

**The University of Michigan
College of Engineering
Curriculum Committee**

**Agenda
November 6, 2007
1:30-3:00 p.m.
GM ROOM 4th Floor
Lurie Engineering Center**

1. Approval of Minutes from 10-23-07 Meeting
2. Course Approvals
3. Textbook Task Force Report
4. Multidisciplinary Design Minor – for Discussion and Vote
5. Proposed ME/AOSS SGUS Program

**University of Michigan
College of Engineering
Curriculum Committee Meeting
Tuesday October 23, 2007
1:30-3:00 p.m.
Lurie Engineering Center GM Room
Minutes**

Dick Robertson called the meeting to order at 1:40 p.m. Toby Teorey was out of town for this meeting.

Members Present: J. Boyd, M. Epelman, J. Holloway, E. Jankowski, C. Lastoskie, M. Moghaddam, S. Montgomery, J. Pan, T. Perakis, R. Robertson, R. Sulewski, G. Wakefield

Members Absent: L. Bernal, J. Hu, A. Hunt, M. Krug, E. Larsen, T. Teorey, M. Wooldridge

Guests: Susan Bitzer (for Alan Hunt), Brian Gilchrist, Henia Kamil, Harris McClamroch (for Luis Bernal), Ann Marie Sastry (for Margaret Wooldridge), Nejat Seyhun, Steve Skerlos, Pete Washabaugh

The minutes of the last meeting (October 2) were approved

Course approval Forms

Dick Robertson called for a motion to approve the following courses. This was moved and seconded.

These Courses Were Approved

- EECS 578 Modification—Changed prerequisites from: EECS 478 *to: EECS 478 or graduate standing*, Changed credit hours from: 3 *to: 4*.
- ESENG 501 New Course
- ESENG 503 New Course
- ESENG 599 New Course
- FINENG 500 New Course
- FINENG 590 New Course
- ME 360 Modification – Changed prerequisites from: ME 240 *to: ME 240 and P/A EECS 314*.
- ME 401(X-Listed with MFG 402) Modification—Changed title from: Statistical Methods for Manufacturing Systems *to: Statistical Quality Control and Design*
- ME 420 Modification—Changed description; adding lab section
- ME 450 Modification—Changed Credit restrictions from: Recommend ME 495 not be elected concurrently. Not open to graduate students. *to: May not be taken concurrently with ME 455 or ME 495. Not open to graduate students.*
- ME 455 Modification—Added credit restriction: May not be elected concurrently with ME 450 or ME 495
- ME 483 New Course
- ME 552(X-Listed with MFG 552) Modification—Changed Title from: Electromechanical System Design *to: Mechatronic Systems Design*; Changed description; Changed Prerequisites from: EECS 210 or equivalent *to: ME 350, ME 360, EEC S 314, or equivalent*; added a lab section.

Multidisciplinary Design Minor—Discussion James Holloway

James Holloway, Pete Washabaugh, Steve Skerlos and Brian Gilchrist opened this discussion. Information on this Proposal was included in a previous meeting packet and also was available as a handout at this meeting.

This proposal for a Multidisciplinary Design Minor was brought to this Committee again to answer any further questions regarding this Minor, such as what to modify or improve. This proposal was open to discussion and questions from this Committee.

One question that came up was how this Minor will fit into the four year program for students. It was stated that this question was answered within some of the examples included in the Proposal (one for ME and one for IOE), in which this fit into 128 credit hours. It was noted that with other departments, it would be more difficult to fit with only 128 hours, so a student would either need to enter the College with advanced placement, elect more credits per term, or spend some more time enrolled as a student in order to fulfill this Minor.

After some discussion, it was decided that the proposed Minor will be revised and re-submitted to the next meeting (November 6) for discussion and vote.

Change in Credit Hours for Financial Engineering Program

Professor Nejat Seyhun, Director of the Financial Engineering Program requested an increase in the number of credit hours for the Financial Engineering program from 36 to 39 credits, beginning January 2008.

Moved and Seconded.

This Change in credit hours was approved.

Creating Subject Area for the Energy Systems Engineering Degree Program

Ann Marie Sastry, Director of Energy Systems Engineering, presented this request to create a subject area for the Energy Systems Engineering Degree Program. This request is similar to the previous requests used to establish the AUTO, FINENG and PIM areas.

