Date Submitted: 12/20/21 3:45 pm

Viewing: **10KP0112BS : Computer Science, BS**

Last approved: 10/08/21 12:48 pm

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Changes proposed by: Steve Herzog

Computer Science, BS

Catalog Pages
Using this
Program

Proposal Type:

In Workflow

1. **U Program Review**
2. **1434 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. 01/05/22 2:31 pm
   Deb Forgacs
   (dforgacs):
   Approved for U
   Program Review
2. 01/05/22 10:58 pm
   Elsa Gunter
   (egunter):
   Approved for 1434
   Head
3. 01/06/22 6:23 am
   Brooke Newell
   (bsnewell):
   Rollback to 1434
   Head for KP
   Committee Chair
4. 01/06/22 3:46 pm
   Elsa Gunter
   (egunter):
   Approved for 1434
   Head
5. 01/06/22 4:44 pm
   Brooke Newell
   (bsnewell):
   Rollback to 1434
   Head for KP

Committee Chair

6. 01/07/22 12:13 am
Elsa Gunter (egunter): Approved for 1434 Head

7. 02/03/22 11:39 am
Brooke Newell (bsnewell): Approved for KP Committee Chair

8. 02/03/22 11:47 am
Candy Deaville (candyd): Approved for KP Dean

9. 02/03/22 11:54 am
John Wilkin (jpwilkin): Approved for University Librarian

10. 02/03/22 4:15 pm
Kathy Martensen (kmartens): Approved for Provost

11. 02/15/22 11:02 am
Barbara Lehman (bjlehman): Approved for Senate EPC

History

1. Dec 13, 2018 by Deb Forgacs (dforgacs)

2. Apr 11, 2019 by Deb Forgacs (dforgacs)

3. May 2, 2019 by Deb Forgacs (dforgacs)

4. Aug 9, 2019 by Deb Forgacs (dforgacs)

5. Aug 12, 2019 by Deb Forgacs (dforgacs)
6. Feb 26, 2020 by Brooke Newell (bsnewell)
7. Mar 31, 2020 by Deb Forgacs (dforgacs)
8. Jun 2, 2021 by Steve Herzog (smherzog)
9. Oct 8, 2021 by Brooke Newell (bsnewell)

Major (ex. Special Education)

This proposal is for a:
Revision

Administration Details

Official Program Name	Computer Science, BS
Sponsor College	Grainger College of Engineering
Sponsor Department	Computer Science
Sponsor Name	Elsa Gunter
Sponsor Email	egunter@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, GCoE; Elsa Gunter, egunter@illinois.edu, CS; Steve Herzog, smherzog@illinois.edu, CS.

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 moved footnotes(when possible) into the Program of Study Table (to improve accessibility).

Clarified the role of CS 100, removing the one hour from the table, and noting in the comments that the course is optional, but highly recommended and that the 1 hour for the course applies to free electives.

Accounted for the recent renumbering of CS 241, a core course requirement, to CS 341.

Included a statement to indicate that students have a new option (CS 211) that satisfies both a core course requirement and the Campus General Education Advanced Composition Requirement.

Added new and recently approved options to the list of technical electives, and indicated their roles in the Focus Areas.

Removed mention of a course that was prematurely added to the list of technical electives, but which has not been offered as a permanently numbered course, and is not planned to be offered in the foreseeable future.

Cleaned up program of study table for clarity.

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 throughout a student's program of study.

Removing CS 100's credit hour from the right column and revising the text makes more transparent the role of the course - not required, but highly recommended and counting toward free electives.

CS 241 has been renumbered to CS 341, and it is a required course in this program. This revision reflects this.

We need to clarify that CS 211 may be simultaneously used to satisfy both the core ethics requirement and the General Education Advance Composition requirement.

Our department continues to grow and expand its selection of technical topics with Computer Science to offer our students. There are an additional 6 courses that have

been added at the 400 and 500-level in Computer Science that need to have their roles in the Focus Areas indicated in the POS.

