

# Curricular Changes in the Mechanical Engineering Program

**Summary:**

The Curriculum Committee approved on May 12, 2004 two new Mechanical Engineering courses: MechEng 110 "*Engineering Fundamentals I*" and MechEng 111 "*Engineering Fundamentals II*". The CEAS faculty approved at the September 24, 2004 meeting these two new mechanical engineering courses. The Curriculum Committee approved on October 6, 2004 using these two new courses to replace EAS-100, MechEng-101, IndEng-101 and IndEng-210; and allowing CS-201 to satisfy CS-151/CS-153

**Rationale:**

It was recognized in 2002, while assessing the mechanical engineering program outcomes, that there was a need to strengthen the outcomes related to design, communications and teamwork in the early part of the mechanical engineering curricula. The existing gap in the early part of the mechanical engineering curriculum is in the area of engineering content in the first year that provides students with preparation in engineering problem solving, design, effective technical communication, and teamwork. These goals can be best addressed in a first year curriculum that is designed to achieve learning outcomes that address these areas and better prepare students for the courses in the mechanical engineering major.

**Impact on the Curriculum:**

A sequence of two courses (MechEng 110 and MechEng 111) was recently approved for the first year in mechanical engineering. This sequence of courses was the result of a series of discussions headed by Associate Dean Venugopalan. These two courses together will address engineering problem solving (tools: Excel and MATLAB), technical communication in oral, written and graphic modes (tools: Word, Excel, PowerPoint, AutoCAD), teamwork in the context of laboratory and other projects, and introduction to engineering design. The outcomes from these two courses will be:

1. Students will be able to use a spreadsheet for engineering calculations, basic statistical analysis, and appropriate presentation of data in tables, graphs and charts.
2. Students will be able to use mathematical analysis software for solving problems and presenting the results in appropriate forms.
3. Students will be able to write acceptable technical reports with a proper structure, correct use of language and grammar, incorporation of figures, charts and tables.

4. Students will be able to deliver acceptable technical presentations with a proper structure, correct use of language and grammar, incorporation of figures, charts and tables.
5. Through experience, students will understand the factors that lead to successful functioning of teams and the roles of each team member.
6. Students will be able to acquire, import and analyze data using computers.
7. Students will be able to visualize and sketch objects in 3-d, understand and generate solid models, orthogonal projections, dimensioning, and assembly drawings.
8. Students will understand the processes and the constraints in engineering design through executing a team design project.

These two courses are designed to teach the concepts, and provide learning experiences related to these outcomes, in an integrated format. For example, gaining proficiency in the use of computers, developing written and oral presentation skills, and learning to function effectively as a team will occur in the context of laboratory exercises and design projects. This integrated format is missing from the sequence of four courses being replaced.

These two new courses are organized in the format of two one-hour lecture sessions and two two-hour laboratory sessions per week. A team of instructors and teaching assistants will facilitate each course.

**Proposed Implementation Plan:**

The first course will be offered in the Spring 2005 semester. These two courses will replace EAS 100, MechEng 101, IndEng 101, IndEng 210. Their placement within the curriculum is shown in the attached proposed curriculum sheet.

**Advantages:**

- These courses afford the opportunity for more consistent achievement of learning outcomes in the early part of the curriculum.
- Students entering the mechanical engineering major will be better prepared
  - in the use of computers for problem solving,
  - in written and oral communication skills,
  - to function as valuable members of interdisciplinary teams,
  - in engineering design practice.
- The engineering content in the first year will potentially increase retention.

**Staffing:**

The primary responsibility for instruction in these two courses will be with the full-time academic staff in the Department (Ted Ressel). In addition, a number of faculty members in the department have expressed an interest in teaching these courses (e.g. Prof. Anoop Dhingra and Prof. Ronald Perez).

# University of Wisconsin – Milwaukee

## College of Engineering and Applied Science

# **MECHANICAL ENGINEERING CURRICULUM (Proposed)**

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Mechanical Engineering is **128** credits. Students who need background preparation courses may need additional credits. See information below regarding placement examinations.

<b>Engineering Core Courses (33 credits)</b>		<b>Credits</b>	<b>Prerequisite</b>
EAS 200	Professional Seminar	0	none
CompSci 151/153	Introduction to Scientific Programming	3	Math 231 (C)
Or CompSci 201	Introduction to Computer Programming	3	Math 105 (P)
Civ Eng 201	Statics	3	Math 232
Civ Eng 202	Dynamics	3	Civ Eng 201, Math 233 (C)
Civ Eng 303	Strength of Materials	4	Civ Eng 201, Math 233 (C)
MatlEng 201	Engineering Materials	4	Chem 102 or 117
ElecEng 301	Electrical Circuits I	3	Physics 210 (C), ElecEng 234(C)
MechEng 110	Engineering Fundamentals I	4	Math 231 (C) or Math 225 (C)
MechEng 111	Engineering Fundamentals II	4	Math 231 (P) or Math 232 (C); Math 225 (P) or Math 226 (C); MechEng 110 (P)
MechEng 301	Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 320	Introduction to Fluid Mechanics	3	Jr St, MechEng 301 (C), ElecEng 234, Civ Eng 202

