

Program Request - Abbreviated Template
University of Utah
Mechanical Engineering Emphases
02/14/2012

Section I: Request

The Department of Mechanical Engineering at the University of Utah proposes the following elective emphases be entered on BS in Mechanical Engineering (BSME) transcripts: Aerospace Engineering, Biomechanics, Design and Manufacturing, Dynamics and Control, Ergonomics and Safety, Fluid Mechanics, Mechatronics, Micro/Nanoscale Engineering, Modeling, Robotics and Control, Solid Mechanics, and Thermal Science and Energy Engineering.

General Program and Emphasis Requirements

University of Utah BSME students take 92 credits of foundational coursework in mathematics, basic science and engineering science (a complete program of study is included at the end of this proposal). In addition, students take four technical elective courses (12 credits total) during the junior and senior years.

Students wishing to complete an emphasis will choose three (of four required) technical electives to satisfy the requirements of a particular emphasis. The technical elective course requirements for each of the proposed emphases are outlined below. In addition to acknowledging specialization, the BSME emphases are intended to indicate high academic achievement in the area of specialization. To that end, students must earn (1) a 3.3 GPA (B+ average) for the three technical electives within the emphasis and (2) a minimum grade of B in each of the three courses. A student will only be allowed to list one BSME emphasis on his/her transcript.

All BSME students will continue to take the same foundational coursework and will be required to satisfy the existing technical elective requirements (e.g., 6 of the 12 technical elective credits must be ME EN courses; approved non-ME EN courses include all 5xxx courses in the College of Engineering and specific Math and Physics courses). Students electing not to pursue an emphasis may choose any set of four technical electives that satisfy these general departmental requirements.

Course Requirements for Proposed BSME Emphases

1. Aerospace Engineering

- Choose one of the following:
 - ME EN 5710 Aerodynamics
 - ME EN 5830 Aerospace Propulsion
- Choose one of the following:
 - ME EN 5300 Advanced Strength of Materials
 - ME EN 5500 Engineering Elasticity
 - ME EN 5510 Introduction to Finite Elements
 - ME EN 5520 Mechanics of Composite Materials
- Choose one of the following:
 - ME EN 5400 Vibrations
 - ME EN 5410 Intermediate Dynamics

2. Biomechanics

- Required: ME EN 5300 Advanced Strength of Materials
- Required: BIOEN 5201 Introduction to Biomechanics
- Choose one of the following:
 - ME EN 5100 Ergonomics
 - BIOEN 5101 Bioinstrumentation, Signals and Systems
 - BIOEN 5301 Biomaterials
 - BIOEN 6240 Human Movement Analysis (with permission)

3. Design and Manufacturing

- Choose three of the following:
 - ME EN 5030 Reliability Engineering
 - ME EN 5040 Quality Assurance Engineering
 - ME EN 5050 Fundamentals of Micromachining Processes
 - ME EN 5055 Microsystems Design and Characterization
 - ME EN 5060 Sustainable Products and Processes
 - ME EN 5110 Industrial Safety
 - ME EN 5510 Introduction to Finite Elements
 - ME EN 5960 Nanotribology and Contact Mechanics

4. Dynamics and Control

- Required: ME EN 5200 Classical Control Systems
- Required: ME EN 5205 System Dynamics
- Choose one of the following:
 - ME EN 5210 State Space Control
 - ME EN 5400 Vibrations
 - ME EN 5410 Intermediate Dynamics

5. Ergonomics and Safety

- Required: ME EN 5100 Ergonomics
- Required: Either ME EN 5110 Industrial Safety or ME EN 5120 Human Factors Engineering
- Choose one of the following:
 - ME EN 5030 Reliability Engineering
 - ME EN 5040 Quality Assurance Engineering
 - ME EN 5110 Industrial Safety or ME EN 5120 Human Factors Engineering

6. Fluid Mechanics

- Required: ME EN 5700 Intermediate Fluids
- Choose two of the following:
 - ME EN 5710 Aerodynamics
 - ME EN 5800 Sustainable Energy Engineering
 - ME EN 5810 Thermal System Design
 - ME EN 5830 Aerospace Propulsion
 - ME EN 5960 Microfluidic Chip Design and Fabrication
 - ME EN 6720 Computational Fluid Dynamics (with permission)

7. Mechatronics

- Required: ME EN 5200 Classical Control Systems
- Required: ME EN 5250 Object-Oriented Programming for Interactive Systems
- Choose one of the following:
 - ME EN 5205 System Dynamics
 - ME EN 5240 Advanced Mechatronics
 - ECE 5570 Control of Electric Motors
 - ECE 5780 Embedded Systems Design
 - PHYS 3610 Electronics I
 - PHYS 3620 Electronics II

