	M.S. Thesis	(0-1)NC	26
*ENE 599	Research Seminar	(0-2)NC	8
ENE 501	Fundamentals of Energy Engineering	(3-0)3	8
**ME 599	Methods and Ethics in Engineering Research	(0-2)NC	3
**CHE 591	Technical Writing and Ethical Issues	(3-0)3	8
ENE 8XX	Special Studies	(8-0)NC	4

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

** One course should be taken from the group.

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

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

Elective Courses

ENE502	Advanced Engineering	(3-0)3	8
	Thermodynamics		
ENE 509	Numerical Fluid Mechanics	(3-0)3	8
ENE 510	Fundamentals of Wind Energy	(3-0)3	8
	Systems		
ENE 511	Wind Energy Meteorology	(3-0)3	8
ENE 512	Wind Turbine Aerodynamics I	(3-2)4	8
ENE 513	Wind Turbine Aerodynamics II	(3-2)4	8
ENE 520	Biomass Energy and Technologies	(3-0)3	8
ENE 521	Thermochemical Conversion of	(3-0)3	8
	Biomass		
ENE 522	Modelling and Simulation of	(3-0)3	8
	Bioenergy Processes		
ENE 530	Fundamentals of Photovoltaic Systems	(3-0)3	8
ENE 531	Power Systems Analysis	(3-0)3	8
ENE 540	Geothermal Energy and Environment	(3-0)3	8
ENE 541	Geothermal Power Plants	(3-0)3	8
ENE 556	Energy Engineering Workshop	(1-4)3 Pre. Cont. of the Inst.	8
ENE 572	Energy Economics and Management	(3-0)3	8
ENE 580	Special Topics in Energy Engineering	(3-0)3	8
ENE 590	Technical Report Writing	(0-2)NC	8

Note : The elective course list does not cover all the courses relevant to our program. Students are advised to consider all courses offered by other departments before enrollment. Students can enroll for the elective courses that are agreed by their advisors.

COURSE CONTENT

Core Courses

M.S. Thesis **ENE 500** (0-1)NC **AKTS: 26**

A research topic which can be experimental and/or theoretical has to be pursued. It should fulfill the requirements stated in the rules set by İzmir Institute of Technology for Master Program.

ENE 8XX **Special Studies** M.S. Students choose and study a topic under the guidance of a faculty member normally his/her advisor.

ENE 599 Research Seminar (0-2)NCAKTS:8

A Seminar must be given by each student on his research area which is graded by academic member of staff. The topic of the seminar can be decided by the student and his supervisor.

ENE 501 Fundamentals of Energy Engineering (3-0)3AKTS:8

The content of the course will include Wind, solar, Geothermal, Biomass, Wave Energy, Energy Efficiency, networks/grids and energy policies. Students will choose a subject after the mid-term as a project topic and work in groups to prepare a scientific report and presentation. The course will also be supported with site visits.

ME 599 Methods and Ethics in Engineering Research (0-2)NCAKTS:3

How to conduct a literature survey, how to design a study, how to analyze and present results of a study, how to prepare a manuscript, how the scientific publication system works, conflict of interest, environmental ethics, ethical issues in peer review and publication, human subjects research, research misconduct, responsible authorship, ethics of mentoring, and whistleblowing and obligation to protect the public.

CHE 591 Technical Writing and Ethical Issues (3-0)3AKTS:8

Introduction to technical writing, how to write the materials and methods section, how to write the results, how to design effective tables and illustrations, how to write the introduction, how to cite the references, use and misuse of english, avoiding jargons, how and when to use abbreviations, how to write the abstract, prepare the title, and list the authors and addresses, how to keyboard the manuscript, how to write the discussion, how to state the acknowledgements, how to write a review paper, how to write a conference report, how to write a book review, how to write a thesis, how to prepare a poster, how to submit and publish the manuscript, the review process, how to present a paper orally, ethics, rights, and permissions. a technical writing will be assigned to each student.

(8-0)NC **AKTS: 4**

Elective Courses:

ENE 502	Advanced Engineering Thermodynamics	(3-0)3	AKTS:8
		(0 0)0	

First law of thermodynamics, second law of thermodynamics, destruction of exergy, single-phase systems, exergy generalised, multiphase systems

ENE 509Numerical Fluid Mechanics(3-0)3AKTS:8

Internal and External flows, linear and non-linear equations, Navier Stokes equations and introduction to the numerical turbulence models and knowledge on the topics.

ENE 510Fundamentals of Wind Energy System(3-0)3AKTS:8

This course includes the history and near future of wind energy, the status of wind energy in turkey and around the globe, basic information about sub-topics of wind energy (i) meteorology (ii) aerodynamics and (iii) control. The content is supported with a site visit. The course gives knowledge and understanding on wind turbine peripherals/sections such as blades, rotor, gearbox, generator, brakes, nacelle, tower, grid connection and wind measurements.