<b>Mechanical Engineering Major (34 credits)</b>			
MechEng 321	Basic Heat Transfer	4	Jr St, MechEng 301
MechEng 323	Fluid Mechanics Laboratory	1	Jr St, MechEng 320
Matl Eng 330	Materials and Processes in Manufacturing	3	Matl Eng 201
Mech Eng 360	Mechanical Design I	3	Ind Eng 101, CompSci 151/153, Civ Eng 202
Mech Eng 366	Design of Machine Elements	4	IndEng 210, CivEng 303, MatlEng 201
Mech Eng 370	Computer Aided Engineering Laboratory	2	IndEng 101, 210, Comp151/153, CivEng 202,303, Elec234, Mech101
MechEng 438	Mechanical Engineering Experimentation	3	Sr St, ElecEng 301, MechEng 321, 360, 366, IE 467
Ind Eng 467	Intro. Statistics for Physical Science and Eng. Students	3	Jr St, Math 233
Mech Eng 474	Introduction to Control Systems	4	Sr St, Elec Eng 234, 301, Civ Eng 202
Mech Eng 479	Control and Design of Mechatronic Systems	3	Sr St, Mech Eng 474 or ElecEng 402
Mech Eng 496	Senior Design Project	3	MechEng 321, 360, 366, 370

<b>*Mathematics (14 - 16 credits)</b>		(16 credits typical: Math 231,232,233, ElecEng 234)	
One of the following <b>Calculus</b> sequences must be completed:			
<b>Math 231-232-233</b>			<b>12</b>
<b>Math placement score, or previous course with at least "C" grade.</b>			
Or Math 221- 222 (Honors)	10		
And ElecEng 234	Analytical Methods in Engineering	4	Math 233

<b>*Chemistry (5 -10 credits)</b>	
One of the following courses must be completed:	
Chem 105 (Suggested) or Chem 102-104	Chem 100 with "C" grade or Chemistry placement test

<b>Physics (10 credits)</b>	
Physics 209 - 214, and Physics 210 - 215	See schedule of classes

<b>General Education Requirements</b>		
<i>Distribution Requirements (15 credits)</i>		
<b>Art</b>	3	none
<b>Humanities</b>	6	none
<b>Social Science</b>	6	none
One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement. (Commun 103 Public Speaking or Commun 105 Business and Professional Communication are recommended as part of the distribution requirements)		
<b>Competency Requirements</b>		
<b>* English Composition (0-6 credits)</b>		
The English Composition requirement is satisfied by:		
1. Earning a satisfactory score on the English placement test, <b>or</b>		
2. Earning a grade of C or higher in English 102		
<b>Foreign Language (0-8 credits)</b> (for new freshman starting fall 1999)		
The foreign language requirement can be completed with one of these options:		
1. Two years of a single foreign language in high school		
2. Two semesters of a single foreign language in college		
3. Demonstrate ability by examination		

<b>*Placement Examinations</b>	
Once admitted to UWM, most engineering students are required to take placement examinations in mathematics, English and chemistry. Students with previous college level credits in these areas may not be required to take placement exams. The placement exams are administered by the UWM Testing Center, Mellencamp Hall, room B28, (414) 229-4689. The results of these tests help students determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above. Possible Math placements for engineering students are Math 090-095-105-116-117-231-221. Possible English placements are English 090-095-101-102. Possible Chemistry placements are Chemistry 100,102 or 105.	

## Technical Electives--Mechanical Engineering Major.

Mechanical engineering students should select a minimum of 15 credits of technical electives, from Restricted and Free Electives, as indicated below.

Students interested in **Thermal Sciences** are recommended to take Mech Eng 402 and two course selected from MechEng 415, 423, 432, 434, 435, 451, or 463.

Students interested in **Mechanical Systems** are recommended to take Mech Eng 463 and two courses from MechEng 461, 475, 476 or 478.

Students interested in **General Mechanical Engineering** are recommended to take at least two courses from Mech Eng 402, 463 and 475.

Students interested in **dual Mechanical Engineering and Physics major** must take Mech Eng 475, Math 321, Physics 309, 408, 421, 441 and 498, and meet the Restricted Technical Elective requirements.

**Restricted Technical Electives:** Select at least 2 courses (6 cr. or more) from this list.

EAS 001	Co-op Work Period	3 <sup>1</sup>	none
Mech Eng 402	Thermal-Fluid Engineering	3	MechEng 320, MechEng 321
Mech Eng 463	Introduction to Finite Elements	3	ElecEng 234, Civ Eng 303, MechEng 320 (C), 321 (C)
Mech Eng 475	Vibrations in Mechanical Design	3	Sr St, Civ Eng 202, ElecEng 234

<sup>1</sup>Students who earn **3 or more** credits of Co-op may use 3 of those credits as approved technical electives.

