# **M.S. IN SPORTS ENGINEERING**

### **Overview**

The Master of Science in Sports Engineering program is designed to provide students with a robust foundation in engineering principles and their application to the sports and human performance sectors. This program integrates advanced mechanical and bioengineering techniques with a focus on the unique challenges of sports technology, biomechanics, and sports equipment design. Graduates will be equipped to address the growing demand for engineering expertise in both industry and academia, focusing on the development and evaluation of technologies that enhance athletic performance, reduce injury risk, and promote long-term health.

The curriculum is designed to prepare students for immediate entry into the sports technology industry. Courses cover topics such as sports equipment materials and manufacturing, data acquisition, real-time performance analysis, and product testing, giving students the practical skills to address real-world challenges faced by companies specializing in sports equipment, performance wearables, and biomechanics.

For students interested in pursuing careers in academia or research, the program emphasizes scientific research methods, computational biomechanics, and experimental design. Opportunities to work on faculty-led projects, contribute to peer-reviewed publications, and present at international conferences prepare students for advanced doctoral studies or research-based careers.

## **Admission Requirements**

A bachelor's degree in a STEM related field from a regionally accredited institution.

### **Curriculum Requirements**

- 1. One academic year, or equivalent, spent in full time graduate study will be the minimum time necessary for a student to fulfill the requirements for the degree of Master of Science in Sports Engineering.
- 2. The student is required to complete only graduate-level courses, 600-level or 700-level, to fulfill the course requirement.
- 3. Both a 30 credit hour thesis option and a 30 credit hour non-thesis option are available.
- 4. M.S. with Thesis Option: The student is required to complete 24 credits of course work and 6 credits of thesis in their chosen area of specialization. The thesis involves research-type work completed under the supervision or guidance of a faculty advisor. At the completion of the thesis, the student is required to write a thesis and make an acceptable oral presentation of the thesis before a committee of three faculty members that includes the faculty thesis advisor as the Chair of the committee. The faculty advisor is required to be from the Department of Mechanical and Aerospace Engineering or the Department of Kinesiology.
- 5. **M.S. with Non-Thesis Option:** The student is required to complete 27 credits of course work and 3 credits of an independent project in an area of his/her interest under the supervision of a faculty advisor. The faculty advisor should be from the College of Engineering or the Department of Kinesiology. After completing the project, the student is required to submit a project report to the faculty advisor and also make an oral presentation of the project before two faculty members, including the faculty advisor. The student will receive a grade for the project. The independent project credits do not count toward the required minimum of two 700-level courses to be completed as part of the total expected credits of coursework required in their chosen option.

### **Curriculum Requirements: Thesis Option**

Code	Title	Credit Hours
Core Courses (take all 3)		
NEW COURSE: MAE 686 Introduction to Sports Engine	ering	3
NEW COURSE: MAE 687 Materials in Sports Equipmen	t	3
KIN 735	Methods in Biomechanical Analysis	3
Physiology (choose 1-2)		3-6
BME 601	Biochemistry and Cellular Physiology for Engineers	
BME 602	Human Physiology for Engineers	
BME 603	Neurophysiology for Engineers	
KIN 621	Advanced Systemic Exercise Physiology	
KIN 630	Cellular Exercise Physiology	
KIN 631	Laboratory Techniques in Functional Evaluation of Skeletal Muscle	
KIN 740	Neurophysiology in Exercise Science	
Electives (choose 2-3)		6-9
Materials		
MAE 607	Advanced Mechanics of Solids	
MAE 616	Introduction to Composite Materials	

Manufacturing		
MAE 605	Design for Manufacturability	
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	
MAE 632	Additive Manufacturing of Engineering Materials	
MAE 733	Additive Manufacturing Lab	
ISE 601	Manufacturing Analysis and Design I	
ISE 602	Manufacturing Analysis and Design II	
ISE 657	Ergonomics and Human Factors Engineering	
Engineering Techniques		
BME 620	Medical Imaging Systems: X-ray and CT	
BME 621	Medical Imaging Systems: MRI, NMI and Ultrasound	
BME 640	Microcomputer-Based Medical Instrumentation	
BME 670	Advanced Biomedical Signal Processing	
BME 687	Finite Element Analysis for Engineers	
EGN 623	Advanced Computing for Engineers	
ECE 638	Introduction to Digital Image Processing	
ISE 616	Introduction to Applied Data Analytics	
ISE 712	Design of Experiments	
KIN 657	Diagnostic Imaging Techniques in Sports Medicine	
Management		
ISE 670	Engineering Management	
ISE 671	Engineering Entrepreneurship	
ISE 672	Management of Technological Innovation	
Research and Clinical Rotations		
BME 725	Special Problems	1
MAE 651	Special Problems	1
KIN 690	Special Topics in Kinesiology and Sport Sciences	1
Thesis Option		
MAE 810	Master's Thesis	6
Total Credit Hours		30