With the last round of revisions to the Focus Areas, an anticipated course, Experimental HCI, listed as CS 566, was added to the Human and Social Impacts Focus Area. While the CS Department was in the process of proposing this class, one of the main instructors of the class unexpectedly retired, and the other instructors were unsure of proceeding without a replacement for him. As a result, the course proposal has been put on indefinite hold, and we are now removing it from the Focus Area listing until such time as we feel we are prepared to complete the process of proposing the course.

Where possible, we are moving footnotes to comments and making other small adjustments in wording in the POS table to improve readability.

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

Explain how the inclusion or removal of the courses/subjects listed above impacts the offering departments.	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	Letters of Acknowledgement - Liberal Education Electives.pdf

acknowledgement
from other
departments.

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 BS in Computer Science program's learning objectives are in two categories: Program Educational Objectives and Student Outcomes. Each of these are described in the following two sections.

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CS PROGRAM EDUCATIONAL OBJECTIVES REVIEW AND UPDATE PROCESS

In this section, we describe the current Program Educational Objectives for the BS in CS degree, together with the process used by the Department of Computer Science for their periodic review and update. This process is managed by the Undergraduate Studies Committee, under the direction of the Director of Undergraduate Programs. The University of Illinois Computer Science Undergraduate Program Educational Objectives are to prepare graduates who:

1. For years after graduation are highly sought-after by employers and accepted at top graduate schools, obtain positions in industry, government, not-for-profits and academia.
2. Pursue education through lifelong learning either through self-directed study or in leading graduate programs.
3. Emerge as leaders in the field through the creation of new knowledge and systems in the rapidly changing world.
4. Provide leadership with their high ethical and technical standards.

The Program Educational Objectives (PEOs) are reviewed roughly every three years by the Undergraduate Studies Committee to decide whether revision is appropriate based on trends in the field, informal input from alumni and other program constituents, and data from student attainment of relevant job positions and entrance into graduate school.

At the beginning of each round of review and revision, input is collected from sources such as informal surveys of our program constituents, reports on employment outcomes for our recent graduates and feedback on success rates for our students applying to graduate school. Information indicating that the PEOs should be revised, or that they are not being highly attained is incorporated into the assessment of the program and the courses therein.

When a revision of the PEOs is deemed appropriate, the revised PEOs are put before the Advisory Board and their approval is solicited. The Advisory Board contains representatives from our alumni and from industry partners who are potential employers of our graduates. If the Advisory Board suggests revisions, these revisions are reviewed by the Undergraduate Studies Committees and new PEOs are generated consistent with these revisions, and then the PEOs are again put to the Advisory Board for their approval.

Once the PEO's have been approved by the Undergraduate Studies Committees and the Advisory Board, they are brought before the faculty of the Department of Computer Science for their discussion and acceptance. If the faculty recommend substantive changes to the PEOs, then the results are sent back to the Undergraduate Studies Committee and the Advisory Board for re-approval. If the recommendations are minor and non-substantive, they are made by the Director of Undergraduate Programs. The website maintained by the Department of Computer Science for publishing the PEOs is updated with the final revision.

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CS STUDENT OUTCOMES ASSESSMENT PROCESS

This section describes the expected student outcomes of the BS in CS program. It details the process for monitoring them --including how data is collected -- and for assessing when and what revisions to courses and the program seem desirable to better meet the student outcomes. The BS in CS program prepares students to achieve the following student outcomes by the completion of their degree:

Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

Communicate effectively in a variety of professional contexts.

Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

Apply computer science theory and software development fundamentals to produce computing-based solutions.

In order to track student progress in achieving the student outcomes of the BS in CS program, the Department of Computer Science has identified a set of "core courses" that ensure student outcomes are being reached. These include the following courses that all students must take:

CS 128, CS 173, CS 210, CS 225, CS 222, CS 233, CS 341, 241, CS 357, CS 361, CS 374, and CS 421.

