Date Submitted: 01/07/22 12:41 pm

Viewing: **10KP4048BS : Aerospace Engineering, BS**

Last approved: 10/18/21 2:43 pm

Last edit: 02/15/22 10:40 am

Changes proposed by: Laura Gerhold

| | |
|---|---|
| Catalog Pages Using this Program | Aerospace Engineering, BS |

Proposal Type:

## In Workflow

1. **U Program Review**
2. **1615 Head**
3. **KP Committee Chair**
4. **KP Dean**
5. **University Librarian**
6. **Provost**
7. **Senate EPC**
8. Senate
9. U Senate Conf
10. Board of Trustees
11. IBHE
12. HLC
13. DMI

## Approval Path

1. 01/07/22 2:42 pm
   Deb Forgacs (dforgacs):
   Approved for U Program Review
2. 01/07/22 5:08 pm
   Jonathan Freund (jbfreund):
   Approved for 1615 Head
3. 02/03/22 11:40 am
   Brooke Newell (bsnewell):
   Approved for KP Committee Chair
4. 02/03/22 11:47 am
   Candy Deaville (candyd):
   Approved for KP Dean
5. 02/03/22 11:56 am

John Wilkin (jpwilkin): Approved for University Librarian
6. 02/03/22 4:16 pm Kathy Martensen (kmartens): Approved for Provost

## History

1. Jul 5, 2019 by Deb Forgacs (dforgacs)
2. Aug 9, 2019 by Deb Forgacs (dforgacs)
3. Aug 12, 2019 by Deb Forgacs (dforgacs)
4. Jan 27, 2020 by Tim Bretl (tbretl)
5. May 5, 2020 by Laura Gerhold (gerhold)
6. May 8, 2020 by Deb Forgacs (dforgacs)
7. Jun 25, 2020 by Deb Forgacs (dforgacs)
8. Mar 12, 2021 by Deb Forgacs (dforgacs)
9. Oct 18, 2021 by Brooke Newell (bsnewell)

Major (ex. Special Education)

This proposal is for a:
Revision

## Administration Details

| | |
|---|---|
| Official Program | Aerospace Engineering, BS |

| | |
|---|---|
| Name | |
| Sponsor College | Grainger College of Engineering |
| Sponsor Department | Aerospace Engineering |
| Sponsor Name | Timothy Bretl |
| Sponsor Email | tbretl@illinois.edu |
| College Contact | Jonathan Makela ~~Brooke Newell~~ |
| College Contact Email | jmakela@illinois.edu ~~bsnewell@illinois.edu~~ |
| College Budget Officer | Tessa Hile |
| College Budget Officer Email | tmhile@illinois.edu |

List the role for rollbacks (which role will edit the proposal on questions from EPC, e.g., Dept Head or Initiator) and/or any additional stakeholders. *Purpose: List here who will do the editing work if proposal needs rolled back. And any other stakeholders.*

Brooke Newell - bsnewell@illinois.edu
Laura Gerhold - gerhold@illinois.edu

Does this program have inter-departmental administration?

No

## Proposal Title

| | |
|---|---|
| Effective Catalog Term | Fall 2022 |

Provide a brief, concise description (not justification) of your proposal.

Removed Liberal Education Electives, updated number of free elective hours, and removed footnotes(when possible) into the Program of Study Table (to improve accessibility).

We will be allowing CS 124 as an approved substitution for CS 101.

We are removing MATH 225 and replacing with MATH 257.

Included a choice for propulsion requirement (either AE 433 or 434).

Updated technical elective list.

List here any related proposals/revisions and their keys. *Example: This BS proposal (key 567) is related to the Concentration A proposal (key 145) and the Concentration B proposal (key 203).*

# Program Justification

Why are these changes necessary?

After careful analysis of programs of studies, various requirements, and course selection for students in The Grainger College of Engineering, we have decided to provide additional flexibility to all engineering undergraduate students by increasing the number of free elective hours in all engineering programs. While the actual number of credit hours for free electives varies by program, within the college-8 programs currently provide only 6 credit hours for free electives while an additional 2 have less than 10-only 4 programs have more than 10 free elective credits. This lack of free elective credit hours limits students' abilities to efficiently pursue minors, certificates, and other educational opportunities and potentially limits those opportunities only to students coming in with significant AP credit or similar.

The additional free elective credit hours added to the program of study are obtained through the removal of The Grainger College of Engineering's Liberal Education requirement, which required engineering students to take an additional 6 credit hours above-and-beyond the campus' General Education requirement from the Humanities & the Arts, Social & Behavioral Sciences, or a college-curated list of courses. Over time, the Liberal Education requirement has been revised within the college, successively relaxing restrictions and providing additional choice to students (i.e., removal of a sequencing requirement in 1999; addition of the college-curated course list in 2010). Simultaneously, the college-curated list of courses continued to expand to include courses from approximately 120 rubrics across campus (including within The Grainger College of Engineering), gradually removing constraints to allow greater flexibility of choice for students to take advantage of the many opportunities the campus has to offer. Still, in its current form, this additional college-level requirement constrains student choice and interferes with their ability to efficiently pursue minors, certificates, and other educational opportunities across campus unless those opportunities intersect with coursework in the Liberal Education requirement.

Simultaneously, the required engineering orientation course, ENG 100, will be granted 1-credit hour. Previously, this course was a 0-credit course. The allocation of 1-credit appropriately recognizes the time and commitment expected of all students who take this course. In the 1-credit version of ENG 100, content will be added to improve teamwork and interpersonal skills, including topics related to diversity, equity, and inclusion (DEI). The engineering accrediting agency, ABET, will soon be adding DEI requirements for accredited programs. This component of ENG 100 is therefore beneficial to all Grainger Engineering programs and students by providing a common framework on which additional DEI topics can build through out a student's program of study.

Due to students interest in pursuing a CS minor, we have allowed for the substitution for CS 124 in place of the CS 101 requirement.

MATH 257 is now a required component of the curriculum as MATH 225 is being phased out.

For students studying Aerospace Engineering, they are given the opportunity to select to focus on either aeronautical or astronautical topics in their senior year through their choice of AE 442/443 sections and their technical electives. Previously all students

were required to take AE 433, Aerospace Propulsion, which focuses primarily on air-breathing engines. After careful discussion and consideration, it was decided that it would better benefit the students to allow them to select their propulsion requirement between AE 433 or AE 434 - Rocket Propulsion. This will allow student flexibility to take a propulsion course that better meets their needs in their AE 442/443 design courses and matches to their interests in either aeronautical or astronautical focus.

Additional technical elective options have been reviewed and approved by the Aerospace Undergraduate Curriculum Committee.

## Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

Yes

Required courses

~~CS 101~~ - ~~Intro Computing:Engrg & Sci~~

MATH 257 - Linear Algebra w Computat Appl

Explain how the inclusion or removal of the courses/subjects listed above impacts the offering departments.

MATH 257 will now see an approximate increase in enrollment of 165 students per year due to aerospace majors being required to take the course.

The current Liberal Education requirement is satisfied by a student completing 6 credit hours beyond those required by campus' General Education requirement from Humanities & the Arts, Social & Behavioral Sciences, or a college-curated list of courses (containing courses from over 120 rubrics across campus). An analysis of student course selection in the Liberal Education category indicates 25% of courses are taken in the College of Liberal Arts & Sciences, 20% from the College of Applied Health Sciences, 18% from Gies College of Business, 11% from the College of Agricultural, Consumer and Environmental Sciences, 11% from the College of Fine and Applied Arts, and 9% from The Grainger College of Engineering. Less than 2% of credits are taken in each of the remaining colleges and units across campus.

