

**THE UNIVERSITY OF WISCONSIN-MILWAUKEE
College of Engineering and Applied Science**

FACULTY MEETING

Friday, February 26, 2016 1:15 P.M. EMS E180

AGENDA

I. ANNOUNCEMENTS

- A. Provost Johannes Britz
- B. Other

II. INFORMAL REPORTS – See Attachment 1

- A. Opportunity for Questions regarding Informal Reports

III. AUTOMATIC CONSENT BUSINESS

- A. Minutes of September 25, 2015 meeting
- B. New Courses and Course Changes – See Attachment 2
- C. Revisions to the Civil Engineering Curriculum – See Attachment 3
- D. Revisions to the Materials Engineering Curriculum – See Attachment 4

IV. NEW BUSINESS

- A. Creation of the Computer Studies Curricular Area – See Attachment 5
- B. Designation for “Honors in the Major” for the Applied Mathematics and Computer Science major – See Attachment 6
- C. Revisions to the Electrical Engineering Curriculum – See Attachment 7

V. GENERAL GOOD AND WELFARE

VI. ADJOURNMENT

John R. Reisel, Secretary
CEAS Faculty

INFORMAL REPORTS

Office of Student Services – Todd Johnson

No Report

Career Services – Juli Pickering

No Report

Curriculum Committee – Prof. Church

No Report

Graduate Program Subcommittee – Prof. Lopez

No Report

Academic Planning Committee – Prof. Misra

CEAS ACADEMIC PLANNING COMMITTEE

INFORMAL REPORT

February 15, 2016

- APC has been reviewing the investments made by the Dean and the returns of those so far. These include investments on research, centers, marketing efforts, and corporation relations.
- Committee considered the idea forwarded by some NS chairs about a possible merger with CEAS to form a STEM College and advised Dean Peters against it. Members were of the view to continue focus on the CEAS Strategic Plan and develop biomedical engineering, energy, and environmental engineering areas. NS faculty members are welcome to collaborate in these areas.
- the APC meets every month for nearly three hours to assess current status and future plans of the CEAS.
- APC members for year 2015-2016 are -
Professors Abu-Zahra (MSE), Hosseini (CS), Misra (EE), Seifoddini (IE), Tabatabai (CEE), Qu (ME), and Dean Peters (Ex-officio).

Biomedical and Health Informatics – Prof. McRoy

No Report

Faculty Senate – Prof. Reisel

In its October 2015 meeting, the Faculty Senate passed a statement opposing proposed legislation that would allow concealed weapons on campus. (Note, the bill is still in the state legislature, although it is not anticipated to be acted upon this term.) The Senate also passed a SAAP involving a policy on children in the workplace, and a SAAP revision involving centers and institutes.

In November, discussion took place regarding a tenure position paper for UWM, and this paper was subsequently adopted in December. (Note: the tenure documents ultimately passed by the Education Committee of the Board of Regents in February do not completely align with the Senate's position paper. Work will be necessary to have UWM in compliance with any revisions to tenure and post-tenure review policy eventually adopted by the Board of Regents.)

In January, there was discussion of the proposed tenure policy and post-tenure review policy being considered by the Board of Regents. In addition, a policy on the protection of research-related data was discussed, and action on it was postponed until all research departments had an opportunity to comment on it.

In February, the Senate approved affiliation of the Department Like Body of Biomedical Engineering with both the Division of the Natural Sciences and the Division of the Professions.

Minutes of the Faculty Senate meetings can be found at <http://www4.uwm.edu/secu/faculty/senate/minutes/> .

In addition, the University Committee is providing more frequent information regarding the budget situation and its other activities at <http://UCNews.uwm.edu>.

Graduate Faculty Committee – Prof. Hosseini

No Report

ATTACHMENT 2

NEW COURSES

- COMPST 702 SOFTWARE DEVELOPMENT FOR IT PROFESSIONALS, 3 cr., G
Programming in Python. Basic control structures including recursion. Basic and library data types. Problem solving with objects. Writing classes. Basic software development skills.
Prereq: grad. st.
- COMPST 703 SOFTWARE ENGINEERING PRINCIPLES FOR IT PROFESSIONALS, 3 cr., G
Introduction to core topics of software engineering including requirements analysis, object-oriented design, testing, and project management. Overview of ethical and social issues in computing.
Prereq: CompST 702 or equiv.

COURSE CHANGES

- MATLENG 201 ENGINEERING MATERIALS, 4 cr., U
Basic behavior and processing of engineering materials emphasizing metals and alloys and including ceramics and plastics. Laboratory work is included.
Prereq: Math 231(C), score of 1 on chem placement test or min grade C in Chem 100(P)
- had been
- MATLENG 201 ENGINEERING MATERIALS, 4 cr., U
Basic behavior and processing of engineering materials emphasizing metals and alloys and including ceramics and plastics. Laboratory work is included.
Prereq: Chem 105(P) or 102(P) or 117(P).

Revisions to the Civil Engineering Curriculum

A number of changes are proposed to address changes in the curriculum requirements, incorporate feedback from students and ABET, and to streamline and simplify the CE curriculum.

- 1) ElecEng 306 course is removed from the engineering core courses.
- 2) ElecEng 301 (Electrical Circuits) is added to the electives (Group B).
- 3) Elective categories have been reduced to two (Groups A and B) from five (Groups A, B, C1, C2, and D). In the proposed curriculum, Group A electives are those electives that are offered by the CEE Department, and Group B electives are offered by other departments.
- 4) One credit is added to Civ Eng 335 (pending CAR approval)
- 5) Recently added new courses (Civ Eng 311 and 555) are added to Group A electives.
- 6) Civ Eng 560, 616, and 691 are added to the Group A list.
- 7) The references to individual Geo Sci courses are removed from Tech Electives. Instead, an option for Geo Science courses at 300 level or above is included under the "Other Natural Science" list.
- 8) Corrections are made to typographical errors.