ENE 511Wind Energy Meteorology(3-0)3AKTS:8

At the end of the course it is expected that the student has knowledge on wind data analysis, atmospheric boundary layer, Monin-Obukhov length, similarity principle, stability, analysis, turbulence, wakes and modelling wind flow.

ENE 512Wind Turbine Aerodynamics I(3-2)4AKTS:8

The content of the course is design to connect the knowledge that the students gets from generic fluid mechanics courses and carry it to the aerodynamic design of the wind turbines.With the methodology that is followed in the course - Blade Element Momentum (BEM) - the student can get the necessary knowledge for wind turbine prototype. Furthermore, students also get extra attention on important sub-topics of the wind turbine aerodynamics (e.g. vortex, tip loss, rotor and tower effects). The course naturally also includes large amount of knowledge on introduction to windturbine aeroelasticty.

ENE 513Wind Turbine Aerodynamics II(3-2)4AKTS:8

Within the course, students learn dynamic wake, dynamic stall and blade design updates, material usages, vortex generators and their calculation. Parallel to this yaw/tilt mechanisms, wind simulation techniques and fatigue analysis are performed.

ENE 520Biomass Energy and Technologies(3-0)3AKTS:8

Biomass energy and types of biomass. Heat and power generation from biomass. Methods and technologies for biofuels production in solid, liquid and gaseous forms. Utilization of organic municipal waste using biomass conversion technologies. Catalytic and high pressure applications in biomass conversion. Biorefineries.

ENE 521Thermochemical Conversion of Biomass(3-0)3AKTS:8

Biomass resources and properties are considered with special attention for environmental impact and aspects of sustainability. Although biological conversion routes are not a topic in this course, the relation between

biological and thermochemical process routes will be clarified. In modern biorefinery concepts, both process types are often combined. Combustion, carbonization, gasification, pyrolysis, and hydrothermal conversion. Biorefineries and biorefinery integration. Techno-economic analysis. Engineering calculations related to thermochemical conversion of biomass.

ENE 522Modelling and Simulation of Bioenergy Processes(3-0)3AKTS:8

Thermochemical conversion of biomass and related process configurations, modelling the processes with solid feedstocks, modelling of unit operations, flowsheeting, mass and energy balance calculations.

ENE 530Fundamental of Photovoltaic Systems(3-0)3AKTS:8

Semiconductor materials and their electronic, optical, physical and chemical properties, electronic structures, 1st and 2nd generation solar cells, design and modeling of c-Si based solar cells, solar panel design and installation principles.

ENE 531Power Systems Analysis(3-0)3AKTS:8

Introduction to power systems (Turkish and EU systems as examples, grid codes, integration of renewable power plants), fundamental concepts, power in single and three-phase circuits (Transmission lines, transformers, synchronous machines, wind turbines, PV units), load flow analysis, symmetrical three-phase short circuit calculations, contributions of wind turbines to symmetrical three-phase faults, power system stability, using a simulation tool for load flow and short circuit analysis.

ENE 540Geothermal Energy and Environment(3-0)3AKTS:8

Geothermal energy, distribution of geothermal system in the World, utilization of geothermal energy, tectonic properties of geothermal system, conception model of geothermal system, hydrogeochemical properties of geothermal system, environmental concerns and environmental impact assessment

ENE 541Geothermal Power Plants(3-0)3AKTS:8

Introduction to geothermal energy. Cycles: geothermal power cycles, energy and exergy analysis. Fluid mechanics, single and two phase pipe flow.Mass transfer and waste heat rejection: cooling towers, condensers. Gas extraction systems. Field trip. Term project.

ENE 556Energy Engineering Workshop(1-4)3AKTS:8

A group/individual design project. The design effort will integrate many aspects of the student's engineering background, including design concepts, technical analyses, economic and safety considerations, etc. A formal report and oral presentation are required. Pre. Consent of the Instructor

ENE 572Energy Economics and Management(3-0)3AKTS:8

Introduction to energy economics and management. Economics and decision making. Investment decisions and analysis. Techniques used in energy economics and management. Break-even analysis. Linear programming. Special problems of linear programming. Pricing.

(It will be applied from 2019-2020 Fall)

ENE 580Special Topics in Energy Engineering(3-0)3AKTS:8

Directed group study of special topics in energy engineering

ENE 590 Technical Report Writing (0-2)NC AKTS:8

Conducting and preparing journal papers, reports and thesis. Methods of research. Procedures for drafting, outlining and revision. Design of layouts. Extensive writing. Practice with journal papers and reports.