Although it might stand to reason that removal of the Liberal Education requirement would reduce the amount of credits Grainger Engineering students take outside of their home college, the data do not support that assertion. Specifically, despite the current

Liberal Education requirement being set at 6 credit hours, the average number of credit hours completed from the Liberal Education course list upon graduation is 11.9. Through discussions with departmental and college advisors as well as students, students are making course selections not because the course satisfies the Liberal Education requirement, but because they are interested in the coursework offered outside of their home college, are pursing minors and other educational opportunities, and are looking to balance course loads between technical and non-technical courses. Taken together, the data and evidence from advisors and students suggest that students will continue to take the types of courses represented on the Liberal Education course list, even if not specifically required to do so.

| | |
|---|---|
| Attach letters of support or acknowledgement from other departments. | Letter of Support_Aerospace Engineering.pdf<br>Aero_Eng_letter_Math_257.pdf<br>Letters of Acknowledgement - Liberal Education Electives.pdf |

## Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

~~The plan for program regulation and assessment is consistent with what was presented to the ABET accreditation board in Fall 2019 (pendingapproval).~~What follows is a summary of our stated process for update and assessment of Program Educational Objectives and of Student Outcomes.

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AE PROGRAM EDUCATIONAL OBJECTIVES UPDATE AND ASSESSMENT PROCESS

This document describes the process that is used to update and assess the Program Education Objectives (PEOs) in the Department of Aerospace Engineering at the University of Illinois. In particular, it describes both the data that are collected and the way in which these data are used to make adjustments to the PEOs, when adjustments are needed. This entire process is managed by the Undergraduate Curriculum Committee.

The educational objectives of the AE undergraduate program are for the graduates to achieve the following within a few years of graduation:

• Obtain employment in industry or government institutions, engage in entrepreneurship, and/or pursue graduate degrees.

• Solve engineering problems throughout their careers using the knowledge and skills earned during their engineering degree program.

• Advance their careers by demonstrating leadership, teamwork, and communication skills in addition to technical knowledge.

• Continue their professional development utilizing educational and career building opportunities through their employer, educational institutions, and/or professional societies.

• Make a positive contribution to society through advancing the state of the art in science and engineering, professional service, community service, and/or mentoring.

STEP 1: Update Determination

Every year, the Undergraduate Curriculum Committee has a discussion about the PEOs and decides—on the basis of emerging trends in the field, informal feedback from constituencies, data from past assessments, or other factors—if these PEOs are still appropriate for the department.

Every three years, constituency groups are asked if they believe an update to the PEOs is necessary.

If either the committee or the constituency groups recommend an update to the PEOs, then the formal process described below begins with Step 2: Input from Constituencies.

STEP 2: Input from Constituencies

The Undergraduate Curriculum Committee recommends draft changes to the PEOs.

These draft changes are then discussed with both the Alumni Advisory Board and the Rcent Alumni Board during their annual meetings on campus. The old PEOs, the draft new PEOs, and the PEOs from several peer institutions are presented to the board, to provide sufficient context. The two boards represent input from broad constituencies in industry, universities, and government labs, at varying career levels. Input is provided during the meeting and interactions are allowed to continue between board members and the Director of Undergraduate Programs for several weeks, as necessary. The Director of Undergraduate Programs presents findings from the board meetings to the Undergraduate Curriculum Committee, which further revises the draft PEOs.

STEP 3: Final Approval

After iteration on the draft PEOs by the Directory for Undergraduate Programs, the Alumni Boards, and the Undergraduate Curriculum Committee, these PEOs are presented at a full faculty meeting for discussion. Feedback from the faculty are then discussed again with the curriculum committee. If the input is relatively minor, then the department head approves the new version of the PEOs, and they are published. If significant changes are requested from the faculty and supported by the curriculum committee, then the PEOs would be presented to the full faculty again for comments and feedback.

STEP 4: Assessment

The Program Educational Objectives are assessed primarily through alumni surveys of recent graduates, since the PEOs are intended to be achieved within a few years of graduation. Surveys of non-recent graduates are also conducted to supplement these assessment data, in particular to track if objectives related to professional development and societal contribution continue to grow in alumni long after graduation. Expected response rates are 30-40%. Data are expected to show that all PEOs are attained at a high level. If data do not show these results or otherwise raise concerns, the Undergraduate Curriculum Committee engages in further discussion about whether the PEOs need to be changed (Step 1: Update Determination) or about whether changes to the undergraduate program need to be considered (see outcomes assessment process).

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AE STUDENT OUTCOMES ASSESSMENT PROCESS

This document describes the process that is used to assess student outcomes in the Department of Aerospace Engineering at the University of Illinois. In particular, it describes both the data that are collected and the way in which these data are used to make adjustments to the undergraduate program, when adjustments are needed.

The Aerospace Engineering Program prepares graduates to achieve the following student outcomes by the time of graduation:
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

STEP 1: Data Collection

Every academic year student outcome attainment data are collected in five of the senior-year required courses (AE 442, 460, 383, 443, 461). These courses include the senior design sequence and the required laboratory courses. All of the student outcomes are assessed several times across all of these courses, but not all outcomes are assessed in within each single course. Additionally, student outcome attainment data are collected in all the other required AE courses every three years. If an area of concern has been identified, outcomes attainment in these other courses may be assessed more frequently.
Prior to each semester in which data will be collected for a course, the instructor for that course is consulted by the Director of Undergraduate Programs to determine if the previously identified outcomes are still appropriate. In courses like senior design, it is expected that all outcomes will always be assessed, but in other required courses, the outcomes could evolve. Once the outcomes have been identified, the specific assessment instruments are discussed. Generally, the assessment instruments are homework or exam problems, presentation grades, or report grades. The outcomes assessed in each course and the assessments methods will be summarized for the Undergraduate Curriculum Committee by the Director of Undergraduate Programs.
After the instructor commits to a particular set of outcomes and outcome assessment tools for his/her class, the instructor is expected to submit a summary to the Director of Undergraduate Programs at the end of the semester. This summary includes the details of the particular assessment, the outcome that is demonstrated by the assessment, and the student data—usually grades—showing the level at which students have attained the outcome. The data for all students in the course in the semester of the assessment is submitted. The Director of Undergraduate Programs is responsible for ensuring that the outcome assessment data provided by the instructor is consistent with what was agreed upon and approved by the Undergraduate Curriculum Committee, and for ensuring the integrity of these data.
Additional outcome data are obtained through an indirect assessment using the graduating senior survey. These survey data are used to identify areas for improvement related to student outcomes. The survey includes questions about the curriculum, improvements to the educational experience, involvement in opportunities outside of class, and qualitative questions about levels of student outcome attainment. Students' perceptions of their own levels of student outcome attainment are used to

Students' perceptions of their own levels of student outcome attainment are used to guide subsequent direct assessment in areas of concern. The senior survey is conducted annually using an online tool, a few weeks prior to graduation during the spring semester. The data are summarized by the Director of Undergraduate Programs for the Undergraduate Curriculum Committee to review.
The review performed by the Undergraduate Curriculum Committee of all these data—collected by direct assessment of student outcome attainment in courses (e.g., homework and exam grades), and by indirect assessment of student outcome attainment in the graduating senior survey—involves computing the percentage of students who achieve the desired level of attainment. This desired level is 70% or higher on each assessment instrument. For direct assessment in junior required courses, the percentage achieving the outcome is expected to be between 70% and 100%. For direct assessment in senior required courses, the percentage achieving the outcome is expected to be between 85% and 100%.