University of Wisconsin – Milwaukee

College of Engineering and Applied Science

CIVIL ENGINEERING CURRICULUM

Proposed

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Civil Engineering is 127 credits. Students who need background preparation courses in math, English, and chemistry may need additional credits. See information below regarding placement examinations.

<u>Engineering Core Courses (33 credits)</u>	<u>Credits</u>	<u>Prerequisite</u>
EAS 100 CEAS Freshman Orientation (recommended only)	1	none
EAS 200 Professional Seminar	1	none
Ind Eng 111 Introduction to Engineering ¹	3	Math 116 (C)
Ind Eng 112 Engineering Drawing & Computer Aided Design/Drafting ¹	3	Math 116
Ind Eng 360 Engineering Economic Analysis	3	Jr St
Civ Eng 280 Computer-Based Engineering Analysis	3	Math 226 or 231, CompSci 132 or equivalent
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 ²	4	Chem 105 or 102 or 117
MechEng 301 Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 320 Introduction to Fluid Mechanics	3	MechEng 301 (C), ElecEng 234, Civ Eng 202

¹ MechEng 110 and 111 may substitute for Ind Eng 111 and 112 for students transferring from another engineering major.

² Civil Engineering majors may take Civ Eng 431 (with proper prerequisites) in place of MatlEng 201.

*Civil Engineering Major (24 credits)

Civ Eng 250 Engineering Surveying	3	Soph. St., Math 232
Civ Eng 335 Soil Mechanics	4	Civ Eng 303
Civ Eng 372 Introduction to Structural Design	4	Jr St, Civ Eng 303
Civ Eng 411 Engineering Principles of Water Resources Design	3	Jr St, MechEng 320
Civ Eng 413 Environmental Engineering	3	Mech Eng 320
Civ Eng 490 Transportation Engineering	3	Civ Eng 280, Jr St
Civ Eng 494 Principles of Civil Engineering Design	1	Sr. St. in Civil Engineering
Civ Eng 495 Senior Design	3	Civ Eng 335, 372, 411, 490

**Mathematics (14 -16 credits)

One of the following **Calculus** sequences must be completed:

Math 231-232-233	12	(16 credits typical: Math 231, 232, 233, ElecEng 234)
Or Math 221- 222 (Honors)	10	Math placement score, or previous course with "C" grade.
And ElecEng 234 Analytical Methods in Engineering	4	Math 233 (P)

**Chemistry (5-10 credits)

One of the following sequences must be completed:

Chem 105 (Suggested) or Chem 102 -104	Chem 100 with "C" grade or Chemistry placement test
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Physics (8 credits)

Physics 209 – 210	8
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Other Natural Sciences (3 credits)

Any geology course 300 level or above, or
 Any biology course 150-level or above, or
 Any atmospheric science course 200 level or above

General Education Requirements

Distribution Requirements (15 credits)

Art	3	none
Humanities	3	none
Social Science	6	none
English 310 Writing, Speaking and Technoscience in the 21st Century	3	English competency
Cultural Diversity - One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.		
Free Elective	2	

Competency Requirements

****English Composition (0-6 credits)**

The English Composition requirement is satisfied by:

1. Earning a satisfactory score on the English placement test, **or**
2. Earning a grade of C or higher in English 102
3. Transferring a grade of C or better in a course (3 credits of more) equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (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

* **Advancement to Major:** Effective Fall 2012 1. Complete a minimum of 24 credits required for major. (Excludes: general education, prerequisite and orientation courses). 2. Complete Math 232 (or 222) with "C" or better grade. 3. Complete EAS 200 Professional Seminar. 4. Complete the English composition requirement. 5. Obtain a 2.33 GPA in all courses in item 1. **The program may impose major status as a prerequisite for courses numbered 300 or above.**

** **Placement Examinations:** Students without previous college level credits in Math, Chemistry or English may be required to take placement exams. The results of these tests determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.

Technical Electives – Civil Engineering 21 CREDITS REQUIRED

The Civil Engineering and Mechanics Department offers numerous elective courses which allow students to work in one of **four areas** of concentration. Normally a minimum of 12 credits will be taken in an area of concentration. **Students who do not follow one of the four areas of concentration will require approval by the Department Chairperson for their programs.**

- 1 Students interested in **geotechnical engineering** should take Civ Eng 456, and select at least three courses from Civ Eng 360, 412, 463, 492, and 598.
- 2 Students interested in **municipal and transportation engineering** should select at least three courses from Civ Eng 492, 590, 592, 594, 596, 598, and 610.
- 3 Students interested in **structural engineering** should take Civ Eng 360, 463, 571, 572 and select at least two courses from Civ Eng 431, 456, 466, 560, 573, 574 and 579.
- 4 Students interested in **water resources and environmental engineering** should select at least three courses from Civ Eng 412, 511, 521, and 610

Group A Technical Electives: Take 15 to 21 credits of Group A electives.

