

Department of Mechanical Engineering
Study plan for MSc degree in
Mechanical Engineering / Energy Systems
(Thesis)

The indications of the course subject's digits

Field Title	Field No.
General engineering	0
Fluid mechanics	1
Thermal sciences	2
Applied mechanics	3
Mechanical systems design	4
Thermal systems	5
Energy conversion and management	6
Graduation project and special topics	7
Courses for other engineering departments	8
Seminar and Thesis	9

Example

Advanced Thermodynamics						120402721	
12	0	4	0	2	7	2	1
Plan Year	Faculty code		Department code		Level	Field	Sequence

First: General conditions

1. This plan is adapted for the general rules and guidelines of the MSc program of the University
2. Applicants must hold a BSc in Engineering.

Second : Prerequisite Courses:

Are determined on the individual student basis and in accordance with article (9) of the MSC degree instructions,

The plan consists of:**1. Compulsory Courses: Twelve (15)Credit Hours as follows:**

Course No.	Course Name	Weekly Hours		Credit hours	Prerequisites
		Theory	practical		
120402701	Engineering Analysis	3	-	3	-
120402702	Computational Methods for Mechanical Engineering	3	-	3	-
120402721	Advanced Thermodynamics	3	-	3	-
120402722	Advanced Heat Transfer	3	-	3	120402701
120402733	Advanced Measurements	2	-	2	-
120402795	Seminar	1	-	1	-

2. Elective Courses: Twelve (9) Credit Hours selected from the following list:

Course No.	Course Name	Weekly Hours		Credit hours	Prerequisites
		Theory	Practical		
120402723	Power Plant Technology	3	-	3	120402721
120402732	Micro-Electromechanical Systems	3	-	3	-
120402761	Energy Management	3	-	3	-
120402762	Solar Energy Engineering	3	-	3	-
120402763	Energy & Environment	3	-	3	-
120402764	Renewable Energy Technology	3	-	3	-

3. MSc Thesis which is equivalent to 9 Credit Hours (0402799)

120402701 Engineering Analysis (3 cr. hrs.) Prerequisite (-) :

Solutions of ordinary and partial differential equations, application of Fourier series and transforms, orthogonal functions, method of separation of variables Bessel functions, Laplace transforms, power series methods, Green functions, linear analysis, vector calculus, conformal mapping techniques.

120402702 Computational Methods for Mechanical Engineering (3 cr. hrs.) Prerequisite (-):

Computational methods for solving ordinary and partial differential equations, finite difference for ordinary differential equations, Runge-Kutta, multi-step methods, Corrector-Predictor methods, adaptive methods, finite difference methods for partial differential equations, explicit method, implicit method, Crank-Nickilson method, alternating direction implicit method (ADI), Finite element method, Rayleigh-Ritz method, Galerkian method, finite element for ordinary differential equations, finite element for elliptic, and hyperbolic partial differential equation.

120402703 Advanced Measurements (2 cr. hrs.) Prerequisite (-):

Generalized performance characteristics of instruments, principles of electromechanical transducers, study of circuit and recording instrument characteristics, introduction to digital data systems, data acquisition systems, and applications to measurement of quantities such as strain, force, temperature, flow, acceleration, and others, Non testing destructive for Mechanical Engineering.

120402721 Advanced Thermodynamics (3 cr. hrs.) Prerequisite (-):

Principles of kinetic theory, classical and statistical mechanics applied to thermodynamic systems, statistical interpretation of equilibrium state and thermodynamics of engineering systems. Legendre transformation and thermodynamic potentials. Maxwell relations, stability of thermodynamic systems, introduction to irreversible thermodynamics.

120402722 Advanced Heat Transfer (3 cr. hrs.) Prerequisite (120402701):

Formulation of conductive and convective heat transfer equations and boundary conditions for of linear and nonlinear heat transfer problems. Conduction topics include: conduction with energy generation, conduction in non-stationary systems, phase transformation. Convective heat transfer topics include: conservation equations for mass, momentum and energy, boundary layer approximations, laminar and turbulent convection heat transfer, exact and approximate solution techniques and numerical techniques for solving convective heat transfer problems. Introduction to radiation.

120402723 Power Plant Technology (3 cr. hrs.), prerequisite (120402721):

World power statistics, Load demand, Economics of power production, Series impedance of Transmission Lines, capacitance of transmission lines, Current and voltage Relations on a transmission line, System modeling. Network calculations, Load-flow Solutions and control, Power plants thermodynamics, Components of Rankine power plants, Heat transfer in boiler components, Two phase flow calculations, Air circulation, Stack design, Steam turbine design, Gas turbines, Diesel generators, Combined systems, Co-generation systems.

120402732 Micro-Electro Mechanical Systems (3 cr. hrs.) Prerequisite (-):

Introduction to Nanotechnology, Microtechnology and MEMS, applications and markets, scaling of micromechanical devices, mechanical properties of MEMS materials, Silicon material systems, flow physics, liquid flows in microchannels, molecular-based microfluidic simulation models, fundamentals of control theory, model-based flow control for distributed architectures, soft computing in control, materials for microelectromechanical systems, MEMS fabrication, LIGA and other replication techniques, x-ray based fabrication, packaging MEMS, Application of MEMS.

120402761 Energy Management (3 cr. hrs.) Prerequisite (-):

The Issue of Energy, Energy Crisis, Energy system analysis, Energy Conservation Measures, Methods of evaluating system efficiency, Conducting energy audits, Energy accounting and analysis, Maintenance and energy audits, Self evaluation checklists, Life cycle analysis, Energy economics, Reporting and controlling, computer software of energy management, Case studies.

120402762 Solar Energy Engineering (3 cr. hrs.), Prerequisite (-):

Solar angles, Solar radiation measurements and calculations, Design of low and moderate temperature Solar water heaters, Solar assisted heat pump, High temperature solar concentrators and receivers, Solar electric generation systems, Industrial solar water heating, Thermal storage simulation, Solar tracking techniques, Solar desalination systems, Photovoltaic (solar cell) performance, Photovoltaic systems, Off grid and grid connected PV systems, Storage battery, Long term performance of solar systems, Economics of solar energy engineering.

120402763 Energy and Environment (3 cr. hrs.) Prerequisite (-):

Effects of power generation and energy utilization on ecology and climate, Transport of pollutants in air, water and ground, Emission control technologies, Hazardous waste management, Recycling, Global and regional energy situation and scenarios for the future, Sustainable development issues, Environmental legislation, Development of environmental standards, Environmental accounting and reporting, Environmental ethics, Environmental impact assessment, Case studies.

120402764 Renewable Energy Technology (3 cr. hrs.) Prerequisite (-):

Solar thermal systems, PV systems, oil shale, Biomass technology, Fuel cells, Hydroelectricity, Tidal power, Wind energy, Wave energy, Geothermal energy, Integration of renewable energy systems, Economics of renewable energy systems.

120402795 Seminar (1 cr. hr.) Prerequisite (-):

Presentations given by students, professors, and invited speaker, term paper must be presented by students.

0402799 Master Thesis (9 cr. hrs.) Prerequisite (-)