STEP 2: Data Analysis and Recommendations

With the outcome summary report that is produced by Step 1: Data Collection (see above) as a guide, the Undergraduate Curriculum Committee arrives at consensus about whether the levels of student outcome attainment are acceptable for the undergraduate program. One of three possible decisions are made:

a. Everything looks good. In this case, the committee would take no further action and would repeat the full review process during the next, regularly scheduled assessment period.
b. The attainment level of a particular outcome is either slightly below what is expected or is somewhat inconsistent with other assessments of the same outcome. In this case, the committee would recommend making a change to the assessment tool and/or reassessing the outcome during the following semester. If this applies to one of the courses that would not normally be assessed each year, the Director of Undergraduate Programs would work with the instructor to ensure an assessment occurs during the next offering.
c. The attainment level of a particular outcome is far below what is expected, is highly inconsistent with other assessments of the same outcome, or otherwise raises a significant concern. In this case, the committee would consider a variety of different ways to address the concern, and would likely recommend a significant change to the course or to the undergraduate curriculum. The Undergraduate Curriculum Committee would present this recommendation to the full faculty. This recommendation would then be discussed at a faculty meeting, where it would be subject to modification. A decision would then be made by the faculty in the meeting (following standard rules of order) about whether to proceed with the recommendation—suitably modified—or to request that the Undergraduate Curriculum Committee reconsider how to best address the concern. If the faculty decides to proceed with a curriculum revision, a faculty vote would be required, followed by additional approvals at the college and campus level.

STEP 3: Implementation

Instructors are responsible for implementing any course or curriculum changes that are recommended by the full faculty in Step 2: Data Analysis and Recommendations (see above). The Undergraduate Curriculum Committee and the Director for Undergraduate

above). The Undergraduate Curriculum Committee and the Director for Undergraduate Programs are available to consult with the responsible instructors about how these changes should best be implemented.

STEP 4: Reassessment

If either an assessment tool in a course has changed or the Undergraduate Curriculum Committee has recommended reassessing student outcome attainment in that course, student outcome attainment data are collected again from that particular course during its next offering. As in the regular, recurring outcome assessment (see Step 1: Data Collection), the instructor collects data from all students enrolled in the course and provides those data to the Director of Undergraduate Programs.

If a course has been changed, student outcome attainment data are collected again from that particular course during its next offering. As in the regular, recurring outcome assessment (see Step 1: Data Collection), the instructor collects data from all students enrolled in the course and provides those data to the Director of Undergraduate Programs.

If the curriculum has been changed, student outcome attainment data are collected from all required AE undergraduate courses during the next semester. As in the regular, recurring outcome assessment (see Step 1: Data Collection), the instructor collects data from all students enrolled in the course and provides those data to the Director of Undergraduate Programs.

The Director of Undergraduate Programs presents the new student outcome attainment data to the Undergraduate Curriculum Committee for review (Step 2: Data Analysis and Recommendations). The committee determines if its earlier recommendations, now implemented, have had the intended impact on student outcome attainment. If the levels of attainment indicate improvement and/or no longer raise concerns, then student outcome attainment data will be collected and reassessed once more in the next offering or semester before returning to the regular assessment schedule. If the levels of attainment do not indicate improvement and/or continue to raise concerns, then the Undergraduate Curriculum Committee will reconvene to make further recommendations, to present these recommendations to the full faculty for review, to proceed (upon approval by the faculty) with implementation, and to do subsequent reassessment. These steps—(1) data collection, (2) data analysis and recommendations, (3) implementation, and (4) reassessment—repeat until the concern with student outcome attainment is sufficiently addressed.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

## Program of Study

*"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.*

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

Revised programs AE Program of Study Change 2021 Updates.xlsx

Attach a side-by-side comparison with the existing program AND, if the revision references or adds "chose-from" lists of courses students can select from to fulfill requirements, a listing of these courses, including the course rubric, number, title, and number of credit hours.

Catalog Page Text - Overview Tab

Text for Overview tab on the Catalog Page. This is not official content, it is used to help build the new catalog page for the program. Can be edited in the catalog by the college or department.

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. Technical ~~A total of 18 hours of technical~~ and free electives allows the student to pursue an individualized program of study.

Statement for Programs of Study Catalog

# Graduation Requirements

**Minimum Overall GPA:** 2.0

**Minimum hours required for graduation:** 128 hours

**General education:** Students must complete the Campus General Education requirements including the campus general education language requirement. ~~Specific Advanced Composition courses required for this degree are listedbelow.~~AE 442 ~~Orientation~~ and AE 443 will satisfy Aerospace Engineering Technical Core requirements ~~Professional DevelopmentFoundational Mathematics~~ and the Campus General Education Advanced Composition requirement.

## Orientation and Professional Development

Course List

| Code | Title | Hours |
|---|---|---|
| AE 100 | Intro to Aerospace Engineering | 2 |

| Code | Title | Hours |
|---|---|---|
| ENG 100 | Grainger Engineering Orientation Seminar (External transfer students take ENG 300.) | 1 |
| Total Hours | | 3 |

## Foundational Mathematics and Science

Course List

| Code | Title | Hours |
|---|---|---|
| CHEM 102 | General Chemistry I | 3 |
| CHEM 103 | General Chemistry Lab I | 1 |
| MATH 221 | Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree. ) | 4 |
| ~~MATH 225~~ | ~~Introductory Matrix Theory~~ | ~~2~~ |
| MATH 231 | Calculus II | 3 |
| MATH 241 | Calculus III | 4 |
| MATH 257 | Linear Algebra with Computational Applications | 3 |
| MATH 285 | Intro Differential Equations | 3 |
| PHYS 211 | University Physics: Mechanics | 4 |
| PHYS 212 | University Physics: Elec & Mag | 4 |
| Total Hours | | 29 |

## Aerospace Engineering ~~Aerospace Engineering Technical Core~~ Technical Core

Course List

| Code | Title | Hours |
|---|---|---|
| AE 140 | Aerospace Computer-Aided Design | 2 |
| AE 202 | Aerospace Flight Mechanics | 3 |
| AE 311 | Incompressible Flow | 3 |
| AE 312 | Compressible Flow | 3 |
| AE 321 | Mechs of Aerospace Structures | 3 |
| AE 323 | Applied Aerospace Structures | 3 |
| AE 352 | Aerospace Dynamical Systems | 3 |
| AE 353 | Aerospace Control Systems | 3 |
| AE 370 | Aerospace Numerical Methods | 3 |
| AE 433 | Aerospace Propulsion | 3 |
| or AE 434 | Rocket Propulsion | |
| AE 442 | Aerospace Systems Design I | 3 |
| AE 443 | Aerospace Systems Design II | 3 |
| AE 460 | Aerodynamics & Propulsion Lab | 2 |
| AE 461 | Structures & Control Lab | 2 |
| AE 483 | Autonomous Systems Lab | 2 |
| CS 101 | Intro Computing: Engrg & Sci (CS 124 may be taken instead of CS 101. ) | 3 |
| ECE 205 | Electrical and Electronic Circuits | 3 |
| ME 200 | Thermodynamics | 3 |
| MSE 280 | Engineering Materials | 3 |
| TAM 210 | Introduction to Statics | 2 |
| TAM 212 | Introductory Dynamics | 3 |
| Total Hours | | 58 |