		<u>Credits</u>	<u>Prerequisite</u>
Civ Eng 311	Introduction to Energy, Environment and Sustainability	3	Jr. St.
Civ Eng 360	Introduction to Structural Analysis	3	Civ Eng 303
Civ Eng 412	Applied Hydrology	3	Jr St, Math 233, MechEng 320
Civ Eng 431	Materials of Construction	3	Jr. St, Civ Eng 303
Civ Eng 456	Foundation Engineering	3	Jr St, Civ Eng 335
Civ Eng 463	Introduction to Finite Elements	3	ElecEng 234, Civ Eng 303, MechEng 320 (C)
Civ Eng 466	Mechanics of Composite Materials	3	Jr. St, Civ Eng 303
Civ Eng 492	Environmental Impact Assessment	3	Sr. St.
Civ Eng 502	Experimental Stress Analysis	3	Jr. St, Civ Eng 303
Civ Eng 511	Water Supply and Sewerage	3	Jr St, Civ Eng 411
Civ Eng 521	Water Quality Assessment	3	Sr. St, Civ Eng 411
Civ Eng 555	Sustainable Construction Materials and Technologies	3	Jr. St.
Civ Eng 560	Intermediate Structural Analysis	3	Jr. St., 360, 372
Civ Eng 571	Design of Concrete Structures	3	Jr. St, Civ Eng 360 (C), 372
Civ Eng 572	Design of Steel Structures	3	Jr St, Civ Eng 360 (C) ,372
Civ Eng 573	Design of Masonry Structures	3	Jr St, Civ Eng 360 (C) ,372
Civ Eng 574	Design of Prestressed Concrete Structures	3	Jr St Civ Eng 360 (C) , 372
Civ Eng 579	Earthquake Engineering	3	Sr St, Civ Eng 571 or 572
Civ Eng 590	Urban Transportation Planning	3	Sr. St.
Civ Eng 592	Traffic Control	3	Sr. St.
Civ Eng 594	Physical Planning and Municipal Engineering	3	Sr. St., Cons Instr
Civ Eng 596	Transportation Facilities Design	3	Civ Eng 335 (C), Civ Eng 490
Civ Eng 598	Pavement Analysis and Design	3	Jr. St, Civ Eng 335
Civ Eng 610	Introduction to Water and Sewage Treatment	3	Sr. St., Civ Eng 413
Civ Eng 480	Software Applications for Civil Engineering	3	Jr. St.
Civ Eng 616	Computational Hydraulics and Environmental Flows	3	Jr. St., Civ Eng 411
Civ Eng 691	Topics in Civil Engineering	3	Based on topic

All non-required Civil and Environmental Engineering courses numbered 400-699 are Group A Technical Electives

Group B Technical Electives: Select no more than 6 credits from this list.

EAS 001	Co-op Work Period	3 ²	None
English 206	Technical Writing	3	Soph St, Eng Comp Reqmt
Geog 403	Remote Sensing	3	Jr St; Geo 215
Comp Sci 250	Introductory Computer Programming	3	Math Placement code 40 or Math 116 or Math 211
ElecEng 301	Electrical Circuits	3	Physics 210
Ind Eng 455	Operations Research I	3	Jr St, Math 233
Ind Eng 465	Operations Research II	3	Ind Eng 467, 455
Ind Eng 467	Intro Statistics for Physical Sciences & Engineering	3	Jr St, Math 233
Ind Eng 575	Design of Experiments	3	Ind Eng 467 or Equivalent
MatlEng 431	Welding Engineering	3	Jr. St, MatlEng 201
MechEng 321	Basic Heat Transfer	4	MechEng 301
Urb Plan 591	Introduction to Urban Geographic Information Systems	3	Jr. St.
Geog 215	Introduction to Geographic Information Sciences	3	None
Any Mathematics course 400-level or above, Math 313, Math 321, Math 322, or			
Any Chemistry course 200-level or above, Chem 104 ¹ , or			
Any Physics course 300-level or above, Physics 214, Physics 215			

¹Students who take Chemistry 102 (or 117) may use Chemistry 104 (118) to satisfy three credits in this group.

²Students who earn **3 or more** credits of Co-op may use 3 of those credits as approved technical electives.

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University of Wisconsin – Milwaukee

College of Engineering and Applied Science

CIVIL ENGINEERING CURRICULUM

Current

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Civil Engineering is 127 credits. Students who need background preparation courses in math, English, and chemistry may need additional credits. See information below regarding placement examinations.

Engineering Core Courses (37 credits)

		Credits	Prerequisite
EAS 100	CEAS Freshman Orientation (recommended only)	1	None
EAS 200	Professional Seminar	1	None
Ind Eng 111	Introduction to Engineering ¹	3	Math 116(C), Admission to CEAS
Ind Eng 112	Engineering Drawing & Computer Aided Design/Drafting ¹	3	Math 116, Admission to CEAS
Ind Eng 360	Engineering Economic Analysis	3	Jr St
Civ Eng 280	Computer-Based Engineering Analysis	3	Math 226 or 231, CompSci 132 or Equivalent
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)
ElecEng 306	Introduction to Electrical Engineering	4	ElecEng 234, Physics 210
MatlEng 201	Engineering Materials ²	4	Chem 105 or 102
MechEng 301	Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 320	Introduction to Fluid Mechanics	3	Civ Eng 202, ElecEng 234, MechEng 301(C)

¹ MechEng 110 and 111 may substitute for Ind Eng 111 and 112 for students transferring from another engineering major

² Civil Engineering majors may take Civ Eng 431 (with proper prerequisites) in place of MatlEng 201

^Civil Engineering Major (23 credits)

Civ Eng 250	Engineering Surveying	3	Soph St, Math 232
Civ Eng 335	Soil Mechanics	3	Jr St, Civ Eng 303 & Admission to Eng Major
Civ Eng 372	Introduction to Structural Design	4	Jr St, Civ Eng 303 & Admission to Eng Major
Civ Eng 411	Engineering Principles of Water Resources Design	3	Jr St, MechEng 320 & Admission to Eng Major
Civ Eng 413	Environmental Engineering	3	Jr St, MechEng 320 & Admission to Eng Major
Civ Eng 490	Transportation Engineering	3	Jr St, Civ Eng 280 & Admission to Eng Major
Civ Eng 494	Principles of Civil Engineering Design	1	Sr St in Civil Engineering, Civ Eng 335(C), 372(C), 411(C), 413(C), 490(C)
Civ Eng 495	Senior Design	3	Civ Eng 335, 372, 411, 413, 490, 494

^^Mathematics (14-16 credits)

One of the following **Calculus** sequences must be completed:

Math 231-232-233	12	Math placement score, or previous course with at least "C" grade
Or Math 221- 222 (Honors)	10	
And ElecEng 234 Analytical Methods in Engineering	4	Math 232*

(16 credits typical: Math 231,232,233, ElecEng 234)

^^Chemistry (5-10 credits)

One of the following sequences must be completed:

Chem 105 (Suggested) or Chem 102 -104		Chem 100* or Chemistry Placement; Math 105* or 108*
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Physics (8 credits)

Physics 209 – 210	8	Physics 209: Math 232(C) Physics 210: Math 233(C), C- or better in Physics 209
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General Education Requirements

Distribution Requirements (15 credits)

Art		3	
Humanities		3	
Social Science		6	
English 310	Writing, Speaking & Technoscience in the 21st Century	3	English Competency

Cultural Diversity - One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.