8. Micro/Nanoscale Engineering

- Required: ME EN 5050 Fundamentals of Micromachining
- Choose two of the following:
 - ME EN 5055 Microsystems Design and Characterization
 - ME EN 5620 Fundamentals of Microscale Engineering
 - ME EN 5960 Nanoscale Heat Transfer
 - ME EN 5960 Nanotribology and Contact Mechanics
 - ME EN 5960 Microfluidics Chip Design and Fabrication
 - ME EN 6960 Microsensors (with permission)
 - ME EN 6960 Microactuators (with permission)
 - ECE 5201 Physics of Nano-Electronic Devices

9. Modeling

- Choose three of the following:
 - ME EN 5205 System Dynamics
 - ME EN 5510 Introduction to Finite Elements
 - ME EN 5810 Thermal System Design
 - ME EN 6720 Computational Fluid Dynamics (with permission)
 - One MATH 5xxx

10. Robotics and Control

- Required: ME EN 5200 Classical Control Systems
- Required: ME EN 5220 Robotics
- Choose one of the following:
 - ME EN 5225 Geometric Motion Planning
 - ME EN 5230 Robot Control

11. Solid Mechanics

- Choose three of the following:
 - ME EN 5300 Advanced Strength of Materials
 - ME EN 5500 Engineering Elasticity
 - ME EN 5510 Introduction to Finite Elements
 - ME EN 5520 Mechanics of Composite Materials
 - ME EN 5530 Introduction to Continuum Mechanics
 - Either ME EN 5400 Vibrations or ME EN 5410 Intermediate Dynamics

12. Thermal Science and Energy Engineering

- Choose three of the following:
 - ME EN 5600 Intermediate Thermo
 - ME EN 5800 Sustainable Energy Engineering
 - ME EN 5810 Thermal System Design
 - ME EN 5820 Thermal Environmental Engineering
 - ME EN 5830 Aerospace Propulsion
 - ME EN 5960 Nanoscale Heat Transfer

Section II: Need

The proposed BSME emphases are expected to attract higher quality undergraduates to the Mechanical Engineering program, promote academic success, and help BSME graduates secure jobs and gain admission to graduate and professional programs.

Mechanical Engineering is the broadest of engineering disciplines, with many possible areas of specialization. Prospective undergraduate students are often unaware of all that Mechanical Engineering encompasses, and select other majors because their interests do not match stereotypical Mechanical Engineering topics. Other prospective students may think they need a degree from a more specialized program (e.g., Aerospace Engineering). The proposed emphases highlight the diversity within the field of Mechanical Engineering and also showcase areas of strength within the Department of Mechanical Engineering at the University of Utah. The implementation of BSME emphases will provide an easy means of advertising the opportunities available in Mechanical Engineering, which will help attract prospective students to the BSME program at the U of U. Students with a general interest in engineering will be attracted by the breadth of choices, while students with more focused interests will be attracted by the opportunity to specialize – and to be recognized for proficiency in that specialization.

The BSME emphases are also expected to benefit students in the program. The emphases clearly define the technical electives that are most aligned with a student's specific interests. The opportunity to receive an emphasis designation on a transcript will encourage students to choose technical electives that are relevant to their career goals instead of choosing "easy" or popular classes, or classes that best fit into their schedules. The GPA and grade requirements of the emphases will also motivate students to excel in their engineering coursework.

Finally, an emphasis designation on a transcript is expected to help a BSME graduate find a job or gain admission to a graduate program in his/her area of interest. The transcript designation is an easy way for employers or admission committees to verify a student's area of specialization. In addition, the GPA and grade requirements for earning an emphasis certify that a student is proficient in the area of specialization, and this will certainly be attractive to both employers and graduate programs.

Section III: Institutional Impact

There will be no impact to the department or institution as the overall BSME degree requirements are unchanged. The implementation of emphases is actually expected to lighten the department's advising load by clearly defining the technical electives that are relevant to a particular area of Mechanical Engineering. Each emphasis has enough course options that any student – regardless of whether they start their upper division coursework in an even or odd academic year – will be able to meet the course requirements of the emphasis with the current frequency of course offerings (i.e., some technical electives are only offered every other year).

Section IV: Finances

There will be no financial impact to the department or institution.

Section VI: Program Curriculum

THIS SECTION OF THE ABBREVIATED TEMPLATE REQUIRED FOR EMPHASES AND MINORS ONLY.

