

PROPOSAL TO THE SENATE COMMITTEE ON EDUCATIONAL POLICY

TITLE OF THE PROPOSAL:

Aerospace Engineering Undergraduate Curriculum Revision, College of Engineering

SPONSOR:

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BRIEF DESCRIPTION:

The curriculum revision encompasses:

- An overall reduction in required hrs from 134 to 128 as recommended by the College of Engineering Executive Committee.
- Required Courses Dropped From The Curriculum (a reduction of 14 hours):
 - CS 101 *Intro Computing: Engrg & Sci* (3 hrs)
 - CHEM 104 *General Chemistry II* (3 hrs)
 - CHEM 105 *General Chemistry Lab II* (1 hour)
 - GE 101 *Engineering Graphics & Design* (3 hrs)
 - AE 302 *Aerospace Flight Mechanics** (3 hrs)
 - 1 hour reduction of free elective required hrs (from 7 to 6).
- Required Courses Added (net addition of 6 hours):
 - IE 300 *Analysis of Data* (3 hrs) and
 - AE 483 (new) *Aerospace Computing Systems* (3 hrs).
- Required Courses Restructured (net addition of 1 hour):
 - AE 202 (new) *Aerospace Flight Mechanics* (3 hrs) replaces AE 201* (2 hrs),
 - AE 323 (new) *Applied Aerospace Structures* (3 hrs) replaces AE 322* (3 hrs),
 - AE 370 (new) *Aerospace Numerical Methods* (3 hrs) replaces AE 470* (3 hrs),
 - AE 442 (new) *Aerospace Systems Design I* (3 hrs) replaces AE 440*(3 hrs),
- Required Course Replaced (net addition of 1 hour):
 - TAM 212 (existing) *Introduction to Dynamics* (3 hrs) replaces AE 252** (2 hrs)
- Several minor ancillary course changes which involve title changes, renumbering, minor content and description changes, prerequisite statement changes, and are summarized in Appendix A.

*denotes course is to be discontinued

**denotes course will no longer be required for AE majors, but is required for NPPE majors

JUSTIFICATION:

The last major curriculum change for the department was approved in 1994 at the time the department was named Aeronautical and Astronautical Engineering (AAE). In July 2003 the department name was changed to Aerospace Engineering (AE). Also during the last decade or so there have been changes to our discipline which this new revised curriculum seeks to incorporate. In particular, there is more emphasis on information technology, integrated systems, and less need for the organic chemistry topics taught in Chemistry 104/105. Furthermore, the College of Engineering Executive Committee, Ad-hoc Subcommittee on Undergraduate Education (February 8, 2008) recommended that all engineering undergraduate programs set as a target 128 hours for graduation while ensuring basic sciences as well as interdisciplinary concepts and engineering systems design.

This undergraduate curriculum revision arose from faculty retreats and several faculty meetings and represents recommendations and suggestions from our three main constituent groups: students, alumni, and industry. Student comments were offered through meetings with the AE Undergraduate Advisory Board, which has seven members. The feedback from the alumni was primarily through the AE Alumni Advisory Board, which has 30 members mostly from the aerospace industry along with a few from universities and government. In general, all three groups made helpful suggestions and were supportive of the changes and suggested it be implemented as soon as possible.

The overall curriculum concept was voted on and unanimously approved by the faculty on November 5, 2008 and includes six major elements to improve the overall quality and experience for undergraduates of the Aerospace Engineering undergraduate program:

- 1) The total number of credit hrs required for the degree will decrease from 134 to 128 to address a College of Engineering Executive Committee recommendation.
- 2) AE 202 *Aerospace Flight Mechanics* (3 hrs) replaces AE 201 (2 hrs) as a required sophomore course to incorporate a substantial introduction to Matlab® for use in that course which will also partially offset the removal of CS 101. Further, this will ensure strong continuity of programming skills with AE 370 which is taken in the junior year and which also uses Matlab®.
- 3) IE 300 *Analysis of Data* (3 hrs) is added to cover prerequisite topics for the new AE 483 *Aerospace Computing Systems* (3 hrs) and to provide comprehensive statistics and probability knowledge to strengthen the experience in the experimental laboratory courses, now slated for the senior year.
- 4) The restrictive sequential order in which junior-year course pairs (AE 311, AE 312), (AE 321, AE 322—to be AE 323), and (AE 351, AE 353) must currently be taken is relaxed. Currently, these courses are only offered once per academic year on a fall-spring rotation. Furthermore, AE 252 will be replaced by TAM 212 to insure that students can take this material either semester and further enhance the students foundations in dynamics with an extra credit hour. The greater flexibility of the curriculum will be especially helpful for students who study abroad or participate in cooperative education programs. This flexibility will also be helpful for students who are either somewhat ahead or behind the traditional four-year schedule, e.g. transfer students, incoming students with significant AP, IB, or similar credit, and students who fall behind due to academic difficulties.
- 5) A new required senior-level course, AE 483 *Aerospace Computing Systems*, is added to incorporate developing techniques in information technology with hardware labs that are