Free Elective	2	
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Competency Requirements

^^English Composition (0-6 credits)

The English Composition requirement is satisfied by:

- Earning a satisfactory score on the English placement test, **or**
- Earning a grade of C or higher in English 102
- Transferring a grade of C or better in a course (3 credits of more) equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (for new freshman starting fall 1999) The foreign language requirement can be completed with one of these options:

- Two years of a single foreign language in high school
- Two semesters of a single foreign language in college
- Demonstrate ability by examination

*C or better in prerequisite

(C) Concurrent Enrollment in Designated Course

^Advancement to Major: Effective Fall 2012 1. Complete a minimum of 24 credits required for major. (Excludes: general education, prerequisite and orientation courses). 2. Complete Math 232 (or 222) with "C" or better grade. 3. Complete EAS 200 Professional Seminar. 4. Complete the English composition requirement. 5. Obtain a 2.33 GPA in all courses in item 1. **The program may impose major status as a prerequisite for courses numbered 300 or above.**

^^Placement Examinations: Students without previous college level credits in Math, Chemistry or English may be required to take placement exams. The results of these tests determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.

Technical Electives – Civil Engineering Major

The Civil Engineering program requires a total of 21 credits of technical electives, chosen as follows.

The Civil and Environmental Engineering Department offers numerous elective courses which allow students to work in one of **four areas** of concentration. Normally a minimum of 12 credits will be taken in an area of concentration. **Students who do not follow one of the four areas of concentration will require approval by the Department Chairperson for their programs.**

- 1 Students interested in **Geotechnical Engineering** should take Civ Eng 456, and select at least three courses from Civ Eng 360, 412, 463, 492, and 598. Students are also strongly recommended to take Geo Sci 470.
- 2 Students interested in **Municipal and Transportation Engineering** should select at least three courses from Civ Eng 492, 590, 592, 594, 596, 598, and 610.
- 3 Students interested in **Structural Engineering** should take Civ Eng 360, 463, 571, 572 and select at least two courses from Civ Eng 456, 560, 573, 574 and 579.
- 4 Students interested in **Water Resources and Environmental Engineering** should select at least three courses from Civ Eng 412, 511, 521, and 610

Group A Technical Electives: Take a minimum of 12 credits of Group A electives or a minimum of 9 credits of Group A electives and 3 credits of Group B electives.

		Credits	Prerequisite
Civ Eng 412	Applied Hydrology	3	Jr St, Math 233, MechEng 320
Civ Eng 456	Foundation Engineering	3	Jr St, Civ Eng 335
Civ Eng 463	Introduction to Finite Elements	3	Jr St, Civ Eng 303, ElecEng 234, MechEng 320(C) or 321(C)
Civ Eng 492	Environmental Impact Assessment	3	Sr St
Civ Eng 511	Water Supply & Sewerage	3	Jr St, Civ Eng 411
Civ Eng 521	Water Quality Assessment	3	Sr St, Civ Eng 411
Civ Eng 571	Design of Concrete Structures	3	Jr St, Civ Eng 360, 372
Civ Eng 572	Design of Steel Structures	3	Jr St, Civ Eng 360, 372
Civ Eng 573	Design of Masonry Structures	3	Jr St, Civ Eng 360, 372
Civ Eng 574	Design of Prestressed Concrete Structures	3	Jr St, Civ Eng 360, 372
Civ Eng 579	Earthquake Engineering	3	Sr St, Civ Eng 571 or 572
Civ Eng 590	Urban Transportation Planning	3	Sr St
Civ Eng 592	Traffic Control	3	Sr St
Civ Eng 594	Physical Planning & Municipal Engineering	3	Sr St
Civ Eng 596	Transportation Facilities Design	3	Jr St, Civ Eng 490
Civ Eng 598	Pavement Analysis & Design	3	Jr St, Civ Eng 335
Civ Eng 610	Introduction to Water & Sewage Treatment	3	Sr St, Civ Eng 413

Group B Technical Electives: Select no more than 9 credits from this list.

Civ Eng 360	Introduction to Structural Analysis	3	Civ Eng 303
Civ Eng 431	Materials of Construction	3	Jr St, Civ Eng 303
Civ Eng 466	Mechanics of Composite Materials	3	Jr St, Civ Eng 303
Civ Eng 502	Experimental Stress Analysis	3	Jr St, Civ Eng 303

Group C Technical Electives: Select 3 to 6 credits of math and science electives with a minimum of 3 credits from Group C1.

Group C1: Take a minimum of 3 credits of Group C1 electives

Geo Sci 414	Structural Geology	3	Jr St, Geo Sci 302(C)
Geo Sci 463	Physical Hydrogeology	3	Jr St, Geo Sci 100 or 101, Math 232
Geo Sci 464	Chemical Hydrogeology	3	Jr St, Chem 102
Any Biology course 150-level or above			
Any Atmospheric Science course 200-level or above			

Group C2: Select no more than 3 credits from the C2 list.

Ind Eng 467	Intro Statistics for Physical Sciences & Engineering	3	Jr St, Math 233
Any Mathematics course 400-level or above, Math 313, Math 321, Math 322			
Any Chemistry course 200-level or above, Chem 104 ¹			
Any Physics course 300-level or above, Physics 214, Physics 215			

¹Students who take Chemistry 102 (or 117) may use Chemistry 104 (118) to satisfy three credits of the Group C technical elective requirement.

Group D Technical Electives: Select no more than 3 credits from this list.