## Technical Electives

Course List

| Code | Title | Hours |
|---|---|---|
| ~~Selected from the departmentally approved list of Technical Electives, satisfying these distribution requirements:~~ | | |
| ~~Chosen from AE Technical Electives listed below~~ | | ~~6~~ |
| ~~AE 199~~ | ~~Undergraduate Open Seminar~~ | ~~0 to 5~~ |
| Select from the departmentally approved list of Technical Electives. Student will choose 6 hours of AE Technical Electives and 6 hours of either additional AE Technical Electives or Non-AE Technical Electives. | | 12 |
| AE Technical Electives listed below | | |
| AE 402 | Orbital Mechanics | 3 or 4 |
| AE 403 | Spacecraft Attitude Control | 3 or 4 |
| AE 410 | Computational Aerodynamics | 3 or 4 |
| AE 412 | Viscous Flow & Heat Transfer | 4 |
| AE 416 | Applied Aerodynamics | 3 or 4 |
| AE 419 | Aircraft Flight Mechanics | 3 or 4 |
| AE 420 | Finite Element Analysis | 3 or 4 |
| ~~AE 427~~ | ~~Course AE 427 Not Found~~ | |
| AE 428 | Mechanics of Composites | 3 |
| ~~AE 434~~ | ~~Rocket Propulsion~~ | ~~3 or 4~~ |
| AE 435 | Electric Propulsion | 3 or 4 |
| AE 451 | Aeroelasticity | 3 or 4 |
| AE 454 | Systems Dynamics & Control | 3 or 4 |
| AE 456 | Global Nav Satellite Systems | 4 |
| AE 468 | Optical Remote Sensing | 3 |
| AE 482 | Introduction to Robotics | 4 |
| AE 484 | UAV Performance, Design, and Fabrication | 3 |
| AE 485 | Spacecraft Environment and Interactions | 3 or 4 |
| AE 497 | Independent Study | 1 to 4 |
| AE 498 | Special Topics | 1 to 4 |
| ENG 491 | Interdisciplinary Design Proj (CU1 & CU2) | 1 to 4 |
| ~~Chosen from AE Technical Electives or Non-AE Technical Electives~~ | | ~~6~~ |
| Non-AE Technical Electives below | | |

| Code | Title | Hours |
|---|---|---|
| ASTR 404 | Stellar Astrophysics | 3 |
| ASTR 405 | Planetary Systems | 3 |
| ASTR 406 | Galaxies and the Universe | 3 |
| ASTR 414 | Astronomical Techniques | 4 |
| ATMS 301 | Atmospheric Thermodynamics | 3 |
| ATMS 302 | Atmospheric Dynamics I | 3 |
| ATMS 303 | Synoptic-Dynamic Wea Analysis | 4 |
| ATMS 304 | Radiative Transfer-Remote Sens | 3 |
| ATMS 305 | Computing and Data Analysis | 3 |
| ATMS 306 | Cloud Physics | 3 |
| ATMS 313 | Synoptic Weather Forecasting | 4 |
| ATMS 406 | Tropical Meteorology | 4 |
| ATMS 410 | Radar Remote Sensing | 4 |
| CEE 310 | Transportation Engineering | 3 |
| CEE 330 | Environmental Engineering | 3 |
| CEE 360 | Structural Engineering | 3 |
| CEE 380 | Geotechnical Engineering | 3 |
| CEE 407 | Airport Design | 3 or 4 |
| CEE 412 | High-Speed Rail Engineering | 3 or 4 |
| CEE 451 | Environmental Fluid Mechanics | 3 |
| CEE 471 | Structural Mechanics | 3 or 4 |
| CHEM 232 | Elementary Organic Chemistry I | 3 or 4 |
| CHEM 233 | Elementary Organic Chem Lab I | 2 |
| CHEM 236 | Fundamental Organic Chem I | 4 |
| CS 225 | Data Structures | 4 |
| CS 420 | Parallel Progrmg: Sci & Engrg | 3 or 4 |
| CS 461 | Computer Security I | 4 |
| CS 465 | User Interface Design | 4 |
| CSE 412 | Numerical Thermo-Fluid Mechs | 2 to 4 |
| ECE 210 | Analog Signal Processing | 4 |
| ECE 220 | Computer Systems & Programming | 4 |
| ECE 310 | Digital Signal Processing | 3 |
| ECE 311 | Digital Signal Processing Lab | 1 |
| ECE 329 | Fields and Waves I | 3 |
| ECE 330 | Power Ckts & Electromechanics | 3 |
| ECE 342 | Electronic Circuits | 3 |
| ECE 343 | Electronic Circuits Laboratory | 1 |
| ECE 385 | Digital Systems Laboratory | 3 |
| ECE 473 | Fund of Engrg Acoustics | 3 or 4 |
| ECE 486 | Control Systems | 4 |

| Code | Title | Hours |
|---|---|---|
| ENG 491 | Interdisciplinary Design Proj (Sections SAE and HYP) | 1 to 4 |
| MSE 401 | Thermodynamics of Materials | 3 |
| MSE 440 | Mechanical Behavior of Metals | 3 |
| MSE 443 | Design of Engineering Alloys | 3 |
| MSE 498 | Special Topics (Section CM3) | 1 to 4 |
| SE 310 | Design of Structures and Mechanisms | 3 |
| SE 420 | Digital Control Systems | 4 |
| SE 423 | Mechatronics | 3 |
| IE 310 | Deterministic Models in Optimization | 3 |
| MATH 347 | Fundamental Mathematics | 3 |
| MATH 402 | Non Euclidean Geometry | 3 or 4 |
| MATH 413 | Intro to Combinatorics | 3 or 4 |
| MATH 416 | Abstract Linear Algebra | 3 or 4 |
| MATH 442 | Intro Partial Diff Equations | 3 or 4 |
| MATH 446 | Applied Complex Variables | 3 or 4 |
| MATH 461 | Probability Theory | 3 or 4 |
| MATH 482 | Linear Programming | 3 or 4 |
| MATH 484 | Nonlinear Programming | 3 or 4 |
| MATH 489 | Dynamics & Differential Eqns | 3 or 4 |
| ME 320 | Heat Transfer | 4 |
| ME 360 | Signal Processing | 3.5 |
| ME 370 | Mechanical Design I | 3 |
| ME 400 | Energy Conversion Systems | 3 or 4 |
| ME 401 | Refrigeration and Cryogenics | 3 or 4 |
| ME 498 | Special Topics | 0 to 4 |
| MSE 450 | Polymer Science & Engineering | 3 or 4 |
| MSE 453 | Plastics Engineering | 3 |
| MSE 457 | Polymer Chemistry | 3 or 4 |
| NPRE 201 | Energy Systems | 2 or 3 |

| Code | Title | Hours |
|---|---|---|
| NPRE 402 | Nuclear Power Engineering | 3 or 4 |
| NPRE 470 | Fuel Cells & Hydrogen Sources | 3 |
| NPRE 475 | Wind Power Systems | 3 or 4 |
| NPRE 498 | Special Topics (Energy Storage and Conveyance) | 1 to 4 |
| PHYS 325 | Classical Mechanics I | 3 |
| PHYS 326 | Classical Mechanics II | 3 |
| PHYS 435 | Electromagnetic Fields I | 3 |
| PHYS 485 | Atomic Phys & Quantum Theory | 3 |
| PHYS 486 | Quantum Physics I | 4 |
| STAT 428 | Statistical Computing | 3 or 4 |
| STAT 448 | Advanced Data Analysis | 4 |
| TAM 324 | Behavior of Materials | 4 |
| TAM 451 | Intermediate Solid Mechanics | 4 |
| TAM 456 | Experimental Stress Analysis | 3 |
| TAM 470 | Computational Mechanics | 3 or 4 |
| TE 401 | Developing Breakthrough Projects | 1 to 4 |
| TMGT 461 | Tech, Eng, & Mgt Final Project | 2 |

## Free Electives

| Course List | | |
|---|---|---|
| Code | Title | Hours |
| ~~The Grainger College of Engineering Liberal Education course list, or additional courses from the campus General Education lists for Social and Behavioral Sciences or Humanities and the Arts 4~~ | | ~~6~~ |
| ~~Free electives. Additional unrestricted course work, subject to certain exceptions as noted by the College, so that there are at least 128 credit hours earned toward the degree. 5~~ | | ~~6~~ |
| ~~Total Hours of Curriculum to Graduate~~ | | ~~128~~ |
| Additional course work,subject to the Grainger College of Engineering restrictions to Free Electives,so that there are at least 128 credit hours earned toward the degree. | | 10 |
| Total Hours of Curriculum to Graduate | | 128 |

~~**12**~~

~~MATH 220%7C *may be substituted, with four of the five credit hours applying toward the degree.* MATH 220%7C *is appropriate for students with no background in calculus.*~~

~~**3***AE 442%7C and AE 443%7C satisfy the General Education Advanced Composition requirement.***4***~~

~~*The Grainger College of Engineering approved liberal education course list can be found here. Note that these credit hours could carry the required cultural studies designation required for campus general education requirements.*~~

~~**5***The Grainger College of Engineering restrictions to free electives can be found here.*~~

| | |
|---|---|
| Corresponding Degree | BS Bachelor of Science |

## Program Features

| | |
|---|---|
| Academic Level | Undergraduate |
| Does this major have transcripted concentrations? | No |

What is the typical time to completion of this program?