# **Curriculum Requirements: Non-Thesis Option**

Code	Title	Credit Hours
Core Courses		
NEW COURSE: MAE 686 Introduction to Sports Engineering		3
NEW COURSE: MAE 687 Materials in Sports Equipment		3
KIN 735	Methods in Biomechanical Analysis	3
Physiology (choose 1-2)		3-6
BME 601	Biochemistry and Cellular Physiology for Engineers	
BME 602	Human Physiology for Engineers	
BME 603	Neurophysiology for Engineers	
KIN 621	Advanced Systemic Exercise Physiology	
KIN 630	Cellular Exercise Physiology	
KIN 631	Laboratory Techniques in Functional Evaluation of Skeletal Muscle	
KIN 740	Neurophysiology in Exercise Science	
Electives (choose 3-4)		9-12
Materials		
MAE 607	Advanced Mechanics of Solids	
MAE 616	Introduction to Composite Materials	
Manufacturing		
MAE 605	Design for Manufacturability	
MAE 631	Scientific and Engineering Foundations of Additive Manufacturing	

MAE 632	Additive Manufacturing of Engineering Materials	
MAE 733	Additive Manufacturing Lab	
ISE 601	Manufacturing Analysis and Design I	
ISE 602	Manufacturing Analysis and Design II	
ISE 657	Ergonomics and Human Factors Engineering	
Engineering Techniques		
BME 620	Medical Imaging Systems: X-ray and CT	
BME 621	Medical Imaging Systems: MRI, NMI and Ultrasound	
BME 640	Microcomputer-Based Medical Instrumentation	
BME 670	Advanced Biomedical Signal Processing	
BME 687	Finite Element Analysis for Engineers	
EGN 623	Advanced Computing for Engineers	
ECE 638	Introduction to Digital Image Processing	
ISE 616	Introduction to Applied Data Analytics	
ISE 712	Design of Experiments	
KIN 657	Diagnostic Imaging Techniques in Sports Medicine	
Management		
ISE 670	Engineering Management	
ISE 671	Engineering Entrepreneurship	
ISE 672	Management of Technological Innovation	
Non-Thesis Option		
Research and Clinical Rotations		
BME 725	Special Problems	1
MAE 651	Special Problems	1
KIN 690	Special Topics in Kinesiology and Sport Sciences	1
MAE 751	Master's Project	3
Total Credit Hours		30

# Sample Plan of Study: Thesis Option

Year One		
Fall		Credit Hours
MAE 686 Introduction to Sports Engineering		3
KIN 735	Methods in Biomechanical Analysis	3
Physiology Course		3
Research rotation		3
	Credit Hours	12
Spring		
MAE 687 Materials in Sports Equipment		3
MAE 810		3
Elective		3
	Credit Hours	9
Year Two		
Fall		
MAE 810	Master's Thesis	3
Elective		3
Elective		3
	Credit Hours	9
	Total Credit Hours	30

### Sample Plan of Study: Non-Thesis Option

Year One		
Fall		Credit Hours
MAE 686 Sports Engineering and Entrepreneurship		3
KIN 735	Methods in Biomechanical Analysis	3
Physiology Course		3
Research rotation		3
	Credit Hours	12
Spring		
MAE 687 Materials in Sports Equipment		3
Elective		3
Elective		3
	Credit Hours	9
Year Two		
Fall		
MAE 751	Master's Project	3
Elective		3
Elective		3
	Credit Hours	9
	Total Credit Hours	30

### Mission

The mission of the graduate program is to prepare students to become knowledgeable and skilled engineers and researchers with an understanding of the ethical and other professional aspects of sports engineering.

#### Goals

The goal of the M.S. program in Sports Engineering is to prepare students for successful careers in industry, academia, or government, or for further study in doctoral or other engineering-related programs. The educational objective of the program is to graduate engineers with advanced skills and knowledge in sports engineering and to train, motivate, and inspire our graduates to become leaders in their fields.

#### **Student Learning Outcomes**

- · Students will demonstrate competence in the theoretical and practical knowledge of sports engineering.
- · Students will demonstrate the ability to effectively communicate the results of their scientific research in writing and in oral presentations.
- Students will demonstrate the ability to think critically in learning and/or research.