Moved and Seconded. This subject area creation was approved.

Proposed ME/AOSS SGUS Program

Information regarding this Program was included in the meeting packet.

This was tabled until the next meeting (November 6).

Adjournment: Motion to adjourn was made and seconded

Motion carried (approved)

Next Meeting: November 6, 2007 GM Room (4th Floor Lurie Engineering Center)

COURSE APPROVAL FORMS

For November 6, 2007 CoE CC Meeting

ME 305 Modification—Changing description; adding lab section



Action Requested

- New Course
- Modification of Existing Course
- Deletion of Course

Complete the following sections:
 New Courses - B & C completely
 Modifications - A modified information, B & C completely
 Deletions - A & C completely

Date 9/10/2007

Effective Winter 2008

A. CURRENT LISTING

B. REQUESTED LISTING

| | | | | | | | | | | | | | |
|--|--|---|--|---|---|--|--|--------------------|-------------------------------|--------------------------|--|-------------------------------|--------------------------|
| <input type="checkbox"/> Home Department _____ Div # _____ Course Number _____ Cross Listed Course Information _____ Course Title _____ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">TITLE ABBREVIATION</td> <td style="width: 15%;">Time Sched Max = 19 Spaces</td> <td style="width: 70%;"></td> </tr> <tr> <td></td> <td>Transcript Max = 20 Spaces</td> <td></td> </tr> </table> Course Description Rod element stiffness matrix. The assembly process. Solution techniques, Gaussian elimination. Truss examples. Beam elements. Frame examples. Plate bending. Heat conduction. Triangular and quadrilateral elements. The Isoparametric formulation. Plane stress applications. The course is project oriented with a substantial design content. A commercial finite element package is used extensively. | TITLE ABBREVIATION | Time Sched Max = 19 Spaces | | | Transcript Max = 20 Spaces | | <input type="checkbox"/> Home Department <u>Mechanical Engineering</u> Div # _____ Course Number <u>305</u> Cross Listed Course Information _____ Course Title <u>Introduction to Finite Elements in Mechanical Engineering</u> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">TITLE ABBREVIATION</td> <td style="width: 15%;">Time Sched Max = 19 Spaces</td> <td style="width: 70%;"><u>Finite Elem in ME</u></td> </tr> <tr> <td></td> <td>Transcript Max = 20 Spaces</td> <td><u>Finite Elem in ME</u></td> </tr> </table> Course Description for Official Publication (Max = 50 words) Introduction to theory and practice of the finite element method. One-dimensional, two-dimensional, and three-dimensional elements is studied, including structural elements. Primary fields of applications are strength of materials (deformation and stress analysis) and dynamics and vibrations. Extensive use of commercial finite element software packages, through computer labs and graded assignments. Two hour lecture and one hour lab. | TITLE ABBREVIATION | Time Sched Max = 19 Spaces | <u>Finite Elem in ME</u> | | Transcript Max = 20 Spaces | <u>Finite Elem in ME</u> |
| TITLE ABBREVIATION | Time Sched Max = 19 Spaces | | | | | | | | | | | | |
| | Transcript Max = 20 Spaces | | | | | | | | | | | | |
| TITLE ABBREVIATION | Time Sched Max = 19 Spaces | <u>Finite Elem in ME</u> | | | | | | | | | | | |
| | Transcript Max = 20 Spaces | <u>Finite Elem in ME</u> | | | | | | | | | | | |
| PROGRAM OUTCOMES: <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e <input type="checkbox"/> f <input type="checkbox"/> g <input type="checkbox"/> h <input type="checkbox"/> i <input type="checkbox"/> j <input type="checkbox"/> k | | | | | | | | | | | | | |
| Degree Requirements <input type="radio"/> Degree Requirement <input type="radio"/> Free Elective <input type="radio"/> Other <input type="radio"/> Core Course <input type="radio"/> Tech Elective | | | | | | | | | | | | | |
| Prerequisites <input type="radio"/> Enforced <input type="radio"/> Advised | | | | | | | | | | | | | |
| Credit Restrictions | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;"> Level of Credit <input type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad </td> <td style="width: 10%;"> Credit Hours Min Max </td> <td style="width: 10%;"> Contact Hrs/Wk Number of Wks </td> </tr> </table> | | Level of Credit <input type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad | Credit Hours Min Max | Contact Hrs/Wk Number of Wks | | | | | | | | | |