4 years

What are the minimum Total Credit Hours required for this program?

128

| | |
|---|---|
| CIP Code | 140201 - Aerospace, Aeronautical, and Astronautical/Space Engineering, General. |

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

## Delivery Method

This program is available:

On Campus - Students are required to be on campus, they may take some online courses.

## Admission Requirements

| | |
|---|---|
| Desired Effective Admissions Term | Fall 2020 |

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Unchanged.

Describe how critical academic functions such as admissions and student advising are managed.

Unchanged.

## Enrollment

Describe how this revision will impact enrollment and degrees awarded.

These changes will not impact enrollment.

Estimated Annual Number of Degrees Awarded

| Year One Estimate | 5th Year Estimate (or when fully implemented) |
|---|---|

What is the matriculation term for this program?
Fall

## Budget

Are there budgetary implications for this revision?
No

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?
No

Additional Budget Information

Attach File(s)

## Financial Resources

How does the unit intend to financially support this proposal?
No change

Will the unit need to seek campus or other external resources?
No

Attach letters of support

What tuition rate do you expect to charge for this program? e.g, Undergraduate Base Tuition, or Engineering Differential, or Social Work Online (no dollar amounts necessary)

Are you seeking a change in the tuition rate or differential for this program?
No

## Resource Implications

## Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?
No

## Technology

Will the program need additional technology beyond what is currently available for the unit?

No

## Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

## Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/acknowledgement from faculty, students, and/or other impacted units as appropriate.

Attach File(s)

## Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

These changes will not impact our faculty resources.

## Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

There is no impact to the use of the Library collections, resources, and services.

## EP Documentation

| | |
|---|---|
| EP Control Number | EP.22.098 |
| Attach Rollback/Approval Notices | ep22098_response from sponsor_20220214.pdf |
| This proposal requires HLC inquiry | No |

## DMI Documentation

| | |
|---|---|
| Attach Final Approval Notices | |
| Banner/Codebook Name | BS: Aerospace Engr -- UIUC |
| Program Code: | 10KP4048BS |

| Minor Code | Conc Code | Degree Code | BS | Major Code |
| --- | --- | --- | --- | --- |
| 4048 | | | | |

Senate Approval Date

Senate Conference Approval Date

BOT Approval Date

IBHE Approval Date

HLC Approval Date

Effective Date:

Attached Document

Justification for this request

Program Reviewer Comments

Key: 111

| KEY |
|---|
| GREEN HIGHLIGHT = Course addition or requirement replacement |
| RED HIGHLIGHT = Course to be removed from listed requirements. |
| Yellow Highlight - Revision to requirement |

## Current Program of Study

Graduation Requirements
Minimum Overal GPA: 2.0
Minimum hours required for graduation: 128 hours

General education: Students must complete the Campus General Education requirements including the campus general education language requirement. Specific Advanced Composition courses required for this degree are listed below.

| *Current Requirements* | *Current Hours* |
|---|---|
| **Orientation and Professional Development** | **0-2** |
| AE 100 Introduction to Aerospace Engineering | 2 |
| ENG 100 Engineering Orientation | 0 |
| **Foundational Mathematics and Science** | **28** |
| CHEM 102 General Chemistry 1 | 3 |
| CHEM 103 General Chemistry Lab 1 | 1 |
| MATH 221 Calculus I | 4 |
| MATH 225 Introductory Matrix Theory | 2 |
| MATH 231 Calculus II | 3 |
| MATH 241 Calculus III | 4 |
| MATH 285 Intro Differential Equations | 3 |
| PHYS 211 University Physics: Mechanics | 4 |
| PHYS 212 University Physics: Elec & Mag | 4 |
| **Aerospace Engineering Technical Core** | **58** |
| AE 140 Aerospace Computer Aided Design | 2 |
| AE 202 Aerospace Flight Mechanics | 3 |
| AE 311 Incompressible Flow | 3 |
| AE 312 Compressible Flow | 3 |
| AE 321 Mechs of Aerospace Structures | 3 |
| AE 323 Applied Aerospace Structures | 3 |
| AE 352 Aerospace Dynamical Systems | 3 |
| AE 353 Aerospace Control Systems | 3 |
| AE 370 Aerospace Numerical Methods | 3 |
| AE 433 Aerospace Propulsion | 3 |
| AE 442 Aerospace Systems Design I | 3 |
| AE 443 Aerospace Systems Design II | 3 |
| AE 460 Aerodynamics & Propulsion Lab | 2 |
| AE 461 Structures and Control Lab | 2 |
| AE 483 Autonomous Systems Lab | 2 |
| CS 101 Introductory Computing: Engineering and Science | 3 |
| ECE 205 Electrical and Electronics Circuits | 3 |
| ME 200 Thermodynamics | 3 |
| MSE 280 Engineering Materials | 3 |
| TAM 210 Introduction to Statics | 2 |
| TAM 212 Introductory Dynamics | 3 |
| **Technical Electives** | |
| Selected from the departmentally approved list of Technical Electives satisfying these distribution requirements. | |
| Chosen from AE Technical Electives listed below | **6** |
| AE 199 Undergraduate Open Seminar | 0 to 5 |
| AE 402 Orbital Mechanics | 3 or 4 |
| AE 403 Spacecraft Attitude Control | 3 or 4 |
| AE 410 Computational Aerodynamics | 3 or 4 |
| AE 412 Viscous Flow & Heat Transfer | 4 |
| AE 416 Applied Aerodynamics | 3 or 4 |
| AE 419 Aircraft Flight Mechanics | 3 or 4 |
| AE 420 Finite Element Analysis | 3 or 4 |
| AE 427 | |
| AE 428 Mechanics of Composites | 3 |
| AE 434 Rocket Propulsion | 3 or 4 |
| AE 435 Electric Propulsion | 3 or 4 |
| AE 451 Aeroelasticity | 3 or 4 |
| AE 454 Systems Dynamics & Control | 3 or 4 |
| AE 456 Global Nav Satellite Systems | 4 |
| AE 468 Optical Remote Sensing | 3 |
| AE 482 Introduction to Robotics | 4 |

## New Program of Study

Graduation Requirements
Minimum Overal GPA: 2.0
Minimum hours required for graduation: 128 hours

General education: Students must complete the Campus General Education requirements including the campus general education language requirement. AE 442 and AE 443 will satisfy Aerospace Engineering Techical Core requirements and the Campus General Education Advanced Composition requirement.