relevant to Aerospace Engineering problems. This course reflects new frontiers in AE that have only been previously addressed with elective courses. This course will utilize the programming and numerical methods of AE 370 and introduce further algorithm design and analysis to offset the removal of CS 101.

- 6) The first semester of the senior design sequence, AE 442 (replaces AE 440), has undergone a major revision to allow students to choose between specializing in aircraft or spacecraft design. This change also allows integration of graphics, design and specific aerospace technical topics which were lost when AE 302 and GE 101 were eliminated. The inclusion of computer graphics in AE 442 is especially helpful since this topic is employed in a large portion of the design work done in this course and the subsequent design course, AE 443. In the current curriculum, the students learned this material in their first semester of the freshman year but did unfortunately not use it until their senior year design courses.

As part of the overall reduction in hours, some courses were unfortunately but necessarily eliminated, chiefly CS 101, GE 101 and CHEM 104/105. The essential topical material from CS 101 needed for AE students will now be distributed throughout AE 202, AE 370 and AE 483. The essential topical material from GE 101 needed for AE students will now be included in AE 442, allowing the students to apply the knowledge directly and immediately for the aircraft and spacecraft design. The CHEM 104/105 courses include material on organic chemistry that is not seen as a critical priority for Aerospace Engineering, especially as Information Technology (IT) issues have become more important. The loss of these courses while significant, is felt to be well compensated by the overall improvement of the curriculum as noted by the above six elements.

BUDGETARY AND STAFF IMPLICATIONS:

1. Additional staff and dollars needed: The reduction in the number of credit hours required for the B.S. degree in Aerospace Engineering (from 134 to 128) is expected to result in some net savings overall. For departments whose courses are currently required in the Aerospace Engineering undergraduate curriculum, qualitative comments on cost implications are discussed in Items 2 and 3.
2. Internal reallocations (e.g., change in class size, teaching loads, student-faculty ratio, etc.):
 - **Aerospace Engineering.** Aerospace is dropping ten hours from our curriculum (4 courses) and adding nine hours (3 courses) so there will be no significant change in budget or staffing.
3. Effect on course enrollment in other departments and explanations of discussions with representatives of those departments:
 - **Chemistry.** Chemistry will no longer support approximately 100 Aerospace Engineering majors each year for 4 hrs of coursework due to the dropping of CHEM 104/105. This is expected to lead to some savings in this department. This has been discussed with Prof. Steve Zimmerman and the Chemistry Department has agreed to this change.
 - **Computer Science (CS).** Computer Science will no longer have to support approximately 100 Aerospace Engineering majors annually for 3 hrs of coursework due to the dropping of

CS 101. This is expected to lead to some savings in this department. This has been discussed with Prof. Lenny Pitts and CS has agreed to this change.

- **Industrial and Enterprise Systems Engineering (IESE).** Industrial and Enterprise Systems will see a shift of AE majors taking IE 300 instead of GE 101. Since these are both 3 hour courses, and will involve roughly the same number of students, no significant change in budget or staffing are expected. This has been discussed with Prof. Manssour Moeinzadeh and IESE has agreed to this change.
- **Mechanical Science and Engineering (MechSE).** Mechanical Science and Engineering will see an increase of approximately 100 students annually in TAM 212, as it will now be a required course for Aerospace Engineering students. This is expected to have some budget implication for MechSE, primarily in terms of graduate teaching assistant support at ¼ FTE annually. This has been discussed with Prof. James Phillips and MechSE is willing to accept these students.
- **Nuclear Engineering (NPRE).** Nuclear Plasma and Radiological Engineering will continue at this time to use AE 252 as part of their required curriculum. This has been discussed with and approved by Prof. James Stubbins.

Overall, the reduction in the number of credit hrs required for graduation (from 134 to 128) is expected to allow some savings, primarily to the Computer Science and Chemistry departments, but offset in part by additional costs to MechSE.