All students must also select at least one team project course from among these:
CS 427/8/9, CS 465, CS 467, CS 493/4, CS 497, and CS498VR. CS 417, CS 427/8/9, CS 437, CS 465, CS 467, CS 493/4, CS 497

These courses (and others) are under continuous assessment and revision informally by instructors teaching the course. More formally though, roughly every three years (the semester prior to the ABET review cycle, and midway between cycles) assessment data and course revision information is collected for each core course, and stored by the academic office.

Each course in CS has a specific list of learning goals. Courses typically have 8 to 12 learning goals each. This list of learning goals is reviewed by the instructors of the course every one to three years. For each class, assessment instruments are identified that assess each learning goal. The assessment instruments include at least one summative assessment, but preferably also at least one formative assessment. They are typically chosen from homework assignments and exams, but for some learning goals, project write up or team presentations are more appropriate. For each assessment instrument, the minimum score required to achieve satisfactory attainment of the learning goal is recorded, along with the percentage of students in the program attaining the learning goal and statistics indicating the range of performance of the students on the learning goal. For most courses in the core, satisfactory attainment of the learning goals translates to receiving a score of 70% or more on the assessment instruments measuring that learning goal. For a few of our most difficult courses, satisfactory attainment is considered achieved with a score of 60%. The rate of attainment is considered very high if at least 85% of the students are achieving satisfactory attainment of the learning goal, and the average score of the BS in CS students in the class is at least 80%.

The rate of attainment for each learning goal is reviewed by the instructors teaching the course and the course coordinator and when found to be less than very high, the student work is reviewed more thoroughly and suggestions are recorded for ways in

student work is reviewed more thoroughly and suggestions are recorded for ways in which improvement might be made to attain a higher rate of attainment of the learning goals. The suggested improvements typically involve either changes within a course, or changes between neighboring courses in the prerequisite chain. Typical changes within a course would include shifting emphasis, or reorganizing topics to clarify the flow of the material related to the learning goal in question. Changes to the relation between courses may involve possibly shifting topics across course boundaries to allow for more time in one course for greater emphasis for a needed prerequisite topic or bring part of the coverage of a prerequisite topic closer to the place where it is used by the topic covering the learning goal on which less than very high attainment was achieved. Once weaknesses have been identified and suggested improvements have been recorded for a learning goal, the suggestions are reviewed by the course coordinators and regular instructors of the courses involved in the suggested revisions. Where possible within the current course structure, a plan is made for how to implement the suggested improvements. If the current course structure for the courses involved does not adequately support the suggested improvements, then the difficulty is brought to the attention of the Undergraduate Studies Committee for a discussion of course revisions. After implementation of the suggested course revisions, at the next program review period for improvement, the learning goals affected are examined in comparison to the previous performance for improvement.

In addition to reviewing the learning goals of the individual courses, the pattern of attainment of learning goals covering the major student outcomes is reviewed. If more than a third of the courses supporting a student outcome fail to achieve very high attainment of the learning goals covering the student outcomes, then the Director of Undergraduate Programs will meet with the course coordinators and regular instructors of the various courses failing to achieve very high attainment of the learning goals covering the student outcome in question to discuss what underlying weaknesses exist contributing to this systemic failure to strongly cover the relevant student outcome. The Director of Undergraduate Programs will deliver a summary of the findings from these discussions to the Undergraduate Studies Committee. The Undergraduate Studies Committee will then review the findings of repeated weakness in learning goals covering the student outcome in question and the findings of potential underlying causes of that weaknesses. The Undergraduate Studies Committee will determine if additional courses or other revisions to the BS in CS program are likely needed to address the identified weaknesses in student outcome attainment.

In addition to revisions of the program driven by the study of course learning goals, once each three years, the Director of Undergraduate Programs will review whether the program is topically in compliance with the latest requirements from the ABET accreditation process. The Director of Undergraduate Programs will present to the Undergraduate Studies Committee any ways in which the program is potentially found to be not in compliance with the topics required to be covered by ABET. The Undergraduate Studies Committee will devise a plan, either through course revision or curriculum revision to bring the program back into topical compliance with ABET.

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   Computer Science, BS Side by Side.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.