| Level of Credit <input type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad | Credit Hours Min Max | Contact Hrs/Wk Number of Wks | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;"> Level of Credit <input checked="" type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad </td> <td style="width: 10%;"> Credit Hours Min Max </td> <td style="width: 10%;"> Contact Hrs/Wk <u>3</u> Number of Wks <u>14</u> </td> </tr> </table> | | Level of Credit <input checked="" type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad | Credit Hours Min Max | Contact Hrs/Wk <u>3</u> Number of Wks <u>14</u> | | | | | | | | | |
| Level of Credit <input checked="" type="checkbox"/> Undergrad only <input type="checkbox"/> Ugrad or Non-Rckhm Grad <input type="checkbox"/> Rackham Grad <input type="checkbox"/> All Credit types <input type="checkbox"/> Non-Rckhm Grad <input type="checkbox"/> Rckhm Grad w/add'l Work <input type="checkbox"/> Ugrad or Rckhm Grad | Credit Hours Min Max | Contact Hrs/Wk <u>3</u> Number of Wks <u>14</u> | | | | | | | | | | | |
| Repeatability (Indi Research, Dir. Study, Dissertation) Is this course repeatable? <input type="radio"/> Yes <input checked="" type="radio"/> No Maximum Hours? _____ Maximum Times? _____ Can it be repeated in the same term? <input type="radio"/> Yes <input checked="" type="radio"/> No | | | | | | | | | | | | | |
| Printing Information (Optional) <input checked="" type="checkbox"/> Print the course in the Bulletin <input type="checkbox"/> Print the course in the Time Schedule | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;"> Class Type(s) <input checked="" type="checkbox"/> Lec <input type="checkbox"/> Rec <input type="checkbox"/> Sem <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Dis <input type="checkbox"/> Ind <input type="checkbox"/> Other </td> <td style="width: 10%;"> Graded Section <input type="radio"/> Lec <input type="radio"/> Rec <input type="radio"/> Sem <input type="radio"/> Lab <input type="radio"/> Dis <input type="radio"/> Ind <input type="radio"/> Other </td> <td style="width: 10%;"> Grading <input checked="" type="checkbox"/> A-E <input type="checkbox"/> CR/NC <input type="checkbox"/> S/U <input type="checkbox"/> P/F <input type="checkbox"/> Y </td> <td style="width: 40%;"> Location <input checked="" type="checkbox"/> Ann Arbor <input type="checkbox"/> Biological Station <input type="checkbox"/> Camp Davis <input type="checkbox"/> Extension </td> </tr> </table> | | Class Type(s) <input checked="" type="checkbox"/> Lec <input type="checkbox"/> Rec <input type="checkbox"/> Sem <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Dis <input type="checkbox"/> Ind <input type="checkbox"/> Other | Graded Section <input type="radio"/> Lec <input type="radio"/> Rec <input type="radio"/> Sem <input type="radio"/> Lab <input type="radio"/> Dis <input type="radio"/> Ind <input type="radio"/> Other | Grading <input checked="" type="checkbox"/> A-E <input type="checkbox"/> CR/NC <input type="checkbox"/> S/U <input type="checkbox"/> P/F <input type="checkbox"/> Y | Location <input checked="" type="checkbox"/> Ann Arbor <input type="checkbox"/> Biological Station <input type="checkbox"/> Camp Davis <input type="checkbox"/> Extension | | | | | | | | |
| Class Type(s) <input checked="" type="checkbox"/> Lec <input type="checkbox"/> Rec <input type="checkbox"/> Sem <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Dis <input type="checkbox"/> Ind <input type="checkbox"/> Other | Graded Section <input type="radio"/> Lec <input type="radio"/> Rec <input type="radio"/> Sem <input type="radio"/> Lab <input type="radio"/> Dis <input type="radio"/> Ind <input type="radio"/> Other | Grading <input checked="" type="checkbox"/> A-E <input type="checkbox"/> CR/NC <input type="checkbox"/> S/U <input type="checkbox"/> P/F <input type="checkbox"/> Y | Location <input checked="" type="checkbox"/> Ann Arbor <input type="checkbox"/> Biological Station <input type="checkbox"/> Camp Davis <input type="checkbox"/> Extension | | | | | | | | | | |
| Terms & Freq. of Offering <input checked="" type="checkbox"/> I <input checked="" type="checkbox"/> II <input type="checkbox"/> IIIa <input type="checkbox"/> IIIb <input type="checkbox"/> III <input checked="" type="checkbox"/> Yearly <input type="checkbox"/> Alter Years <input type="checkbox"/> Even Years <input type="checkbox"/> Odd Years Half term <input type="checkbox"/> 1st <input type="checkbox"/> 2nd | | | | | | | | | | | | | |
| Cognizant Faculty Member: <u>G. Hulbert</u> Title <u>Professor</u> Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty | | | | | | | | | | | | | |

Approval

Curriculum Comm. _____

Faculty _____

Rackham _____

Cross listed Unit 1 _____

Cross listed Unit 2 _____

Submitted By: Home Dept. Cross-listed Dept.

Name, Signature & Department
 Home Dept. Mechanical Engineering
 Cross-listed Dept(s) [Signature]

2007 October 30

To: CoE Curriculum Committee
From: MLTT Multidisciplinary Design Committee
Subject: Request to approve the structure for the Minor in Multidisciplinary Design

The MLTT Multidisciplinary Design Committee respectfully requests that the attached proposed Minor in Multidisciplinary Design (Proposal for Minors in Multidisciplinary Design FINAL Nov 2007) be reviewed and approved. The requested vote will approve:

1. the creation of a multidisciplinary design minor in the College of Engineering
2. the proposed program requirements for the minor, and
3. the proposed administrative points.

We have appreciated the discussion with the committee this fall. The final version of our proposal includes two changes from the previous version (rev 10) distributed to you. The changes are as follows:

- Based on the discussion at the CoE Currcomm meeting on October 23, we are specifically requiring each minor specialization to clearly describe educational objectives and metrics of success, plus a “sunset plan” that kicks in when and if a specialization shuts down. These would be reviewed and approved by the Advisory Council and would be part of the package sent to the CoE Curriculum Committee for final approval. The changed text is as follows.

“...A key determinant of the approval process for specializations, beyond their compliance with the template criteria, will be the educational objectives and metrics of success identified by the faculty proposing the specialization. Specializations must also be sustainable programmatically for at least 4 years. After 4 years, the specialization will be reviewed and either phased-out or re-approved by the Multidisciplinary Design Program Advisory Council (described below). An approved plan for handling students in the event of phase out will be required for each specialization.”

- The revised proposal also includes a third example of a student from Nuclear Engineering and Radiological Sciences (NERS) taking advantage of the MD Minor within the student’s general and technical electives. This is intended to show that it is possible for students in programs with more specific curricular requirements can take advantage of the MD Minor. We are very excited to have this appeal to a broad range of our students.

At the October 23rd Currcomm meeting there was also a request for clarification that faculty who choose to get involved in this program will have the support of the College. We believe the College is showing strong support for multidisciplinary and team taught programs as evidenced by the attached letter of support from Dean Dave Munson to the

Provost's MLTT committee. Besides cost sharing from the CoE Dean, the Associate Dean for Undergraduate Education is currently providing administrative support for the Multidisciplinary Design committee, and has identified staff to assist in program auditing. We also expect the Program Advisor for the Multidisciplinary Design minor to have a salary offset provided by the CoE. Further, the Provost's MLTT committee is currently formulating recommendations to the Provost to support multidisciplinary programs. These recommendations are expected to touch on both the university budget and on promotion and tenure processes. Recommendations are also being developed within the CoE to further incentivize multidisciplinary course teaching. We do believe that by establishing this overarching minor program it will be possible to create a coherent vision that can attract both the students and support (e.g. industrial sponsors) to help faculty teams run exciting minor specializations.

We appreciate the special efforts of the CoE Curriculum Committee to make the Minor in Multidisciplinary Design a success!