All Program Courses

Course Prefix & Number	Title	Credit Hours
Required Courses		
ME EN 1000	Introduction to Robotic Systems Design I	3
ME EN 1010	Introduction to Robotic Systems Design II	3
ME EN 1300	Statics/Strength of Materials	4
ME EN 2080	Dynamics	4
ME EN 2500	Introduction to Sustainable Energy System Design I	3
ME EN 2510	Introduction to Sustainable Energy System Design II	3
ME EN 2660	Machining Lab	0.5
ME EN 3000	Design of Mechanical Elements	3
ME EN 3200	Mechatronics I	4
ME EN 3210	Mechatronics II	4
ME EN 3300	Strength of Materials	4
ME EN 3600	Thermodynamics	3
ME EN 3650	Heat Transfer	4
ME EN 3700	Fluid Mechanics	4
ME EN 3900	Ethics and Professionalism Seminar	0.5
ME EN 4000	Senior Design I	3
ME EN 4010	Senior Design II	3
ME EN 4060	Manufacturing Practices	3
MATH 1210	Calculus I	4
MATH 1220	Calculus II	4
MATH 2210	Calculus III	3
MATH 2250	ODEs and Linear Algebra	4
MATH 3150	PDEs	2
CHEM 1210	General Chemistry I	4
CHEM 1215	General Chemistry I Lab	1
PHYS 2210	Physics for Scientists and Engineers I	4
PHYS 2220	Physics for Scientists and Engineers II	4
ECE 2210	Electrical Engineering for Non-Majors	3
MSE 2160	Elements of Materials Science and Engineering	3
WRTG 2010	Intermediate Writing	3
Sub-Total		95

Elective Courses		
ME EN 5XXX (or other approved)	Technical Elective	3
ME EN 5XXX (or other approved)	Technical Elective	3
ME EN 5XXX (or other approved)	Technical Elective	3
ME EN 5XXX (or other approved)	Technical Elective	3
ECON 1750, HIST 1700, POLS 1100	American Institutions	3
Approved FF course	Fine Arts	3
Approved FF course	Fine Arts	3
Approved BF course	Social & Behavioral Science	3
Approved BF course	Social & Behavioral Science	3
Approved HF course	Humanities	3
Approved HF course	Humanities	3
Sub-Total		33
Total Number of Credits		128

New Courses to Be Added in the Next Five Years

The proposed emphases do not require the addition of any new courses over the next five years.

Program Schedule

Year One	Fall Semester	
Sub./Cat. #	Course Title	Cr. Hr.
MATH 1210	Calculus I	4
CHEM 1210	Chemistry I	4
CHEM 1215	Chemistry I Lab	1
ME EN 1000	Intro to Robotic Systems Design I	3
WRTG 2010	Intermediate Writing	3
Total Credit Hours		15

Year One	Spring Semester	
Sub./Cat. #	Course Title	Cr. Hr.
Math 1220	Calculus II	4
Phys 2210	Physics I	4
ME EN 1300	Statics/Strengths	4
ME EN 1010	Intro to Robotic Systems Design II	3
Total Credit Hours		15

Year Two	Fall Semester	
Sub./Cat. #	Course Title	Cr. Hr.
Math 2250	ODEs/Linear Algebra	4
Physics 2220	Physics II	4
MSE 2160	Materials Science	3
ME EN 2500	Intro to Sustainable Energy Systems Design I	3
	American Institutions ¹	3
Total Credit Hours		17

Year Two	Spring Semester	
Sub./Cat. #	Course Title	Cr. Hr.
Math 2210	Calculus III	3
ECE 2210	Electrical Eng. w/Lab	3
ME EN 2080	Dynamics	4
ME EN 2510	Intro to Sustainable Energy Systems Design II	3
ME EN 2660	Machining Lab	0.5
	Intellectual Exploration ¹	3
Total Credit Hours		16.5

Year Three Fall Semester		
Sub./Cat. #	Course Title	Cr. Hr.
ME EN 3200	Mechatronics I w/Lab	4
ME EN 3600	Thermodynamics w/Lab	3
ME EN 3700	Fluids w/ Lab	4
ME EN 3300	Strengths II w/Lab	4
ME EN 3900	Professionalism & Ethics Seminar	0.5
Total Credit Hours		15.5

Year Three Spring Semester		
Sub./Cat. #	Course Title	Cr. Hr.
Math 3150	PDEs	2
ME EN 3000	Design of Mechanical Elements	4
ME EN 3210	Mechatronics II w/Lab	4
ME EN 3650	Heat Transfer w/Lab	3
	Technical Elective ¹	3
Total Credit Hours		16

Year Four Fall Semester		
Sub./Cat. #	Course Title	Cr. Hr.
ME EN 4000	4th Yr. Design	3
ME EN 4060	Manufacturing Processes	3
	Technical Elective ¹	3
	2 Intellectual Exploration ¹	6
Total Credit Hours		15

Year Four Spring Semester		
Sub./Cat. #	Course Title	Cr. Hr.
ME EN 4010	4th Yr. Design II	3
	2 Technical Electives ¹	6
	3 Intellectual Exploration ¹	9
Total Credit Hours		18

Overall Total Credit Hours 128

NOTES:

¹ Intellectual Exploration, American Institutions and Technical Elective courses may be taken in any sequence.