| *Revised Requirements* | *Revised Hours* |
|---|---|
| **Orientation and Professional Development** | **3** |
| AE 100 Introduction to Aerospace Engineering | 2 |
| ENG 100 Engineering Orientation (External transfer students take ENG 300.) | 1 |
| **Foundational Mathematics and Science** | **29** |
| CHEM 102 General Chemistry 1 | 3 |
| CHEM 103 General Chemistry Lab 1 | 1 |
| MATH 221 Calculus I (MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.) | 4 |
| MATH 231 Calculus II | 3 |
| MATH 241 Calculus III | 4 |
| MATH 257 Linear Algebra with Computational Applications | 3 |
| MATH 285 Intro Differential Equations | 3 |
| PHYS 211 University Physics: Mechanics | 4 |
| PHYS 212 University Physics: Elec & Mag | 4 |
| **Aerospace Engineering Technical Core** | **58** |
| AE 140 Aerospace Computer Aided Design | 2 |
| AE 202 Aerospace Flight Mechanics | 3 |
| AE 311 Incompressible Flow | 3 |
| AE 312 Compressible Flow | 3 |
| AE 321 Mechs of Aerospace Structures | 3 |
| AE 323 Applied Aerospace Structures | 3 |
| AE 352 Aerospace Dynamical Systems | 3 |
| AE 353 Aerospace Control Systems | 3 |
| AE 370 Aerospace Numerical Methods | 3 |
| AE 433 Aerospace Propulsion | 3 |
| or AE 434 Rocket Propulsion | 3 |
| AE 442 Aerospace Systems Design I | 3 |
| AE 443 Aerospace Systems Design II | 3 |
| AE 460 Aerodynamics & Propulsion Lab | 2 |
| AE 461 Structures and Control Lab | 2 |
| AE 483 Autonomous Systems Lab | 2 |
| CS 101 Introductory Computing: Engineering and Science (CS 124 may be taken instead of CS 101.) | 3 |
| ECE 205 Electrical and Electronics Circuits | 3 |
| ME 200 Thermodynamics | 3 |
| MSE 280 Engineering Materials | 3 |
| TAM 210 Introduction to Statics | 2 |
| TAM 212 Introductory Dynamics | 3 |
| **Technical Electives** | |
| Select from the departmentally approved list of Technical Electives. Student will choose 6 hours of AE Technical Electives and 6 hours of either additional AE Technical Electives or Non-AE Technical Electives. | **12** |
| AE Technical Electives listed below | |
| AE 402 Orbital Mechanics | 3 or 4 |
| AE 403 Spacecraft Attitude Control | 3 or 4 |
| AE 410 Computational Aerodynamics | 3 or 4 |
| AE 412 Viscous Flow & Heat Transfer | 4 |
| AE 416 Applied Aerodynamics | 3 or 4 |
| AE 419 Aircraft Flight Mechanics | 3 or 4 |
| AE 420 Finite Element Analysis | 3 or 4 |
| AE 428 Mechanics of Composites | 3 |
| AE 435 Electric Propulsion | 3 or 4 |
| AE 451 Aeroelasticity | 3 or 4 |
| AE 454 Systems Dynamics & Control | 3 or 4 |
| AE 456 Global Nav Satellite Systems | 4 |
| AE 468 Optical Remote Sensing | 3 |
| AE 482 Introduction to Robotics | 4 |