DAVID C. MUNSON, JR.
ROBERT J. VLASIC DEAN OF ENGINEERING
PROFESSOR OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING

ROBERT H. LURIE ENGINEERING CENTER
1221 BEAL AVENUE
ANN ARBOR, MICHIGAN 48109-2102
734 647-7010 FAX 734 647-7009
munson@umich.edu
<http://www.engin.umich.edu/admin/dean/>

September 11, 2006

Brian Gilchrist, Interim Chair
Electrical Engineering and Computer Science
University of Michigan
3303A EECS Building
1301 Beal Avenue
Ann Arbor, MI 48109-2122

Dear Brian,

The College of Engineering has a strong interest in expanding opportunities for students in “real-world” activities that are multi-disciplinary in nature and require students to work across boundaries. Beginning this fall, the College is undertaking planning on several fronts to both improve and expand such opportunities. The “Practicum in a Multi-Disciplinary World” proposal has the potential to play an important part in such efforts and I am pleased to endorse its vision. The College is available to work with faculty this academic year to begin integrating your ideas into the College’s efforts.

I also endorse the idea we discussed that this initiative should span the University, engaging students, faculty, and academic units from outside of engineering. I encourage you to move forward with reaching out to other groups within the University this fall.

I anticipate that there will be College (cost-sharing) support for these efforts, including faculty and staff support and assistance in coordinating space for pilot projects. The College already is planning for project space in the Space Research Building this fall. Further details will be worked out over the next couple of months.

Sincerely,

David C. Munson, Jr.

DCM/mas

Proposal for Minors in Multidisciplinary Design

Undergraduate students enrolled in a College of Engineering degree program can benefit from practical experience designing technology systems in collaboration with students from other disciplines both inside and outside of engineering. This experience requires students to apply their in-depth disciplinary analysis skills to projects that also require broader multidisciplinary concepts and approaches. This will expose participating students to systems engineering and will help them succeed in the fast-paced, global and entrepreneurial market for graduate students and professionals in the 21st Century.

A Minor in Multidisciplinary Design requires students to exercise their acquired disciplinary expertise in the context of a significant multi-semester design project¹. These projects must be multi-disciplinary and involve concepts and approaches from at least two other disciplines to be completed successfully². The projects must also require the following elements: 1) problem definition based on qualitative and/or quantitative requirements, 2) generation of creative solution concepts, 3) analysis of the quality of proposed concepts, 4) selection and optimization of a final concept, 5) evaluation of the final concept through the *building* and *testing* of prototypes or virtual models, and 6) iteration and/or detailed recommendation for improvement of the final concept based on the lessons learned from steps 1 through 5. These design projects are conducted during or after the student has taken a defined set of preparatory courses and ideally features a meaningful connection with at least one discipline outside of CoE.

The Minor in Multidisciplinary Design will be comprised of 15 credits and can be sponsored by individual faculty, groups of faculty and by the Office of the Associate Dean for Undergraduate Education for the purpose of supporting cross-departmental or college programs. An Advisory Council supporting the program will seek to engage other units outside of engineering to promote joint student projects and parallel curricular outcomes (e.g., non-engineering minors in multi-disciplinary design). Sponsoring faculty within CoE can develop their own *specialization* within the template for minors in multidisciplinary design provided below. For example, specializations that have been proposed so far include Space Systems, Environmental Sustainability, Service Learning, and Solar Vehicle Systems. A student completing the requirements for a specialization within the Minor in Multidisciplinary Design can elect to have this specialization reflected on his or her transcript (e.g., “Minor in Multidisciplinary Design with Specialization in Space Systems Design”, “Minor in Multidisciplinary Design with Specialization in Service Learning”, etc.). While these specializations can be tailored to the passions of specific faculty groups and students, an umbrella Minor in Multidisciplinary Design will also exist that is supported by the Office of the Associate Dean for Undergraduate Education and serves as the template for all specializations.

¹ We allow the interpretation of a multi-semester design project to include a series of linked single-semester multidisciplinary design experiences in appropriate circumstances.

² Here we note the possible distinction between discipline and department/program: it is possible for students in the same department/program to practice different disciplines, as it is possible for students in different departments/programs to practice the same discipline. The goal is disciplinary diversity, not programmatic diversity per se.