EAS 001	Co-op Work Period	3 ²	Prior Cons Co-Op Dir
English 206	Technical Writing	3	GER English
Geog 403	Remote Sensing	3	Jr St, Geo 215
Comp Sci 201	Introductory Computer Programming	3	Math 116 or 211
Ind Eng 455	Operations Research I	3	Jr St, Math 233
Ind Eng 465	Operations Research II	3	Jr St, Ind Eng 467
Matl 431	Welding Engineering	3	Jr St, MatlEng 201
MechEng 321	Basic Heat Transfer	4	Jr St, MechEng 301
Urb Plan 591	Introduction to Urban Geographic Information Systems	3	Jr St
Geog 215	Introduction to Geographic Information Sciences	3	None

²Students who earn **3 or more** credits of Co-Op may use 3 of those credits as approved technical electives.

***C or better in prerequisite**

(C) Concurrent Enrollment in Designated Course

Degree Requirements: Students must maintain an average GPA of at least 2.0 on all work attempted at the University and in all courses offered by the College. Students majoring in Civil Engineering must maintain an average GPA of at least 2.5 in all 300-level and above courses in the Civil Engineering department. Transferable courses will be included as appropriate. Advancement to major status is required for graduation.

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Revisions to the Materials Engineering Curriculum

A number of changes are proposed to address new course availability in Physics and to enhance flexibility with Group A and Group B Technical Electives.

- 1) Allow students to take the new combined physics courses 219 (=209+214) and Phys 220 (=210+215) or the traditional lecture with separate lab combination. Current requirements are a total of 10 credits calculus-based physics. This is achieved through a combined lecture and lab offering. Lectures are 4Cr (209 and 210) and each lecture has a complimentary 1-Cr lab (214 and 215). Physics has recently developed a "studio format" combined 5-Cr calculus-based courses where lecture and lab are combined into one course number. Course content is identical and Physics is recommending the 219-220 courses to their undergraduate students. The proposed action would allow either the current lecture/lab combination or the new studio course format.
- 2) The Materials Engineering program requires a total of 18 credits of Group A Technical Electives. This is currently split into 9 Cr from Group A1 (Structure) and 9 Cr from Group A2 (Processing). The proposed change is to move to a minimum of 6 Cr from each group such that a student is given greater flexibility in taking courses of interest while still maintaining a breadth of exposure within the field. Total credit requirement of 18 remains unchanged.
- 3) Group B technical electives are expanded with "blanket" approval for courses above certain levels in engineering and sciences. This is to eliminate the barrier of needing Dept Chair approval for courses acceptable as Group B without having to publish an exhaustive list. Approval of additional courses via Dept Chair approval remains in place.

Proposed

**University of Wisconsin – Milwaukee
College of Engineering and Applied Science**

MATERIALS ENGINEERING CURRICULUM

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Materials Engineering is 124 credits. Students who need background preparation courses may need additional credits. See information below regarding placement examinations.

Engineering Core Courses (24 credits)

Credits Prerequisite

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)
CompSci 240	Introduction to Engineering Programming	3	Math Placement Code of 40 or Math 116(P).
EAS 200	Professional Seminar	1	none
ElecEng 301	Electrical Circuits I	3	Physic 210 (C)
Ind Eng 467	Introductory Statistics for Physical Sciences and Engineering Students	3	Jr St, Math 233
MatlEng 201	Engineering Materials	4	Math 231(C), Chem 100 with "C" grade or Chemistry placement test

Materials Engineering Major (28 credits)

MatlEng 330	Materials and Processes in Manufacturing	3	MatlEng 201
MatlEng 402	Physical Metallurgy	3	Jr St, MatlEng 201
MatlEng 410	Mechanical Behavior of Materials	3	Jr St, MatlEng 201
MatlEng 411	Materials Laboratory	3	Sr St, MatlEng 201
MatlEng 442	Thermodynamics of Materials	3	Jr St, MatlEng 201
MatlEng 443	Transport Phenomena in Materials Processing	3	Jr St, MatlEng 442, ElecEng 234
MatlEng 452	Ceramic Materials	3	Jr St, MatlEng 201
MatlEng 453	Polymeric Materials	3	Jr St, MatlEng 201
MatlEng 490	Senior Design Projects - I	1	Sr St, MatlEng 411 (C)
MatlEng 491	Senior Design Projects - II	3	MatlEng 490

***Mathematics (14-16 credits)**

One of the following **Calculus** sequences must be completed:

Math 231-232-233	12	Math placement score, or previous course with at least "C" grade.
Or Math 221- 222 (Honors)	10	
And ElecEng 234 (Analytical Methods in Engineering)	4	Math 233

***Chemistry (5-10 credits)**

One of the following sequences must be completed:

Chem 105 (Suggested) or Chem 102 -104	5	Chem 100 with "C" grade or Chemistry placement test
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Physics (10 credits)

219 - 220 (recommended)	10	See Schedule of Classes
or Physics 209 & 214 – 210 & 215	10	See Schedule of Classes

General Education Requirements

Distribution Requirements (15 credits)

Art	3	none
Humanities	6	one
Social Science	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)

Free Elective	2	
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Competency Requirements

***English Composition (0-6 credits)**

The English Composition requirement is satisfied by:

1. Earning a satisfactory score on the English placement test, or
2. Earning a grade of C or higher in English 102
3. Transferring a grade of C or better in a course (3 credits or more) equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (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

***Placement Examinations**

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 090-095-105-116-117-225-231-221. Possible English placements are English 090-095-101-102. Possible Chemistry placements are Chemistry 100, 102 or 105.

Technical Electives--Materials Engineering Major

The materials engineering program requires a minimum of 24 credits of technical electives, chosen from the following lists. At least 18 of the credits of technical electives must be from Group A1 and A2 as outlined below.

Group A1 Technical Electives (Structure): Select at least 2 courses.