| | | | |
|---|---|---|---|
| | | AE 484 UAV Performance, Design, and Fabrication | 3 |
| | | AE 485 Spacecraft Environment and Interactions | 3 |
| AE 497 Independent Study | 1 to 4 | AE 497 Independent Study | 1 to 4 |
| AE 498 Special Topics | 1 to 4 | AE 498 Special Topics | 1 to 4 |
| ENG 491 Interdisciplinary Design Proj (CU1 & CU2) | 1 to 4 | ENG 491 Interdisciplinary Design Proj (CU1 & CU2) | 1 to 4 |
| | | | |
| **Chosen from AE Technical Electives or Non-AE Technical Electives** | **6** | **Non-AE Technical Electives below** | |
| ASTR 404 Stellar Astrophysics | 3 | ASTR 404 Stellar Astrophysics | 3 |
| ASTR 405 Planetary Systems | 3 | ASTR 405 Planetary Systems | 3 |
| ASTR 406 Galaxies and the Universe | 3 | ASTR 406 Galaxies and the Universe | 3 |
| ASTR 414 Astronomical Techniques | 4 | ASTR 414 Astronomical Techniques | 4 |
| ATMS 301 Atmospheric Thermodynamics | 3 | ATMS 301 Atmospheric Thermodynamics | 3 |
| ATMS 302 Atmospheric Dynamics I | 3 | ATMS 302 Atmospheric Dynamics I | 3 |
| ATMS 303 Synoptic-Dynamic Wea Analysis | 4 | ATMS 303 Synoptic-Dynamic Wea Analysis | 4 |
| ATMS 304 Radiative Transfer-Remote Sens | 3 | ATMS 304 Radiative Transfer-Remote Sens | 3 |
| ATMS 305 Computing and Data Analysis | 3 | ATMS 305 Computing and Data Analysis | 3 |
| ATMS 306 Cloud Physics | 3 | ATMS 306 Cloud Physics | 3 |
| ATMS 313 Synoptic Weather Forecasting | 4 | ATMS 313 Synoptic Weather Forecasting | 4 |
| ATMS 406 Tropical Meteorology | 4 | ATMS 406 Tropical Meteorology | 4 |
| ATMS 410 Radar Remote Sensing | 4 | ATMS 410 Radar Remote Sensing | 4 |
| CEE 310 Transportation Engineering | 3 | CEE 310 Transportation Engineering | 3 |
| CEE 330 Environmental Engineering | 3 | CEE 330 Environmental Engineering | 3 |
| CEE 360 Structural Engineering | 3 | CEE 360 Structural Engineering | 3 |
| CEE 380 Geotechnical Engineering | 3 | CEE 380 Geotechnical Engineering | 3 |
| CEE 407 Airport Design | 3 or 4 | CEE 407 Airport Design | 3 or 4 |
| CEE 412 High-Speed Rail Engineering | 3 or 4 | CEE 412 High-Speed Rail Engineering | 3 or 4 |
| CEE 451 Environmental Fluid Mechanics | 3 | CEE 451 Environmental Fluid Mechanics | 3 |
| CEE 471 Structural Mechanics | 3 or 4 | CEE 471 Structural Mechanics | 3 or 4 |
| CHEM 232 Elementary Organic Chemistry I | 3 or 4 | CHEM 232 Elementary Organic Chemistry I | 3 or 4 |
| CHEM 233 Elementary Organic Chem Lab I | 2 | CHEM 233 Elementary Organic Chem Lab I | 2 |
| CHEM 236 Fundamental Organic Chem I | 4 | CHEM 236 Fundamental Organic Chem I | 4 |
| CS 225 Data Structures | 4 | CS 225 Data Structures | 4 |
| CS 420 Parallel Progrmg: Sci & Engrg | 3 or 4 | CS 420 Parallel Progrmg: Sci & Engrg | 3 or 4 |
| CS 461 Computer Security I | 4 | CS 461 Computer Security I | 4 |
| CS 465 User Interface Design | 3 or 4 hours | CS 465 User Interface Design | 4 |
| CSE 412 Numerical Thermo-Fluid Mechs | 2 to 4 | CSE 412 Numerical Thermo-Fluid Mechs | 2 to 4 |
| ECE 210 Analog Signal Processing | 4 | ECE 210 Analog Signal Processing | 4 |
| ECE 220 Computer Systems & Programming | 4 | ECE 220 Computer Systems & Programming | 4 |
| ECE 310 Digital Signal Processing | 3 | ECE 310 Digital Signal Processing | 3 |
| ECE 311 Digital Signal Processing Lab | 1 | ECE 311 Digital Signal Processing Lab | 1 |
| ECE 329 Fields and Waves I | 3 | ECE 329 Fields and Waves I | 3 |
| ECE 330 Power Ckts & Electromechanics | 3 | ECE 330 Power Ckts & Electromechanics | 3 |
| ECE 342 Electronic Circuits | 3 | ECE 342 Electronic Circuits | 3 |
| ECE 343 Electronic Circuits Laboratory | 1 | ECE 343 Electronic Circuits Laboratory | 1 |
| ECE 385 Digital Systems Laboratory | 3 | ECE 385 Digital Systems Laboratory | 3 |
| ECE 473 Fund of Engrg Acoustics | 3 or 4 | ECE 473 Fund of Engrg Acoustics | 3 or 4 |
| ECE 486 Control Systems | 4 | ECE 486 Control Systems | 4 |
| ENG 491 Interdisciplinary Design Proj (Sections SAE and HYP) | 1 to 4 | ENG 491 Interdisciplinary Design Proj (Sections SAE and HYP) | 1 to 4 |
| MSE 401 Thermodynamics of Materials | 3 | MSE 401 Thermodynamics of Materials | 3 |
| MSE 440 Mechanical Behavior of Metals | 3 | MSE 440 Mechanical Behavior of Metals | 3 |
| MSE 443 Design of Engineering Alloys | 3 | MSE 443 Design of Engineering Alloys | 3 |
| MSE 498 Special Topics (Section CM3) | 1 to 4 | MSE 498 Special Topics (Section CM3) | 1 to 4 |
| SE 310 Design of Structures and Mechanisms | 3 | SE 310 Design of Structures and Mechanisms | 3 |
| SE 420 Digital Control Systems | 4 | SE 420 Digital Control Systems | 4 |
| SE 423 Mechatronics | 3 | SE 423 Mechatronics | 3 |
| IE 310 Deterministic Models in Optimization | 3 | IE 310 Deterministic Models in Optimization | 3 |
| MATH 347 Fundamental Mathematics | 3 | MATH 347 Fundamental Mathematics | 3 |
| MATH 402 Non Euclidean Geometry | 3 or 4 | MATH 402 Non Euclidean Geometry | 3 or 4 |
| MATH 413 Intro to Combinatorics | 3 or 4 | MATH 413 Intro to Combinatorics | 3 or 4 |
| MATH 416 Abstract Linear Algebra | 3 or 4 | MATH 416 Abstract Linear Algebra | 3 or 4 |
| MATH 442 Intro Partial Diff Equations | 3 or 4 | MATH 442 Intro Partial Diff Equations | 3 or 4 |
| MATH 446 Applied Complex Variables | 3 or 4 | MATH 446 Applied Complex Variables | 3 or 4 |
| MATH 461 Probability Theory | 3 or 4 | MATH 461 Probability Theory | 3 or 4 |
| MATH 482 Linear Programming | 3 or 4 | MATH 482 Linear Programming | 3 or 4 |
| MATH 484 Nonlinear Programming | 3 or 4 | MATH 484 Nonlinear Programming | 3 or 4 |
| MATH 489 Dynamics & Differential Eqns | 3 or 4 | MATH 489 Dynamics & Differential Eqns | 3 or 4 |
| ME 320 Heat Transfer | 4 | ME 320 Heat Transfer | 4 |
| ME 360 Signal Processing | 3.5 | ME 360 Signal Processing | 3.5 |
| ME 370 Mechanical Design I | 3 | ME 370 Mechanical Design I | 3 |
| ME 400 Energy Conversion Systems | 3 or 4 | ME 400 Energy Conversion Systems | 3 or 4 |
| ME 401 Refrigeration and Cryogenics | 3 or 4 | ME 401 Refrigeration and Cryogenics | 3 or 4 |
| ME 498 Special Topics | 0 to 4 | ME 498 Special Topics | 0 to 4 |
| MSE 450 Polymer Science & Engineering | 3 or 4 | MSE 450 Polymer Science & Engineering | 3 or 4 |
| MSE 453 Plastics Engineering | 3 | MSE 453 Plastics Engineering | 3 |
| MSE 457 Polymer Chemistry | 3 or 4 | MSE 457 Polymer Chemistry | 3 or 4 |
| NPRE 201 Energy Systems | 2 or 3 | NPRE 201 Energy Systems | 2 or 3 |
| NPRE 402 Nuclear Power Engineering | 3 or 4 | NPRE 402 Nuclear Power Engineering | 3 or 4 |
| NPRE 470 Fuel Cells & Hydrogen Sources | 3 | NPRE 470 Fuel Cells & Hydrogen Sources | 3 |
| NPRE 475 Wind Power Systems | 3 or 4 | NPRE 475 Wind Power Systems | 3 or 4 |
| NPRE 498 Special Topics (Energy Storage and Conveyance) | 1 to 4 | NPRE 498 Special Topics (Energy Storage and Conveyance) | 1 to 4 |
| PHYS 325 Classical Mechanics I | 3 | PHYS 325 Classical Mechanics I | 3 |
| PHYS 326 Classical Mechanics II | 3 | PHYS 326 Classical Mechanics II | 3 |
| PHYS 435 Electromagnetic Fields I | 3 | PHYS 435 Electromagnetic Fields I | 3 |

| | |
|---|---|
| PHYS 485 Atomic Phys & Quantum Theory | 3 |
| PHYS 486 Quantum Physics I | 4 |
| STAT 428 Statistical Computing | 3 or 4 |
| STAT 448 Advanced Data Analysis | 4 |
| TAM 324 Behavior of Materials | 4 |
| TAM 451 Intermediate Solid Mechanics | 4 |
| TAM 456 Experimental Stress Analysis | 3 |
| TAM 470 Computational Mechanics | 3 or 4 |
| TE 401 Developing Breakthrough Projects | 1 to 4 |
| TMGT 461 Tech, Eng, & Mgt Final Project | 2 |

| | |
|---|---|
| **Liberal Electives**<br>Select from college-approved list. | **6** |

| | |
|---|---|
| **Free Electives**<br>Free electives. Additional unrestricted course work, subject to certain exceptions as noted by the College, so that there are at least 128 credit hours earned toward the degree. | 6 |

**Footnotes**

1 External transfer students take ENG 300%7C instead.
2 MATH 220%7C may be substituted, with four of the five credit hours applying toward the degree. MATH 220%7C is appropriate for students with no background in calculus.
3 AE 442%7C and AE 443%7C satisfy the General Education Advanced Composition requirement.
4 The Grainger College of Engineering approved liberal education course list can be found here. Note that these credit hours could carry the required cultural studies designation required for campus general education requirements.
5 The Grainger College of Engineering restrictions to free electives can be found here.

| | |
|---|---|
| PHYS 485 Atomic Phys & Quantum Theory | 3 |
| PHYS 486 Quantum Physics I | 4 |
| STAT 428 Statistical Computing | 3 or 4 |
| STAT 448 Advanced Data Analysis | 4 |
| TAM 324 Behavior of Materials | 4 |
| TAM 451 Intermediate Solid Mechanics | 4 |
| TAM 456 Experimental Stress Analysis | 3 |
| TAM 470 Computational Mechanics | 3 or 4 |
| TE 401 Developing Breakthrough Projects | 1 to 4 |
| TMGT 461 Tech, Eng, & Mgt Final Project | 2 |

| | |
|---|---|
| **Free Electives**<br>Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. | 10 |

ILLINOIS

COLLEGE OF AGRICULTURAL, CONSUMER
& ENVIRONMENTAL SCIENCES

Office of the Dean
227 Mumford Hall, MC-710
1301 W. Gregory Drive
Urbana, IL 61801

January 13, 2022

Dear Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from our college. Grainger Engineering students will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

Sincerely,

Germán Bollero, Interim Dean

ILLINOIS

COLLEGE OF APPLIED HEALTH SCIENCES

Office of the Dean
110 Huff Hall, MC-586
1206 S. Fourth St.
Champaign, IL 61820

January 25, 2022

Dear Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from our college. Grainger Engineering students will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

While I support the move the give your students more freedom in course selection, it is important to express my concern that discontinuing your Liberal Education requirement may negatively impact my college's finances by reducing the IUs generated from lower enrollments in AHS courses. As you know, the current budget model rewards colleges financially based on the number of registrants in courses. I am hopeful that your students and advisors will continue to view AHS courses as relevant and valuable when they are selecting electives.