Program Requirements

A Minor in Multidisciplinary Design is granted after completion at least 15 credit hours of coursework, including at least 2 upper division courses, distributed as follows³:

A. Completion of at least 2 credits of introductory “Design, Build, Test” (DBT) experience.

- Examples include appropriate sections of ENG 100, ME 250, AERO 205, and possibly a new ENG course at the 200 level that is currently under discussion.

B. Completion of at least 3 credits of “cornerstone” coursework that serves to prepare the student *in depth* for his or her multi-semester project work.

- The Minor in Multidisciplinary design is best served if the cornerstone experience meets the needs of the project and exceeds the nominal preparation associated with the student’s major discipline. Therefore the student must identify a cornerstone course, outside the set of his or her required classes, which will serve to prepare the student for his or her specific project work.
- This course is to be taken prior to completing the final 3 credits of project work and should be identified during the project scoping exercise (see item C below).
- Specializations can require students to take a specific cornerstone class.

C. Completion of at least 7 credits of multidisciplinary design project work⁴.

- Ideally this project features consecutive semesters of in-depth work on the same design project⁵.
- These credits cannot all be taken in the same semester.
- The project work can occur within departmental design courses (e.g., ME 450 and ME 455), independent study courses (e.g., ME 490), or in the ENG curriculum (e.g., ENG 350, ENG 390, and/or ENG 450)⁶.
- Prior or at the beginning of this multi-semester project experience, the student must complete a thoughtful project scoping exercise that details the project objectives, approach to completing the objectives and how the student intends to contribute his or her expertise to the completion of the project. Courses the student plans to take to complete the minor should also be identified at this time.

D. Completion of at least 2 credits of formal leadership and/or mentorship activities within the Multidisciplinary Design program⁷.

³ Completion of the minimum credit hours for each category A-D adds up to 14 credit hours; therefore the student needs at least one extra credit hour in one of the categories. This will be straight forward. For example, all sample courses in A are 3-4 credits.

⁴ A “multidisciplinary design project” is operationally defined as a design project containing a significant engagement and integration of students, faculty, or course projects from three distinct disciplines. Ideally one of these disciplines is outside the College of Engineering. Students must be prepared for these projects to be extensive, often involving co-curricular (non-graded) and extra-curricular activities.

⁵ Exceptions can be considered under appropriate circumstances.

⁶ Co-ops and research projects can be considered if they reflect the spirit of the program and are appropriately reflected in graded coursework.

⁷ The two credits of mentorship/leadership activity can carry pass/fail grades.

Additional Administrative Points

Creation of the template for minors in multidisciplinary design requires approval by the College of Engineering Curriculum Committee. If approved, the proposal will be forwarded to the CoE faculty for final approval/disapproval. Once the template is approved, the CoE Curriculum Committee will be responsible for approving specializations. A key determinant of the approval process for specializations, beyond their compliance with the template criteria, will be the educational objectives and metrics of success identified by the faculty proposing the specialization. Specializations must also be sustainable programmatically for at least 4 years. After 4 years, the specialization will be reviewed and either phased-out or re-approved by the Multidisciplinary Design Program Advisory Council (described below). An approved plan for handling students in the event of phase out will be required for each specialization.

The Associate Dean for Undergraduate Education will convene an Advisory Council of faculty. This Advisory Council, with appropriate staff support, is responsible for administering the minor. The staff will perform activities such as advising, maintaining relations with partner units, and providing timely auditing during the student's final term. The Advisory Council faculty will be responsible for approving variances to the minor requirements, approving use of the umbrella minor, developing course lists for program requirements, establishing multidisciplinary contacts across campus, and maintaining the rigor of the program.

In addition to the normal rules for a CoE minor, the following rules apply to the Minor in Multidisciplinary Design:

- i. Transfer credit may not be used to fulfill the multidisciplinary design project course requirement (item C above) or the mentorship/leadership course requirement (item D above).
- ii. Only the 2-credit mentorship and leadership requirement can be fulfilled by taking Pass/Fail courses.
- iii. The Advisory Committee of the Multidisciplinary Design Program is responsible for approving any variance in course requirements for a minor. Such variances are usually proposed by the student, ideally during the project scoping activity in item C above.

