

**WASHINGTON UNIVERSITY**  
**DEPARTMENT OF MECHANICAL, AEROSPACE, & STRUCTURAL ENGINEERING**  
**MASTER OF SCIENCE DEGREE COURSE OPTION**  
**(Revised 11/5/09)**

The Department offers the Master of Science degree in Mechanical or Aerospace Engineering without thesis. The quantitative requirement for the degree is 30 credit hours (normally 10 courses) completed with a grade-point average of 2.75 or better. Course programs may be composed in any one of five areas of specialization: applied mechanics, dynamics/mechanical design, fluid dynamics/thermal sciences, solid mechanics/materials science, energy conversion and efficiency, or aerospace engineering (for the AE degree). They must conform to the following distribution:

<i>Applied Mathematics</i>	<i>6 credits</i>
<i>Area of Specialization</i>	<i>15 credits</i>
<i>Electives</i>	<i>9 credits</i>

Elective courses may be used to accumulate additional credits in the chosen area of technical specialization in other areas of engineering or in mathematics. A maximum of 3 credits of Independent Study, MASE 500, may be included as an elective course. A maximum of 6 units of 400-level courses (not required for MASE undergraduate degree) may also be included. Non-engineering courses (such as Engineering Policy Courses in business-related areas such as finance and entrepreneurship) cannot be counted as engineering electives.

Degree candidates will plan their course programs with the help of a departmental advisor. Given below are partial listings of courses recommended for satisfaction of distribution requirements in mathematics and each of the available areas of specialization.

**APPLIED MATHEMATICS**

ESE 415	Optimization
ESE 501-502	Methods of Modern Engineering I,II
ESE 517	Partial Differential Equations
ESE 520	Probability and Stochastic Processes
Math 4111	Intro to Analysis
Math 416	Complex Variables
Math 429-430	Linear Algebra, Modern Algebra
Physics 501-502	Theoretical Physics (must know quantum mechanics)
Physics 503-504	Advanced Math Methods for Physicists and Engineers
MASE 5001	Optimization Methods in Engineering
MASE 5510	Finite Element Analysis

**ENGINEERING AREAS OF SPECIALIZATION**

**APPLIED MECHANICS**

MASE 5301	Nonlinear Vibrations
MASE 5302	Theory of Vibrations
MASE 5401	Thermodynamics
MASE 5404	Fracture Mechanics
MASE 5410	Fluid Dynamics I
MASE 5411	Fluid Dynamics II (Fluids I is not a prerequisite)
MASE 5500	Elasticity
MASE 5501	Mechanics of Continua
MASE 5502	Plates and Shells
MASE 5510	Finite Element Analysis
MASE 5520	Advanced Analytical Mechanics

***DYNAMICS/MECHANICAL DESIGN***

ESE 541	Control Systems
MASE 5001	Optimization Methods in Engineering
MASE 5102	Materials Selection
MASE 5301	Nonlinear Vibrations
MASE 5302	Theory of Vibrations
MASE 5500	Elasticity
MASE 5502	Plates and Shells
MASE 5503	Structural Stability
MASE 5504	Fracture Mechanics
MASE 5510	Finite Element Analysis
MASE 5512	Composite Structures
MASE 5513	Computational Structural Mechanics
MASE 5520	Advanced Analytical Mechanics
MASE 5605	Mechanical Behavior of Composite Materials
MASE 5703	Analysis of Rotary-Wing Systems
MASE 5704	Aerospace Structures
MASE 5705	Wind Energy Systems
MASE 5801-5802	Micro-Electrical Mechanical Systems I, II
MASE 5803	Topics in Nanotechnology

***FLUIDS/THERMAL SCIENCES MECHANICS***

MASE 4401	Combustion and Environment
MASE 5401	Thermodynamics
MASE 5402	Radiation Heat Transfer
MASE 5403	Conduction and Convection Heat Transfer
MASE 5404	Combustion Phenomenon
MASE 5410	Fluid Dynamics I
MASE 5411	Fluid Dynamics II (Fluids I is not a prerequisite)
MASE 5412	Computational Fluid Dynamics
MASE 5700	Aerodynamics
MASE 5701	Aerospace Propulsion
MASE 5705	Wind Energy Systems
MASE 5801-5802	Micro-Electrical Mechanical Systems I, II
MASE 5803	Topics in Nanotechnology

***SOLID MECHANICS/MATERIALS SCIENCE***

MASE 5102	Materials Selection
MASE 5500	Elasticity
MASE 5501	Mechanics of Continua
MASE 5502	Plates and Shells
MASE 5503	Structural Stability
MASE 5504	Fracture Mechanics
MASE 5510	Finite Element Analysis
MASE 5512	Composite Structures
MASE 5513	Computational Structural Mechanics
MASE 5601	Mechanical Behavior of Materials
MASE 5602	Non-Metallics
MASE 5603-5604	Materials Characterization I and II
MASE 5605	Mechanical Behavior of Composite Materials
MASE 5704	Aerospace Structures
MASE 5801-5802	Micro-Electrical Mechanical Systems I, II
MASE 5803	Topics in Nanotechnology

## **AEROSPACE ENGINEERING**

ESE 541	Control Systems
MASE 5102	Materials Selection
MASE 5301	Nonlinear Vibrations
MASE 5302	Theory of Vibrations
MASE 5401	Thermodynamics
MASE 5402	Radiation Heat Transfer
MASE 5403	Conduction and Convection Heat Transfer
MASE 5410	Fluid Dynamics I
MASE 5411	Fluid Dynamics II (Fluids I is not a prerequisite)
MASE 5412	Computational Fluid Dynamics
MASE 5500	Elasticity
MASE 5502	Plates and Shells
MASE 5503	Structural Stability
MASE 5504	Fracture Mechanics
MASE 5510	Finite Element Analysis
MASE 5512	Composite Structures
MASE 5605	Mechanical Behavior of Composite Materials
MASE 5700	Aerodynamics
MASE 5701	Aerospace Propulsion
MASE 5703	Analysis of Rotary-Wing Systems
MASE 5704	Aerospace Structures
MASE 5705	Wind Energy Systems

## **ENERGY CONVERSION AND EFFICIENCY**

The curriculum is designed to provide mechanical engineering skills in energy applications, renewable energy, and the technologies that improve energy conversion and efficiency. The quantitative requirement for the degree is 30 credit hours completed with a GPA of 2.75 or better. The course program must conform to the following distribution:

Area of specialization	15 credits
Electives (graduate level engineering or math)	9 credits
Energy Analysis & Design Project or Thesis	6 credits

Courses from which one must choose 15 units of specialization (any 5 courses)

ME 541/542	Thermal Systems Analysis and Design I & II
MASE 5420/5421	HVAC Analysis and Design I & II
ME 580	Building Environmental Systems Parameters
MASE 5422	Solar Energy Thermal Processes I
MASE 5423	Solar Energy Thermal Processes II
MASE 5404	Combustion Phenomenon
MASE 5101	Fluid Power Systems
MASE 5401	General Thermodynamics
MASE 5402	Radiation Heat Transfer
MASE 5403	Conduction and Convection Heat Transfer
MASE 5410	Fluid Dynamics I
MASE 5412	Computational Fluid Dynamics
MASE 5705	Wind Energy Systems