Statement for Programs of Study Catalog

Graduation Requirements

Minimum Technical GPA: 2.0
TGPA is required for CS and Math courses. See **Technical GPA** to clarify 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. If the option of CS 211 is chosen, it will satisfy a core course requirement and the Campus General Education Advanced Composition requirement.

Orientation and Professional Development

Course List

Code	Title	Hours
CS 100	Freshman Orientation (optional course highly recommended may be used to help meet free elective requirements)	1
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300)	1
	Highly recommended, optional 1 credit hour course, CS 100 Freshman Orientation. Credit hour counts toward free electives.	
CS 210	Ethical & Professional Issues	2 or 3
or CS 211	Ethical and Professional Conduct	
Total Hours		3-4

Foundational Mathematics and Science

Course List

Code	Title	Hours
Total Hours chosen from the following:		25
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

Code	Title	Hours
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 415	Applied Linear Algebra	3
or MATH 257	Linear Algebra with Computational Applications	
or MATH 416	Abstract Linear Algebra	
MATH 257	Linear Algebra with Computational Applications	3
or MATH 415	Applied Linear Algebra	
or MATH 416	Abstract Linear Algebra	
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
One Science elective course:		3

Students must take one course from the Natural Science & Technology (NST) list, in addition to those taken as part of the General Education requirements. The course must be a course that is allowed for credit by the Grainger College of Engineering.

Exceptions to the list are: ASTR 100, PHYS 101 and PHYS 102, and CHEM 101.

Students who select either ASTR 121, ASTR 122, or ASTR 150 to satisfy the Science Elective requirement will not be allowed to take ASTR 131 and ASTR 132 as free elective (maximum of 4 credit hours of ASTR 100-level can count towards graduation requirements for all Grainger College of Engineering Undergraduates)

Computer Science Technical Core

Course List

Code	Title	Hours
CS 124	Introduction to Computer Science I	3
CS 128	Introduction to Computer Science II	3
CS 173	Discrete Structures	3
CS 222	Software Design Lab	1
CS 225	Data Structures	4
CS 233	Computer Architecture	4
CS 241	Course CS 241 Not Found	4
CS 341	System Programming	4
CS 357	Numerical Methods I	3
CS 361	Probability & Statistics for Computer Science	3
CS 374	Introduction to Algorithms & Models of Computation	4
CS 421	Programming Languages & Compilers	3
Total Hours		35

Technical Electives

Course List

Code	Title	Hours

Students must take a minimum of (6) six additional technical electives with at least eighteen (18) cumulative credit hours and chosen from CS 397 and the CS 400-level courses, not including CS 400, CS 401, CS 402, CS 403 or CS 491. CS 500-level courses may be used as technical electives, but only with special permission from the CS Academic Office. CS 397 and CS 499 may be used with a cumulative maximum of six (6) credits from them counting as technical electives. One "CS-like" course in another department (e.g., ECE) may also be counted as a CS 400-level course with permission of the CS Academic Office. Non-CS tech electives will not be considered in focus areas.

At least one (1) of the CS courses used for technical electives must be chosen from the list below of CS courses satisfying the team project requirement.

Team Project Course List:

Code	Title	Hours
CS 417	Virtual Reality	3
CS 427	Software Engineering I	3 or 4

Code	Title	Hours
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 437	Topics in Internet of Things	3
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 493	Senior Project II, ACP	3
CS 494	Senior Project II	3
CS 497	CS Team Project	1 to 3

At least three (3) of the CS courses used for technical electives must be chosen from a single focus area, from among the list of focus areas listed below. The team project course may be used as one of them. CS 498 Special Topics and CS 598 Special Topics classes may be included in a focus area by department approval.