Sample Paths for Completing a CoE Minor in Multidisciplinary Design

Scenario for Student #1: This is a Mechanical Engineering student pursuing a Minor in Multidisciplinary Design with Specialization in Product Innovation⁸. The specific project the student will perform is to design a stylish cellular telephone housing that can accept the electronics components from numerous models of working and discarded cell phones. The idea is to develop a “brand” of second-hand phones that looks good, is low cost, functions properly despite the input variability, and reduces demand for natural resources. This specialization lies at the intersection of engineering product design and industrial design. Other students on the project are looking at business and market development aspects – rounding out the project’s multi-disciplinarity. The project is supported by the BLUElab.

- A. Completion of at least 2 credits of introductory “Design, Build, Test” experience.**
 - Student takes ME 250 (4 cr)

- B. Completion of at least 3 credits of “cornerstone” coursework that serves to prepare the student in depth for his or her multi-semester project work.**
 - Student takes Art and Design 300.0193⁹ (3 units).

- C. Completion of at least 7 credits of multidisciplinary design project work: Prior to or at the beginning of this multi-semester project experience, the student must complete a detailed project scoping exercise that details the project objectives, approach to completing the objectives and how the student will contribute his or her expertise to the completion of the project.**
 - Student takes ME 455 (4 cr) and does the project scoping exercise during the first month of the class and submits it for approval.
 - Student takes ME 490 (3 cr) the following semester and completes the sequence.

- D. Completion of at least 2 credits of formal leadership and/or mentorship activities within the Multidisciplinary Design program.**
 - Student takes ME 491 (2 cr, Pass/Fail)

⁸ Placeholder title.

⁹ 3-D Design: From Concept to Realization: An exploration of design principles and methodologies resulting in the design of original three dimensional and functional objects. Emphasis will be placed on defining unique problems, refining problem solving techniques, developing conceptualization and visualization skills and exploring 3D form development. Students will develop their own concepts through to highly crafted three dimensional appearance models of functional objects appropriate to mass production and for use by diverse users.

Scenario for Student #2: This is an Industrial and Operations Engineering student interested in entrepreneurship, clean technology, and sustainable development and is pursuing the general Minor in Multidisciplinary Design. The design project the student will perform is a part of AWARE@home, a system of intuitive interfaces for homeowners to understand and reduce their consumption of utilities such as gas, electric, and water. The student will develop cost estimates for mass production of system elements and recommend manufacturing partners. The student will also evaluate the environmental impact of the product relative to the reduction in environmental emissions that the system is expected to achieve. Other students on the project are looking at circuit design, user interfaces and consumer behavior aspects – rounding out the project’s multi-disciplinarity. The project is supported by the BLUElab.

- A. Completion of at least 2 credits of introductory “Design, Build, Test” experience.**
 - Student takes ME 250¹⁰ (4 cr)

- B. Completion of at least 3 credits of “cornerstone” coursework that serves to prepare the student in depth for his or her multi-semester project work.**
 - Student takes CEE 260 (4 units).

- C. Completion of at least 7 credits of multidisciplinary design project work. Prior to or at the beginning of this multi-semester project experience, the student must complete a detailed project scoping exercise that details the project objectives, approach to completing the objectives and how the student will contribute his or her expertise to the completion of the project.**
 - Student takes IOE 424 (4 cr) and does the project scoping exercise during the first month of the class and submits it for approval.
 - Student takes IOE 490 (3 cr) or ME 589 (3 cr) in a subsequent semester and completes the sequence.

- D. Completion of at least 2 credits of formal leadership and/or mentorship activities within the Multidisciplinary Design program.**
 - Student takes ENG 4yy (2 cr)
 - New course to be developed that provides template for leadership and mentorship activities appropriate in the context of design projects.

¹⁰ IOE students can take ME 250, and some do already. There is a big problem however if ME 250 becomes the “catch-all” for students not in ME and who didn’t take a DBT version of ENG 100. ME 250 is already maxed out in terms of enrollment.

An easy requirement would be to change all ENG 100 so they are DBT (maybe not realistic!). This still wouldn’t address transfer students or LSA students. An alternative is to make ENG 270 a possible DBT.