		Credits	Prerequisite
MatlEng 380	Engineering Basis for Materials Selection	3	MatlEng 201
MatlEng 461	Environmental Degradation of Materials	3	Jr St, MatlEng 201
MatlEng 465	Friction and Wear	3	Jr St, MatlEng 201
MatlEng 481	Electronic Materials	3	Jr St, MatlEng 201
MatlEng 483	Materials for Energy Systems	3	Jr St, MatlEng 201
MatlEng 485	Introduction to Biomaterials	3	Jr St, MatlEng 201
MatlEng 511	Advanced Materials Characterization	3	Jr St, MatlEng 201

Group A2 Technical Electives (Processing): Select at least 2 courses.

		Credits	Prerequisite
MatlEng 431	Welding Engineering	3	Jr St, MatlEng 201
MatlEng 456	Metal Casting Engineering	3	Jr St, MatlEng 201
MatlEng 457	Engineering Composites	3	Jr St, MatlEng 201
MatlEng 460	Nanomaterials and Nanomanufacturing	3	Jr St, MatlEng 201
MatlEng 471	Heat Treatment of Materials	3	Jr St, MatlEng 201

Group B Technical Electives: Select no more than 6 credits

		Credits	Prerequisite
EAS 001	Co-op Work Period	3 ¹	none
English 206	Technical Writing	3	Soph St, Completion of Eng Comp
Ind Eng 112	Engineering Drawing & Computer Aided Design/Drafting	3	Math 116
MatlEng 699	Independent Study	3	Jr St, Cons Instr
MechEng 110	Engineering Fundamentals I	4	Math 231 (C)
MechEng 111	Engineering Fundamentals II	4	MechEng 110

Any Physics course above 250-level or above
Chemistry 104, 221, any Chemistry course 300-level or above
Any College of Engineering course 300-level or above
Any Mathematics course 300-level or above
Any Biology course 150-level or above
Any Geoscience course 300-level or above
English 428, 429, 435

Other appropriate courses by permission of the department chair.

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

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MATERIALS ENGINEERING CURRICULUM

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Materials Engineering is 124 credits. Students who need background preparation courses may need additional credits. See information below regarding placement examinations.

Engineering Core Courses (24 credits)

		Credits	Prerequisite
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)
CompSci 240	Introduction to Engineering Programming	3	Math Placement Code of 40 or Math 116(P).
EAS 200	Professional Seminar	1	none
ElecEng 301	Electrical Circuits 1	3	Physic 210 (C)
Ind Eng 467	Introductory Statistics for Physical Sciences and Engineering Students	3	Jr St, Math 233
MatlEng 201	Engineering Materials	4	Chem 105 or 102 or 117

Materials Engineering Major (28 credits)

MatlEng 330	Materials and Processes in Manufacturing	3	MatlEng 201
MatlEng 402	Physical Metallurgy	3	Jr St, MatlEng 201
MatlEng 410	Mechanical Behavior of Materials	3	Jr St, MatlEng 201
MatlEng 411	Materials Laboratory	3	Sr St, MatlEng 201
MatlEng 442	Thermodynamics of Materials	3	Jr St, MatlEng 201
MatlEng 443	Transport Phenomena in Materials Processing	3	Jr St, MatlEng 442, ElecEng 234
MatlEng 452	Ceramic Materials	3	Jr St, MatlEng 201
MatlEng 453	Polymeric Materials	3	Jr St, MatlEng 201
MatlEng 490	Senior Design Projects - I	1	Sr St, MatlEng 411 (C)
MatlEng 491	Senior Design Projects - II	3	MatlEng 490

***Mathematics (14-16 credits)**

One of the following **Calculus** sequences must be completed:

Math 231-232-233	12	Math placement score, or previous course with at least "C" grade.
Or Math 221- 222 (Honors)	10	
And ElecEng 234 (Analytical Methods in Engineering)	4	Math 233

***Chemistry (5-10 credits)**

One of the following sequences must be completed:

Chem 105 (Suggested) or Chem 102 -104	5	Chem 100 with "C" grade or Chemistry placement test
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Physics (10 credits)

Physics 209 & 214 – 210 & 215	10	See Schedule of Classes
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General Education Requirements

Distribution Requirements (15 credits)

Art	3	none
Humanities	6	none
Social Science	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)

Free Elective	2	
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Competency Requirements

***English Composition (0-6 credits)**

The English Composition requirement is satisfied by:

1. Earning a satisfactory score on the English placement test, or
2. Earning a grade of C or higher in English 102
3. Transferring a grade of C or better in a course (3 credits or more) equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (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

***Placement Examinations**

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 090-095-105-116-117-225-231-221. Possible English placements are English 090-095-101-102. Possible Chemistry placements are Chemistry 100, 102 or 105.

Technical Electives--Materials Engineering Major

The materials engineering program requires a minimum of 24 credits of technical electives, chosen from the following lists. At least 18 of the credits of technical electives must be from Group A1 and A2 as outlined below.

Group A1 Technical Electives (Structure): Select at least 3 courses.

		<u>Credits</u>	<u>Prerequisite</u>
MatlEng 380	Engineering Basis for Materials Selection	3	MatlEng 201
MatlEng 461	Environmental Degradation of Materials	3	Jr St, MatlEng 201
MatlEng 465	Friction and Wear	3	Jr St, MatlEng 201
MatlEng 481	Electronic Materials	3	Jr St, MatlEng 201
MatlEng 483	Materials for Energy Systems	3	Jr St, MatlEng 201
MatlEng 485	Introduction to Biomaterials	3	Jr St, MatlEng 201
MatlEng 511	Advanced Materials Characterization	3	Jr St, MatlEng 201

Group A2 Technical Electives (Processing): Select at least 3 courses.

