



COLUMBIA | ENGINEERING

The Fu Foundation School of Engineering and Applied Science

MECHANICAL ENGINEERING

The Master of Science degree in Mechanical Engineering allows a student to develop a course of study tailored to his or her interests and objectives. Students may construct their own sequence of courses (referred to as the Standard Track), or choose courses from predefined concentrations, such as the Energy Systems, Biomechanics, Micro/Nanoscale Engineering, or Robotics and Control. In general, attainment of the degree requires two to three semesters of full-time study, although it may also be undertaken on a part-time basis over a correspondingly longer period (international students must enroll full-time except in the third semester).

M.S Degree in Mechanical Engineering

The program leading to the Master of Science degree in mechanical engineering requires completion of a minimum of 30 points of approved coursework consisting of no fewer than ten courses. Research (MS projects or MS thesis) is not required for the MS requirements but is valuable, and could be taken for up to 6 credits over two semesters. A thesis based on either experimental, computational, or analytical research is also optional and may be taken for up to 6 credits. In general, attainment of the degree requires one academic year of full-time study, although it may also be undertaken on a part-time basis over a correspondingly longer period.

The Master of Science concentrations are:

- Energy Systems Engineering Mechanics
- Biomechanics
- Micro/Nanoscale Engineering
- Mechanical Engineering with Specialization in Robotics and Control

M.S. in Mechanical Engineering with concentration in Energy Systems

The concentration in energy systems provides the M.S. candidate with a global understanding of current energy challenges. Advanced thermofluidic knowledge is provided to design and optimize energy systems, with a strong emphasis on renewable energies. Courses related to energy and environmental policy, two strong areas of Columbia as a global university, can be integrated into the course sequence. This specialization is a suitable preparation for careers in energy production and energy consultation.

- MECE E4210:** Energy infrastructure planning
- MECE E4211:** Energy: sources and conversion
- MECE E4302:** Advanced thermodynamics
- MECE E4304:** Turbomachinery
- MECE E4305:** Mechanics and thermodynamics propulsion
- MECE E4312:** Solar thermal engineering
- MECE E4314:** Energy dynamics of green buildings
- MECE E4320:** Intro to combustion
- MECE E4330:** Thermofluid systems design
- MECE E6100:** Advanced mechanics of fluids

M.S. in Mechanical Engineering with concentration in Biomechanics

The concentration in Biomechanics is developed with the Department of Biomedical Engineering and provides the M.S. candidate with knowledge of the mechanics of biological tissues. The 4000-level courses offered in this concentration provide foundations of fluid and solid mechanics applicable to biomechanics, as well as applications of mechanics to specific cell, tissue, and organ systems. The higher-level courses provide deeper foundations on theoretical and computational

approaches relevant to biomechanics. This concentration is a suitable preparation for careers in the biomedical devices industry or engineering and scientific consulting

- MEBM E4703:** Molecular mechanics in biology
- MEBM E4710:** Morphogenesis: shape and structure in biological materials
- MECE E4100:** Mechanics of fluids
- MECE E6100:** Advanced mechanics of fluids
- MECE E6106:** FEM for fluid-flow and fluid-structure interactions
- MECE E6310-6311:** Mixture theories for biological tissues I and II
- MECE E6422-6423:** Introduction to the theory of elasticity I and II
- MECE E8501:** Advanced continuum biomechanics

When offered by the Biomedical Engineering dept, the following courses may also count towards the Biomechanics concentration

- BMEN E4301:** Structure, mechanics, and adaptation of bone
- BMEN E4302:** Biomechanics of musculoskeletal soft tissues
- BMEN E4305:** Cardiac mechanics
- BMEN E4310:** Solid biomechanics
- BMEN E4320:** Fluid biomechanics
- BMEN E4340:** Biomechanics of cells
- BMEN E4350:** Biomechanics of developmental biology
- BMEN E4570:** Science and engineering of body fluids
- BMEN E4750:** Sound and hearing
- BMEN E6301:** Modeling of biological tissues with finite

elements

BMME E4702: Advanced musculoskeletal biomechanics

M.S. in Mechanical Engineering with concentration in Micro/Nanoscale Engineering

The concentration in micro/nanoscale engineering provides the M.S. candidate with an understanding of engineering challenges and opportunities in micro- and nanoscale systems. The curriculum addresses fundamental issues of mechanics, fluid mechanics, optics, heat transfer, and manufacturing at small-size scales. Application areas include MEMS, bio-MEMS, microfluidics, thermal systems, and carbon nanostructures.

MECE E4212: Microelectromechanical systems

MECE E4213: BioMEMS

MECE E6105: Transport phenomena in the presence of interfaces

MECE E6700: Carbon nanotubes

MECE E6710: Nanofabrication laboratory

MECE E6720: Nano/microscale thermal transport

processes

MECE E8990: Small scale mechanical behavior

ELEN E4503: Sensors, actuators, and electromechanical

systems

ELEN E6945: Device nanofabrication

BMEN E4590: BioMEMS: cellular and molecular

M.S. in Mechanical Engineering with concentration in Robotics and Control

The field of robotics is seeing unprecedented growth, in areas as diverse as manufacturing, logistics, transportation, health care, space exploration, and more. This program prepares

students for a career in robotics and its many applications in society. Students perform in-depth study of topics such as robotic manipulation, navigation, perception, human interaction, medical robotics, assistance and rehabilitation.

MEBM E4439: Modeling & id of dynamic system

MECE E4058: Mechanics and embedded microcomputer control

MECS E4510: Design Automation

MECE E4601: Digital control systems

MECE E4602: Intro to robotics

MECE E4606: Digital manufacturing

MECE E4611: Robotics Studio

MECE E4601: Digital Control Systems

MECE E6601: Intro to control theory

MECEE6400: Advanced machine dynamics

EEMEE6602: Intro to control theory

MECEE6400: Advanced machine dynamics

EEME E6610: Optimal control theory

ELEN E4610: Digital Signal Processing

BMMEE4440: Physiological Controls

BMME E4702: Advanced Musculoskeletal Biomechanics

MEBM E4439: Modelling & System Identification

When Offered By the CS Dept, the following courses may be used to satisfy the robotics requirements:

COMSE4731: Computer Vision

COMS E4733: Computational Aspects of Robotics

COMSE6733: 3-D Photography



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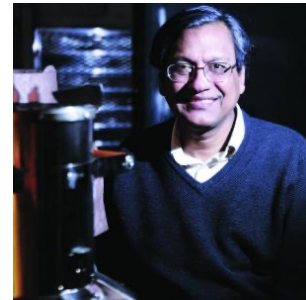
Mechanical Engineering Faculty



Jeffrey Kysar
Professor



Y. Lawrence Yao
Professor



Vijay Modi
Professor



Matei Ciocarlie
Associate Professor



P. James Schuck
Associate Professor



Hod Lipson
Professor



Arvind Narayanaswamy
Associate Professor



Karen Kasza
Assistant Professor



Vijay Modi
Professor