Scenario for Student #3: This is a student in Nuclear Engineering & Radiological Sciences interested the design of a nuclear powered spacecraft for the exploration of the Jupiter Icy Moons. The design project will involve other students from Aerospace Engineering and Atmospheric, Oceanic and Space Sciences. The project will consider spacecraft power (NERS), science payload (AOSS & Aero), mission trajectory and control (AOSS & Aero), and space environment (NERS, AOSS, Aero). The minor can fit completely within the student's general and technical electives.

- E. Completion of at least 2 credits of introductory “Design, Build, Test” experience.**
- Student takes a DBT section of Eng 100 (4 cr)
- F. Completion of at least 3 credits of “cornerstone” coursework that serves to prepare the student in depth for his or her multi-semester project work.**
- Student takes AERO 245 - Performance of Aircraft and Spacecraft¹¹ (4 units).
- G. Completion of at least 7 credits of multidisciplinary design project work. Prior to or at the beginning of this multi-semester project experience, the student must complete a detailed project scoping exercise that details the project objectives, approach to completing the objectives and how the student will contribute his or her expertise to the completion of the project.**
- Student takes Eng 450 (4 cr) and completes the project scoping exercise and a system level design with the team.
 - Student takes NERS 442 (4 cr) or NERS 554 (4 cr) and completes a detailed reactor or spacecraft shield design in concert with the group taking other design courses (e.g. Aero 483) and completing other component designs.
- H. Completion of at least 2 credits of formal leadership and/or mentorship activities within the Multidisciplinary Design program.**
- Student takes ENG 4yy (2 cr)
 - New course to be developed that provides template for leadership and mentorship activities appropriate in the context of design projects.

¹¹ The student might then take Aero 345, Flight Dynamics and Control, as a technical elective in NERS

The attached descriptive page provides specific information about the ME/AOSS SGUS program as approved by AOSS SGUS Advisor, the Mechanical Engineering (ME) Undergraduate Program Committee, and the Chair of ME. There are currently three students in the ME Department who would like to pursue this SGUS program. The ME Dept. seeks the approval of the CoE Curriculum Committee for this SGUS program.

Please contact us if there are any questions.

Prof. David R. Dowling (drd@umich.edu)

Prof. Thomas Zurbuchen (thomasz@umich.edu)

SEQUENTIAL GRADUATE/UNDERGRADUATE STUDY (SGUS)

B.S.E.[Mech. Engin.] and the M.S.E. [Atmos., Ocean., & Space Sci..]

Admission to SGUS ME/AOSS (Intent Form)

By the end of the junior year (80-85 hours) the student must meet with the ME UG student advisor to discuss the SGUS program. The Intent Form must be filed at this time with a copy given to the AOSS graduate program office. This form actually outlines what credits are to be double counted and what courses can be possibly transferred to the graduate degree.

- 3.2 cumulative GPA required at time of filing Intent Form and at time of admission to the AOSS graduate program.
- may double count a maximum of 9 approved graduate credits graded "B" or better from the advanced technical elective or unrestricted electives.
- may transfer a maximum of 3 acceptable graduate credits graded "B" or better not used for BSE in Mech. Eng.
- may take AOSS 581 (Space System Management) and AOSS 464 (Space and Spacecraft Environment) as general electives for the BSE in Mech. Eng.
- must enter the graduate program in the subsequent full term upon completing the BSE in ME ; no BSE in ME requirements are waived.
- must enroll in the AOSS graduate program for a minimum of two full terms at full time status subsequent to completing the BSE. (minimum of 9 hours each semester).
- may dual enroll in undergraduate/graduate program early if within 6 hours of completing the BSE. (Details to be worked out on a case-by-case basis).

Advanced Mathematics and Other Requirements

Any graduate Stat or Math course approved/accepted by Undergraduate Program will be honored.

Restrictions

May not pursue both EGL and SGUS, and may not switch from one of these programs to another at any time.

GRE

Students may enter this SGUS program without taking the GRE .

Approved by ME UG Program Committee on 9-19-07

Approved by AOSS SGUS Advisor, 09-15-07

Approved by the ME Chair, 10-9-07