		<u>Credits</u>	<u>Prerequisite</u>
MatlEng 431	Welding Engineering	3	Jr St, MatlEng 201
MatlEng 456	Metal Casting Engineering	3	Jr St, MatlEng 201
MatlEng 457	Engineering Composites	3	Jr St, MatlEng 201
MatlEng 460	Nanomaterials and Nanomanufacturing	3	Jr St, MatlEng 201
MatlEng 471	Heat Treatment of Materials	3	Jr St, MatlEng 201

Group B Technical Electives: Select no more than 6 credits

Chem 104	General Chemistry and Qualitative Analysis	3	Chem 102
Chem 223	Elementary Quantitative Analysis	4	Chem 104 or 118
Chem 341	Introductory Survey of Organic Chemistry	3	Chem 104 or 118
Civ Eng 401	Intermediate Strength of Materials	3	Jr St, CivEng 303
Civ Eng 502	Experimental Stress Analysis	3	Jr St, CivEng 303
EAS 001	Co-op Work Period	3 ¹	none
English 206	Technical Writing	3	Soph St, Completion of Eng Comp
Ind Eng 111	Introduction to Engineering	3	Math 116 (C)
Ind Eng 112	Engineering Drawing & Computer Aided Design/Drafting	3	Math 116
Ind Eng 360	Engineering Economic Analysis	3	Jr St
MatlEng 699	Independent Study	3	Jr St, Cons Instr
Math 413	Introduction to Numerical Analysis	3	Jr St, Math 233(C), 234 (C)
MechEng 110	Engineering Fundamentals I	4	Math 231 (C)
MechEng 111	Engineering Fundamentals II	4	MechEng 110
MechEng 301	Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 320	Introduction to Fluid Mechanics	3	MechEng 301, ElecEng 234, Civ Eng 202

Other appropriate courses by permission of the department chair.

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

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Department: EE & Computer Science
Action: New

The University of Wisconsin - Milwaukee
CURRICULAR AREA APPROVAL FORM

School/College: Engineering & Applied Science, Date: 11/27/2015

I. ACTION REQUESTED: Effective date of action requested: Semester Summer 2016
APPROVE NEW CURRICULAR AREA

II. OLD CURRICULAR AREA
Old Curricular Area Title:
Old Curricular Area Abbreviation:

III. NEW CURRICULAR AREA
New Curricular Area Title: Computer Studies
New Curricular Area Abbreviation: COMPST
UDDS Code: B 19 2520

IV. FOR NEW CODES, PROVIDE DESCRIPTION OF CURRICULAR AREA AND RELATIONSHIP TO ACADEMIC PROGRAMS:

This curricular area will house courses that are computer related but not strictly computer science. These courses will serve programs such as SOIS' new MSIST program.

V. REASON FOR CHANGE:

VI. OTHER DEPARTMENTS AND CURRICULAR AREAS THAT MAY BE AFFECTED:

COMPSCI INFOST

VII. APPROVAL:

Chair, School/College Curriculum Committee _____

Chair, Academic Program and Curriculum Committee _____

Chair, Graduate Course and Curriculum Committee _____

Dean, School/College: _____

Provost: _____

Comments:

This is a proposal to designate “Honors in the Major” for the Applied Mathematics and Computer Science (AMCS) major. The major is part of the College of Letters and Science.

“Faculty Policy (Fac Doc #320): 3.00 cumulative GPA in all UWM graded credits attempted; 3.5 GPA in all credits attempted that count toward the major; 3.5 GPA in all advanced credits that count toward the major. Additional departmental requirements must be approved by the L&S curriculum committee.”

Applied Mathematics and Computer Science (AMCS): Honors in the Major

Students in AMCS who meet all of the following criteria can be awarded honors in the major upon graduation:

1. A 3.0 cumulative GPA in all UWM graded credits;
2. A 3.5 GPA over all UWM courses counting toward the AMCS major;
3. A 3.5 GPA over all upper division UWM courses counting toward the AMCS major;
4. A grade of B+ or better on Math 599 (Capstone Experience), Math 699 (Independent Study), CS 595 (Capstone), CS 699 (Independent Study);
5. Completion of 3 credits in Mathematical Sciences (curricular areas MATH or MTHSTAT) or Computer Science in a course numbered 600 or higher that is different from Math 699 and CS 699.

Students who believe they may qualify for honors in AMCS should apply to the Mathematical Sciences Department during their last semester of study.

University of Wisconsin – Milwaukee
College of Engineering and Applied Science
ELECTRICAL ENGINEERING CURRICULUM

The typical number of credits required to complete the Bachelor of Science in Engineering with a major in Electrical Engineering is 126 credits. Students who need background preparation courses may need additional credits. See information below regarding placement examinations.

Engineering Core Courses (23 17 credits)		Credits	Prerequisite
ElecEng 101	Fundamentals of Electrical Engineering	3	Math 116(C), admis to College of Engineering & Applied Science
EAS 200	Professional Seminar	1	none
CompSci 240	Introduction to Engineering Programming	3	Math Placement Code of 40 or Math 116 (P)
Civ Eng 201	Statics	3	Math 232 (P)
Civ Eng 202	Dynamics	3	Civ Eng 201 (P), Math 233 (C)
MatlEng 201	Engineering Materials	4	Chem 105 (P) or 102 (P) or 117(P)
ElecEng 301	Electrical Circuits I	3	Physic 210 or 220 (C)
MechEng 301	Basic Engineering Thermodynamics	3	Math 233 (P), Physics 209 or 219 (P)

***Electrical Engineering Major (36 credits)**

ElecEng 305	Electrical Circuits II	4	ElecEng 301 (P), ElecEng 234 (P)
ElecEng 310	Signals and Systems	3	ElecEng 305 (P)
ElecEng 330	Electronics I	4	ElecEng 305 (C)
ElecEng 335	Electronics II	4	ElecEng 330 (P), ElecEng 310 (C)
ElecEng 354	Digital Logic	3	CompSci 201 (P) or 240 (P) or 250 (P)
ElecEng 361	Electromagnetic Fields	3	Phys 210 or 220(P), ElecEng 234 (P), grade C or better in Math 233
ElecEng 362	Electromechanical Energy Conversion	4	ElecEng 305 (P), ElecEng 361(P)
ElecEng 367	Introduction to Microprocessors	4	CompSci 240(P) or 250(201)(P) & C or better in ElecEng 354(P)
ElecEng 420	Random Signals and Systems	3	Jr St, ElecEng 310(P)
ElecEng 595	Capstone Design Project	4	Sr St, ElecEng 335 (P), ElecEng 367 (P)

****Mathematics (14 -16 credits)**

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

****Chemistry (5 credits)**

One of the following courses must be completed:			Chem 100 with "C" grade or Chemistry placement test
Chem 102 or Chem 105			

Physics (8 10 credits)

Physics 219 - 220 (recommended)	10	Physics 209 & 219; Math 232 (C) Phys 210 & 220; Math 233 (C)
Physics 209 - 210 & 214 - 215	10	Physics 214; Physics 209 (C) Physics 215; Physics 210 (C)

General Education Requirements

Distribution Requirements (15 credits)

Art	3	none
Humanities	3	none
Social Science	6	none
English 310 Writing, Speaking and Technoscience in the 21st Century	3	English competency

Cultural Diversity - One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.

