

BME Focus Area: Multiscale Biomechanics

Multiscale biomechanics applies principles of statics, dynamics, and mechanics of solid and fluid materials from nano- to macro-levels. Macro-scale applications include characterizing physiologic systems and disease states and designing medical devices. Micro- and nano-scale applications include measuring the forces cells exert on their environment, as well as nano-technology and lab-on-a-chip applications.

Application Examples

Neuroengineering
Biomolecular, cellular, and tissue engineering
Nano devices
Rehabilitation engineering & devices
Orthopaedics
Medical device design
Biomechatronics
MR/US elastography
Mechanobiology
Musculoskeletal (cartilage, bone, tendon, ligament, muscle, etc.) biomechanics
Injury biomechanics
Cardiac mechanics
Prosthetic & orthotic design
Robotic exoskeletons
Musculoskeletal models
Dynamic simulations and finite element (FE) models
Gait analysis
Sport engineering
BioMEMs
Biofluid mechanics

Company Examples

ABIOMED	Intuitive Surgical
Aesculap	Johnson & Johnson
AMTI	LeMaitre Vascular
AngioDynamics	MEA Forensics
ARCCA	Medtronic
Arthrex	Merit Medical
Aspen Medical Products	NuVasive
ATEC Spine	Orthofix
AxioMed	Oscor
B. Braun Medical	Ossur
Becton Dickinson	Replication Medical Inc.
Bionix	Rimkus
Boston Scientific	Robson Forensic
Bruker	RTI Surgical Holdings
Cell Scale	Scanco
DePuy Synthes	Smith & Nephew
DJO Global	Stryker
Edwards Lifesciences	SynCardia Systems, LLC
Endolite	TA Instruments
Endologix	Terumo
Ethicon (Johnson & Johnson)	Thoratec Corporation
Globus Medical	VICON
Instron	Wright Medical Group
Intellijoint	Zimmer Biomet

Relevant Course Examples

* required in BME curriculum

BMEG 310	*Bioengineering Mechanics I	KAAP 220	Fundamentals of Anatomy and Physiology
BMEG 311	*Bioengineering Mechanics II		Motor Control and Learning
BMEG 340	*Biomedical Modeling and Simulation	KAAP 428	Exercise Physiology
BMEG 440	Attachments in Biology	KAAP 430	Mechanical Engineering Computer-Aided Design
BMEG 441	Biomechanics	MEEG 102	Intro to Microsystems
BMEG 442	Engineering Exercise and Sports	MEEG 451	Manufacturing Processes and Systems
BMEG 444	Microscale Biofluid Mechanics	MEEG 453	Cytomechanics
BMEG 463	Mechanotransduction	MEEG 481	Clinical Biomechanics
BMEG 464	Medical Device Development	MEEG 482	Biomaterials and Tissue Engineering
BMEG 479	Introduction to Medical Imaging Systems	MEEG 484	Cell and Tissue Transport
BMEG 665	Tissue Biomechanics and Modeling	MEEG 486	Nanoscales Materials Laboratory
CIEG 305	Fluid Mechanics	MSEG 402	Experimental Mechanics of Composites
CIEG 401	Introduction to the Finite Element Method	MSEG 410	Degradation and Failure of Materials
CIEG 605	Intermediate Topics in Finite Element Analysis	MSEG 415	

Pathway Examples

Pathways are optional groupings of 6 technical electives (including at least 2 BME) that demonstrate depth and focus in a particular area. Examples below are provided for reference and are not all-inclusive. Be sure to check current course offerings, approved technical electives, and pre-requisites (all subject to change).

<i>Path 1: Micro-Mechanics</i>	
BMEG 440	Attachments in Biology
BMEG 444	Microscale Biofluid Mechanics
BMEG 463	Mechanotransduction
MEEG 451	Intro to Microsystems
MEEG 481	Cytomechanics
MEEG 486	Cell and Tissue Transport

<i>Path 2: Macro-Mechanics</i>	
BMEG 441	Biomechanics
BMEG 464	Medical Device Development
BMEG 479	Introduction to Medical Imaging Systems
KAAP 220	Fundamentals of Anatomy and Physiology
MEEG 482	Clinical Biomechanics
MSEG 410	Experimental Mechanics of Composites

<i>Path 3: Multi-Scale Biomechanical Design and Manufacturing</i>	
BMEG 441	Biomechanics
BMEG 464	Medical Device Development
MEEG 102	Mechanical Engineering Computer-Aided Design
MEEG 451	Intro to Microsystems
MEEG 453	Manufacturing Processes and Systems
MSEG 402	Nanoscales Materials Laboratory

Other Curricular Enhancements

- Biomechanical Engineering Minor
- RSO: Assistive Medical Technologies
- RSO: Orthotics & Prosthetics Club