4. Impact on the University Library: There will be no significant budgetary or staff impact with respect to the University Library or with respect to computer and laboratory use.
5. Impact on computer use, laboratory use, equipment, etc.: There will be no significant net amount change since the laboratory and computer related instruction will be quite similar.

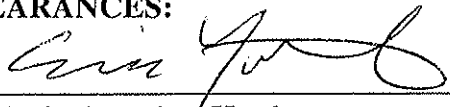
GUIDELINES FOR UNDERGRADUATE EDUCATION:

This curriculum revision continues to meet the guidelines for undergraduate education as identified by the Senate Committee on Educational Policy which include three basic tenets for each undergraduate student. These tenets can be summarized as the ability: 1) to communicate as well as to think critically, creatively and with tolerance; 2) to understand and appreciate our heterogeneous cultures as well as foreign cultures; and 3) to demonstrate a strong theoretical base and skill set for the profession as well as an understanding of its future challenges. The first tenet is primarily satisfied by the non-technical required courses (including Rhetoric) as well as the four laboratory and design AE courses which remain unchanged in this revised curriculum. The second tenet is primarily satisfied by the campus-wide requirements for Social Sciences and Humanities which remain unchanged in this revised curriculum. The third requirement is more suitably satisfied with the revised curriculum due to its stronger focus on information technology and decision making issues (through the new course AE 483) and an understanding of theoretical probability and statistics (through the newly required course IE 300). Furthermore, the new curriculum allows a more integrated use of computer programming with Matlab in AE 202, AE 370, and in AE 483.

STATEMENT FOR PROGRAMS OF STUDY CATALOG: See Appendix B

EFFECTIVE DATE: Fall 2009

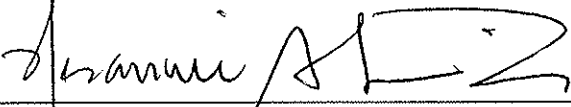
CLEARANCES:



Date: 11/13/08
Eric Loth, Associate Head
Undergraduate Studies in Aerospace Engineering



Date: 11/13/08
Craig Dutton, Department Head
Aerospace Engineering



Date: 3/10/09
Ilesanmi Adesida, Dean
College of Engineering

Date: _____
Office of the Provost

Appendix A: Minor Ancillary Course Revisions

* denotes an existing course has more than one type of revision

Title Changes:

AE 321: from *Aerospace Structures I* to *Mechs of Aerospace Structures*

AE 352*: from *Aerospace Dynamics II* to *Aerospace Dynamical Systems*

Renumbering:

AE 360*: to AE 461

AE 441: to AE 443

Description:

AE 312*: description

AE 433*: description

Prerequisite Statement Changes:

AE 311: from *CS 101; credit or concurrent registration in MATH 241 or MATH 380* to *Credit or concurrent registration in AE 202, MATH 241 or MATH 380*

AE 312*: from *AE 311, CS 101, MATH 285, ME 300; credit or concurrent registration in AE 201 to AE 202 and MATH 285; credit or concurrent registration in ME 300*

AE 352*: from *AE 252, MATH 225, and MATH 285* to *MATH 225, MATH 285, and TAM 212*

AE 353: from *AE 252, MATH 225, and MATH 285* to *MATH 225, MATH 285, and TAM 212*

AE 360* to 461: from *Credit or concurrent registration in AE 322, AE 352, and AE 353* to *AE 321, and AE 352; credit or concurrent registration in AE 323, and AE 353*

402: from *AE 302* to *AE 202*

AE 419: from *AE 302 and AE 353* to *AE 202 and AE 353*

AE 433*: from *AE 312 and CS 101* to *AE 312 and PHYS 212*

Courses Discontinued:

AE 201, *Aerospace Flight Mechanics I*

AE 302, *Aerospace Flight Mechanics II*

AE 322, *Aerospace Structures II*

AE 360, *Structures and Control Lab*

AE 440, *Aerospace Systems Design I*

AE 441, *Aerospace Systems Design II*

AE 470, *Aerospace Numerical Methods*

Appendix B: Statement for Programs of Study Catalog

The Aerospace Engineering curriculum provides a strong fundamental background in engineering, mathematics, and science, along with the ability to apply this fundamental knowledge to the analysis and design of future aircraft and spacecraft. It also prepares students for lifelong learning and the attainment of their career goals in the field of aerospace engineering and in a wide range of other areas. The concepts of system design are introduced early in the curriculum and culminate in the yearlong senior capstone design experience (AE 442, AE 443), in which students work in teams to respond to a design challenge from industry, government, or a professional engineering society. A total of 18 hours of technical and free electives allows the student to pursue an individualized program of study.