

## **MSME in Dynamics and Vibration**

The dynamics and vibration track provides the engineering and scientific foundation for the analysis and design of machines and structures for their movement and vibration. Dynamics is the description of motion and the study of motion that results from applied forces and constraints. Vibration is the special case of the dynamics of oscillatory motion or sound.

### **MS Track for Dynamics and Vibration**

The MSME degree program for dynamics and vibration is based on the fundamental course work offered through the Department of Mechanical Engineering (ME). This sequence of courses includes those below, with a choice between the last two depending on the odd/even year.

ME 860	Theory of Vibration	Fall (every year)
ME 861	Advanced Dynamics	Spring (every year)
ME 863	Nonlinear Vibrations	Spring (even years)
ME 961	Nonlinear Dynamics and Chaos	Spring (odd years)

The systems-oriented student may wish to include ME/ECE 851 (Linear Systems and Control), and a follow-up controls course, or ME 855 (Data Acquisition). The mechanics-oriented student may wish to include ME 820 (Continuum Mechanics), ME 825 (Experimental Mechanics), or ME 872 (Finite Element Analysis).

### **Graduate Course and Research Topics**

#### Dynamics:

Kinematics in two and three dimensions, Newton's equations of motion, energy methods for deriving equations of motion, Hamilton's principle, Hamiltonian systems, particle and rigid body dynamics. (Shaw, Haddow, Feeny)

#### Vibration:

Mathematical modeling of vibration systems using the principles of dynamics; free vibration with linear and Coulomb damping, harmonically forced vibration, suddenly forced vibration, and randomly excited vibration; single and multiple degrees of freedom, modal analysis, proportional and general damping; distributed parameter systems and reduced order modeling; nonlinear resonances, modal interactions, parametric excitation and self excited systems; perturbation methods and bifurcation theory; symbol dynamics and chaos. (Shaw, Haddow, Feeny)

## Typical M.S. Thesis Program

in

## Dynamics and Vibration

Fall Arrival

Fall Semester: 9 cr

ME 800	Engineering Analysis	3 cr
ME 860	Theory of Vibration	3 cr
(1) course from the list below		3 cr
ME 820	Continuum Mechanics	
ME/ECE 851	Linear Systems and Control	

Spring Semester: 9cr

ME 861	Advanced Dynamics	3 cr
(1) course from the list of courses below		3 cr
ME 863	Nonlinear Vibrations	
ME 961	Nonlinear Dynamics and Chaos	
(1) course from the list of courses below		3 cr
ME 825	Experimental Mechanics	
ME 855	Data Acquisition	
ME 809	Finite Element Analysis	
or other 400, 800 or 900 level courses inside or outside Mechanical Engineering		

Summer: 6 cr

ME 899	Master's Thesis Research	6 cr
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Fall Semester: 6 cr

ME 8xx	Breadth Course (see list below)	3 cr
ME 8xx	Breadth Course	3 cr

TOTAL 30 credits

### Breadth Course Requirement:

In addition to ECE/ME 851: Linear Systems and Control, each student must take course from at least two (2) of the three (3) areas below.

Solid and Structural Mechanics:	ME 820, ME 828
Fluid Mechanics:	ME 830
Thermal Sciences:	ME 802, ME 812, ME 814

## Typical M.S. Thesis Program

**in**

## Dynamics and Vibration

Spring Arrival

Spring Semester: 9cr

ME 861	Advanced Dynamics	3 cr
ME 814	Convective Heat Transfer (Breadth course)	3 cr
	(1) course from the list of courses below	3 cr
ME 825	Experimental Mechanics	
ME 855	Data Acquisition	
ME 809	Finite Element Analysis	
	or other 400, 800 or 900 level courses inside or outside Mechanical Engineering	

Fall Semester: 9 cr

ME 800	Engineering Analysis	3 cr
ME 860	Theory of Vibration	3 cr
ME 8xx	Breadth Course (see list below)	3 cr

Summer: 6 cr

ME 899	Master's Thesis Research	6 cr
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Spring Semester: 6 cr

	(1) course from the list of courses below	3 cr
ME 863	Nonlinear Vibrations	
ME 961	Nonlinear Dynamics and Chaos	
	(1) Elective: 400, 800 or 900 level courses inside or outside ME	3 cr

TOTAL	30 credits
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Fluid Mechanics:	ME 830
Thermal Sciences:	ME 802, ME 812, ME 814