Free Electives

23

Competency Requirements

***English Composition (0-6 credits)**

The English Composition requirement is satisfied by:

1. Earning a satisfactory score on the English placement test, or
2. Earning a grade of C or higher in English 102, or
3. Transferring with a grade of C or better in a course (3 credits or more) equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (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

*** Advancement to Major:** 1. Complete a minimum of 24 credits required for major. (Excludes: general education, prerequisite and orientation courses). 2. Complete Math 232 (or 222) with "C" or better grade. 3. Complete EAS 200 Professional Seminar. 4. Complete the English composition requirement. 5. Obtain a 2.5 GPA in all courses in item 1. **The program may impose major status as a prerequisite for courses numbered 300 or above.**

**** Placement Examinations:** Students without previous college level credits in Math, Chemistry or English may be required to take placement exams. The results of these tests determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.

Technical Electives--Electrical Engineering Major.

The electrical engineering program requires a total of **21-24** credits of technical electives, chosen as follows.

Group A Technical Electives: Select at least **15-18** credits. All non-required Electrical Engineering courses number 400-699 are Group A Technical Electives.

		Credits	Prerequisite
EAS 001	Co-op Work Period	3 ¹	Prior cons co-op dir
EAS 497	Study Abroad	3 ²	Acceptance to Study Abroad Prog; cons CEAS assoc dean
ElecEng 410	Principles of Discrete Systems & Digital Signal Processing	3	Jr St, ElecEng 310(P)
ElecEng 421	Communication Systems	3	ElecEng 335(C)
ElecEng 436	Introduction of Medical Instrumentation	3	Jr St, ElecEng 330(P)
ElecEng 437	Introduction to Biomedical Imaging	3	Sr St, ElecEng 310(P)
ElecEng 451	Introduction to VLSI Design	3	Jr St, ElecEng 330(P), 354(P)
ElecEng 457	Digital Logic Laboratory	3	Jr St, ElecEng 330(P), 354(P)
ElecEng 458	Computer Architecture	3	Jr. St., ElecEng 354(P), CS 315(P) or EE 367(P)
CompSci 459	Fundamentals of Computer Graphics	3	Jr St, CompSci 217(P), CompSci 252(P)
ElecEng 461	Microwave Engineering	3	Jr St, ElecEng 361(P)
ElecEng 462	Antenna Theory	3	Jr St, ElecEng 361(P)
ElecEng 464	Fundamentals of Photonics	3	Jr St, ElecEng 361(P)
ElecEng 465	Broadband Optical Networks	3	Jr St, ElecEng 305(P), 361(P)
ElecEng 471	Electric Power Systems	3	Jr St, ElecEng 362(P)
ElecEng 474	Introduction to Control Systems	4	Jr St, ElecEng 310(P) or CivEng 202 or cons instr
ElecEng 482	Introduction to Nanoelectronics	3	Jr St, ElecEng 330(C), 361(C)
ElecEng 490	Special Topics	1-3	Jr St
CompSci 520	Computer Networks	3	Jr St, CompSci 315(P) or 458(P) or ElecEng 367(P)
CompSci 530	Computer Networks Laboratory	3	Jr St, CompSci 520(P)
ElecEng 541	Integrated Circuits and Systems	3	Jr St, ElecEng 330(P)
ElecEng 545	FPGA Embedded CPUs & Firmware Development	3	Jr St, ElecEng 367(P) & 457(P)
ElecEng 562	Telecommunication Circuits	3	Sr St, ElecEng 330(P)
ElecEng 565	Optical Communication	3	Sr St, ElecEng 361(P), 330(P) or 465(P)
ElecEng 572	Power Electronics	3	Sr St, ElecEng 335(C)
ElecEng 574	Intermediate Control Systems	3	Sr St, ElecEng 474(402)(P) or MechEng 474(P)
ElecEng 575	Analysis of Electric Machines and Motor Drives	3	Jr St, ElecEng 330 (P), 362 (P)
ElecEng 588	Fundamentals of Nanotechnology	3	Jr St, ElecEng 361(P)
ElecEng 599	Senior Thesis	3	Sr St, Cons Instr
ElecEng 699	Independent Study	1-3	Jr St, Cons Instr
Ind Eng 360	Engineering Economic Analysis	3	Jr St
Matl 481	Electronic Materials	3	Jr St, MatlEng 201(P)
MechEng 321	Basic Heat Transfer	4	Jr St, MechEng 301(P)
BusAdm 447	Entrepreneurship	3	Jr St, Bus Adm 350(P)

Group B Technical Electives: Choose no more than 6 credits from the following list.

Any Mathematics course 400-level or above, or Math 313, Math 321, or Math 322

Any Chemistry course 200-level or above, or Chem 104³

Any Physics course 300-level or above, **or Phy 214, or Phy 215**

Any Biology course 150-level or above

Any Atmospheric Sciences course 100-level or above

Any Computer Science course 200-level or above

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

²Students who earn **3 or more** credits of Study Abroad may use 3 of those credits as approved technical electives.

³Students who take Chem 102 and 104 (equaling a min. of 8 credits) may use up to **3** credits of Chem 104 as Group B technical electives.

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