Sincerely,

Cheryl Hanley-Maxwell

Dean

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

**College of Education**
Undergraduate Student Academic Affairs Office
110 Education Building, MC-708
1310 S. Sixth St.
Champaign, IL 61820

Dear Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from our college. Grainger Engineering students will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

Sincerely,

Assistant Dean for Academic Affairs
College of Education | University of Illinois at Urbana-Champaign

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

**College of Fine & Applied Arts**

Office of the Dean
100 Architecture Building, MC-622
608 E. Lorado Taft Dr.
Champaign, IL 61820

21 December 2021

Rashid Bashir, Dean
306 Engineering Hall
1308 W. Green St.
M/C 266
Urbana, IL 61801

Dear Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from the College of Fine & Applied Arts. Grainger Engineering students will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

Sincerely,

Kevin Hamilton
Dean and Professor

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

College of Liberal Arts & Sciences
2090 Lincoln Hall, MC-448
702 S. Wright St.
Urbana, IL 61801

December 20, 2021

Dear Dean Bashir,

Thank you for informing the College of LAS of the proposed removal of the Liberal Education requirement in all undergraduate programs in the Grainger College of Engineering. I understand that this requirement includes an extensive list of courses from which your students could choose some, many of which are from our college. Grainger Engineering students will continue to be welcome to take our courses formerly on your Liberal Education list as free electives after the removal of this requirement from their programs of study.

Sincerely,

Venetria K. Patton
Harry E. Preble Dean

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

**College of Media**
Office of the Dean
119 Gregory Hall, MC-462
810 S. Wright St.
Urbana, IL 61801

January 13, 2022

Rashid Bashir, Dean
The Grainger College of Engineering
306 Engineering Hall
1308 W. Green Street
Urbana, IL 61801

Dear Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from our college. Grainger Engineering students will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

Sincerely,

Tracy Sulkin
Dean, College of Media

Gies College of Business
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

**Office of the Dean**
260 Wohlers Hall, 1206 S. 6th Street
Champaign, IL 61820
217.333.2747

December 13th, 2021

Dean Bashir,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in The Grainger College of Engineering. I understand that this requirement included an extensive list of courses Grainger Engineering students could choose from, including some from Gies College of Business. Students from Grainger will continue to be welcome to enroll in the courses formerly on your Liberal Education list as Free Electives after the removal of this requirement.

Sincerely,

Jeffrey R. Brown
Dean, Gies College of Business

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

**School of Information Sciences**
501 E. Daniel St., MC-493
Champaign, IL 61820-6211

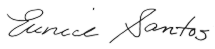
February 3, 2022

Dean Rashid Bashir
306 Engineering Hall
1308 West Green Street
Urbana, IL 61801

Dear Rashid,

Thank you for informing us of the proposed removal of the Liberal Education requirements in all undergraduate programs in the Grainger College of Engineering. I understand that this requirement included an extensive list of courses that Grainger Engineering students could choose from, including some from the iSchool. This letter acknowledges that Grainger Engineering students will continue to be able to enroll in courses as articulated and constrained in Course Explorer and formerly on your Liberal Education list as Free Electives, after the removal of this requirement.

Sincerely,



Eunice Santos
Professor and Dean

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Mathematics

273 Altgeld Hall, MC-382
1409 West Green Street
Urbana, IL 61801

**Re: Use of Math 257 in Aero Eng**

The Mathematics Department, working with the Grainger College of Engineering, has recently created the course MATH 257, *Linear Algebra with Computational Applications*. Quoting from the justification of the approved proposal, "In the future, MATH 257 will replace the MATH 415 requirement in many science and engineering curricula." The Mathematics department anticipated that many programs would also shift from Math 225 to Math 257 and the department is reallocating instructional resources from Math 225 to Math 257 as the need shifts. With this in mind, the department would be pleased to have Aero Space Engineering replace Math 225 with MATH 257 in their program. The change by Aerospace will not cause any undue difficulties for the Mathematics program.

Sincerely

Randy McCarthy

Randy McCarthy
Professor of Mathematics
Dir of Undergraduate Studies in Math
rmccrthy@illinois.edu

*telephone* 217-333-3350 • *fax* 217-333-9576
*email* office@math.uiuc.edu • *url* http://www.math.uiuc.edu/

ILLINOIS

DEPARTMENT OF COMPUTER SCIENCE
Thomas M. Siebel Center for Computer Science
201 N. Goodwin Ave.
Urbana, IL 61801-2302 USA

NANCY M. AMATO
Abel Bliss Professor and Head
2248 Siebel Center
namato@illinois.edu

December 17, 2021

Dear Professor Jonathan Freund,

The Department of Computer Science is fully supportive of the Department of Aerospace Engineering using CS 124 as an option in addition to CS 101 for the introductory programming requirement in their undergraduate degree program 10KP4048BS: Aerospace Engineering, BS.

Sincerely,

**Nancy M. Amato**
Abel Bliss Professor and Head
Department of Computer Science

**From:** Hanley-Maxwell, Cheryl D <cherylhm@illinois.edu>
**Sent:** Monday, February 14, 2022 3:57 PM
**To:** Miller, Nolan H <nmiller@illinois.edu>
**Subject:** RE: Senate Ed Pol - Re: change to Grainger Liberal Education requirement

That's fine. Thanks for asking

**CHERYL D HANLEY-MAXWELL**
*Dean*

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*Human kindness has never weakened the stamina or softened the fiber of a free people. A nation does not have to be cruel to be tough. -- President Franklin D. Roosevelt*




**From:** Miller, Nolan H <nmiller@illinois.edu>
**Sent:** Monday, February 14, 2022 1:49 PM
**To:** Hanley-Maxwell, Cheryl D <cherylhm@illinois.edu>
**Subject:** RE: Senate Ed Pol - Re: change to Grainger Liberal Education requirement

Dear Cheryl,

Thanks again for talking with me about the changes to the Grainger BS programs. I read the statement you sent to the committee today. The Chair would like to include it in the record that is forwarded to the Senate. Is it ok to include the email you sent below?

Thanks,

Nolan

_____

**NOLAN H MILLER**
*Daniel and Cynthia Mah Helle Professor in Finance* | Department of Finance
*Director,* Center for Business and Public Policy
Gies College of Business | University of Illinois at Urbana-Champaign
217.244.2847 | nmiller@illinois.edu | http://www.business.illinois.edu/nmiller



**From:** Hanley-Maxwell, Cheryl D <cherylhm@illinois.edu>
**Sent:** Thursday, February 10, 2022 1:49 PM
**To:** Miller, Nolan H <nmiller@illinois.edu>
**Subject:** RE: Senate Ed Pol - Re: change to Grainger Liberal Education requirement

Hi Nolan –

I appreciate what Ed Pol does in juggling the interests and concerns of the various programs across the campus, while keeping the students in mind. I served on a committee like this at my previous institution and know that it all boils down to what is best for the students' learning. Thanks for reminding me of that.

Here is a statement: While the Grainger proposal has the potential to financially affect AHS, we want to affirm another college's right to control their program requirements and student experiences, ensuring the best possible outcomes for their students. As a result, AHS supports this proposal and hopes that Grainger advisors will recognize the valuable contribution AHS classes make to the education of their students and continue to encourage them to consider relevant and/or high interest classes in AHS.

Hope this works!

Cheryl

CHERYL D HANLEY-MAXWELL, PHD
*Dean*

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