

# Mechanical Engineering

## *Elective Focus Area (EFA)*

### **Bio-Engineering**

Bio-engineering is a growing area of engineering research and development. Mechanical engineers can significantly contribute to the biomedical area due to the broad reach of the mechanical engineering curriculum. Several systems in the human body involve phenomena, such as fluid, heat and mass transport, material response to deformation, dynamics and kinematics of moving parts etc. where the expertise of mechanical engineers can be invaluable in design, analysis and therapeutics. Specific areas of current and potential application of mechanical engineering principles include cardiovascular biomechanics, biomaterials processing, manufacture and design of implants, stents, valves, vascular shunts and other therapeutic devices, medical imaging and simulation, ergonomics, bio-measurements and instrumentation, thermal control of bio-environments and others. Three possible tracks are:

1. **Solids Track:** Fundamentals of biomedical engineering with solid mechanical theory, modeling and computations. Mechanics of bone and soft tissue, strength and other properties of manufactured biomaterials, including composites and polymers.
2. **Fluid Track:** Biomedical engineering phenomena with flow, heat and mass transport. Applications include cardiovascular and pulmonary transport. Methods for analysis of phenomena in several human systems in order to fight diseases, such as heart ailments, strokes, aneurysms etc.
3. **Biomechanics Track:** Applications of the principles of mechanical engineering to the study of human motion in terms of kinematics and dynamics. Phenomena underlying the fields of ergonomics and haptics are introduced.

Semester	Course	Session	SH	Pre-/Co-Requisites
4 (Spring)	2:010 Principles of Biology I	F,S	4	4:011
5 (Fall)	4:012 Principles of Chemistry II	F,S	4	4:011
6 (Spring)	27:130 Human Physiology	F,S	3	none
6 (Spring)	51:130 Introduction to Genetics and Quantitative Physiology	S	1	27:130
7 (Fall)	Elective		3	
7 (Fall)	Elective		3	
8 (Spring)	Elective		3	
8 (Spring)	Elective		3	

Elective Courses	SH	Pre-/Co-Requisites	Emphasis
51:155 Cardiovascular Biomechanics	3	57:019,57:020,27:130	Fluids Track
58:143 Computational Fluid & Thermal Engineering	3	58:045	Fluids Track
58:159 Fracture Mechanics	3		Solids Track
58:170 (or 51:177) Composite Materials	3		Solids Track
58:115 Finite Element I	3	22M:041,57:019	Solids Track
51:070 Biomaterials I	3	27:130	Fluids/ Solids Track
02:011 Biology II	4	2:010,4:013	Fluids/ Solids Track
51:030 Biomedical Engineering Fundamentals	2	2:010, 57:007	All Tracks
51:050 Biomechanics	3	22M:042, 57:007,27:130	Biomechanics/Solids Track
27:197 Biomechanics of Human Motion	4	None listed	Biomechanics Track
58:154 Intermediate Kinematics and Dynamics	3	57:010, /58:052	Biomechanics Track
27:150 Gross anatomy for exercise science	2	None listed	Biomechanics Track

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