**Free Technical Electives:** Select no more than 9 credits from this list.<sup>2</sup>

		<u>Credits</u>	<u>Prerequisite</u>
Chem 104	General Chemistry and Qualitative Analysis	5 <sup>3</sup>	C or better in Chem 102 or 117
Civ Eng 401	Intermediate Strength of Materials	3	Jr St, Civ Eng 303
Civ Eng 502	Experimental Stress Analysis	3	Jr St, Civ Eng 303
Ind Eng 360	Engineering Economic Analysis	3	Jr St
Ind Eng 455	Basic Optimization Techniques	3	Jr St, ElecEng 234
MatlEng 410	Mechanical Behavior of Materials	3	Jr St, MatlEng 201
Math 413	Introduction to Numerical Analysis	3	Jr St, Math 233 (C), 234 (C)
Math 601	Advanced Engineering Mathematics	3	Jr St, ElecEng 234 or Math 234
MechEng 415	Modern Thermo Manufacturing Processes	3	Jr St, Mech Eng 321, Civ Eng 303
MechEng 423	Applied Fluid Mechanics	3	Jr St, MechEng 320
MechEng 432	Internal Combustion Engines	3	Jr St, MechEng 301
MechEng 434	Air Conditioning System Design	3	Jr St, MechEng 321, Ind Eng 210
MechEng 435	Power Plant Theory and Design	3	Jr St, MechEng 301
MechEng 451	Applied Optics in Engineering	3	Sr St, Physics 210 or Cons Instr
MechEng 455	Processing of Plastics	3	MechEng 320,321
MechEng 461	Intermediate Kinematics and Dynamics	3	Jr St, MechEng 360
MechEng 462	Intermediate Design of Machinery	3	Jr St, MechEng 365
MechEng 465/ MatlEng 465	Friction and Wear	3	Jr St, MatlEng 201
MechEng 469	Introduction to Biomechanical Engineering	3	Sr St, CivEng 202
MechEng 476	Introduction to Robotics	3	ElecEng 234, MechEng 360
MechEng 477	Introduction to Automobile Dynamics	3	Jr St, ElecEng 234, MechEng 360
MechEng 478	Intermediate Control Systems	3	Sr St, MechEng 474
MechEng 490	Topics in Mechanical Engineering	1-3	Jr St, Cons Instr
MechEng 699	Independent Study	1-3 <sup>4</sup>	

<sup>2</sup>Dual Mechanical Engineering and Physics Major students should see the table below.

<sup>3</sup>Students who take Chem 102 (or 117) may use up to three credits of Chem 104 (or 118) as Free Technical Electives.

<sup>4</sup>Students who earn **3 or more** credits of MechEng 699 may use only 3 of those credits as approved Free Technical Electives.

**Physics Dual Major Requirements:** Students interested in a dual major must take the following courses. A maximum of 9 credits from the following list may be used to offset the Free Technical Elective requirements.

Math 321	Vector Analysis	3	Jr St, Math 233, Math 234 or Elec Eng 234
Physics 309	Modern Physics	3	Physics 210 or 220, Math 233 (C)
Physics 408	Experiments in Linear Electronics	3	Jr St, PHY 210 or 220
Physics 421	Electricity and Magnetism	4	Physics 210 or 220, Math 321
Physics 441	Quantum Physics I	4	Physics 309, Math 321 (C)
Physics 498	Undergraduate Physics Seminar	1	Sr St

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<b>Engineering Core Courses (33 credits)</b>		<b>Credits</b>	<b>Prerequisite</b>
EAS 100	CEAS Freshman Orientation	1	none
EAS 200	Professional Seminar	0	none
Ind Eng 101	Fundamentals of Graphics	3	Math 105 (C)
Ind Eng 210	Introduction to Design Techniques	3	Soph St
CompSci 151/153	Introduction to Scientific Programming	3	Math 231 (C)
Civ Eng 201	Statics	3	Math 232
Civ Eng 202	Dynamics	3	Civ Eng 201, Math 233 (C)
Civ Eng 303	Strength of Materials	4	Civ Eng 201, Math 233 (C)
MatlEng 201	Engineering Materials	4	Chem 102 or 117
ElecEng 301	Electrical Circuits I	3	Physics 210 (C), ElecEng 234(C)
MechEng 301	Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 320	Introduction to Fluid Mechanics	3	Jr St, MechEng 301 (C), ElecEng 234, Civ Eng 202

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MechEng 321	Basic Heat Transfer	4	Jr St, MechEng 301
MechEng 323	Fluid Mechanics Laboratory	1	Jr St, MechEng 320
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