Software Foundations:

Code	Title	Hours
CS 407	Cryptography	3 or 4
CS 409	The Art of Web Programming	3
CS 422	Programming Language Design	3 or 4
CS 426	Compiler Construction	3 or 4
CS 427	Software Engineering I	3 or 4
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 474	Logic in Computer Science	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 492	Senior Project I	3
CS 493	Senior Project II, ACP	3
CS 494	Senior Project II	3
CS 521	Advanced Topics in Programming Systems	4
CS 522	Programming Language Semantics	4
CS 524	Concurrent Progrmg Languages	4
CS 526	Advanced Compiler Construction	4
CS 527	Topics in Software Engineering	4
CS 528	Obj-Oriented Progrmg & Design	4
CS 576	Topics in Automated Deduction	2 to 4

Algorithms and Models of Computation:

Code	Title	Hours
CS 407	Cryptography	3 or 4
CS 413	Intro to Combinatorics	3 or 4
CS 473	Algorithms	4

Code	Title	Hours
CS 474	Logic in Computer Science	3 or 4
CS 475	Formal Models of Computation	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 481	Advanced Topics in Stochastic Processes & Applications	3 or 4
CS 482	Simulation	3 or 4
CS 571	Combinatorial Mathematics	4
CS 572	Extremal Graph Theory	4
CS 573	Algorithms	4
CS 574	Randomized Algorithms	4
CS 575	Methods of Combinatorics	4
CS 576	Topics in Automated Deduction	2 to 4
CS 579	Computational Complexity	4
CS 580	Topics in Algorithmic Game Theory	4
CS 581	Algorithmic Genomic Biology	4
CS 583	Approximation Algorithms	4
CS 584	Embedded System Verification	4
CS 586	Combinatorial Optimization	4

Intelligence and Big Data:

Code	Title	Hours
CS 410	Text Information Systems	3 or 4
CS 411	Database Systems	3 or 4
CS 412	Introduction to Data Mining	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 416	Data Visualization	3 or 4
CS 440	Artificial Intelligence	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 442	Trustworthy Machine Learning	3 or 4
CS 444	Deep Learning for Computer Vision	3 or 4
CS 445	Computational Photography	3 or 4
CS 446	Machine Learning	3 or 4
CS 447	Natural Language Processing	3 or 4

Code	Title	Hours
CS 448	Audio Computing Laboratory	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 467	Social Visualization	3 or 4
CS 469	Computational Advertising Infrastructure	3
CS 470	Social and Information Networks	3
CS 510	Advanced Information Retrieval	4
CS 511	Advanced Data Management	4
CS 512	Data Mining Principles	4
CS 514	Advanced Topics in Network Science	4
CS 540	Deep Learning Theory	4
CS 542	Statistical Reinforcement Learning	4
CS 543	Computer Vision	4
CS 544	Optimiz in Computer Vision	4
CS 545	Machine Learning for Signal Processing	4
CS 546	Advanced Topics in Natural Language Processing	4
CS 548	Models of Cognitive Processes	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 567	Social Signals and Social Media	4
CS 576	Topics in Automated Deduction	2 to 4
CS 582	Machine Learning for Bioinformatics	4
Human and Social Impact:		
CS 409	The Art of Web Programming	3 or 4
CS 416	Data Visualization	3 or 4
CS 417	Virtual Reality	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 442	Trustworthy Machine Learning	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3
CS 470	Social and Information Networks	3
CS 500	Current Topics in Computing Education Research	4
CS 514	Advanced Topics in Network Science	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4

Code	Title	Hours
CS 563	Advanced Computer Security	4
CS 565	Human-Computer Interaction	4
CS 566	Course CS 566 Not Found (Experimental HCI)	4
CS 567	Social Signals and Social Media	4

Media:

Code	Title	Hours
CS 409	The Art of Web Programming	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 416	Data Visualization	3 or 4
CS 417	Virtual Reality	3 or 4
CS 418	Interactive Computer Graphics	3 or 4
CS 419	Production Computer Graphics	3 or 4
CS 445	Computational Photography	3 or 4
CS 448	Audio Computing Laboratory	3 or 4
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3 or 4
CS 519	Scientific Visualization	4
CS 545	Machine Learning for Signal Processing	4
CS 565	Human-Computer Interaction	4
CS 567	Social Signals and Social Media	4

Scientific, Parallel, and High Perfomance Computing:

Code	Title	Hours
CS 419	Production Computer Graphics	3 or 4
CS 435	Cloud Networking	3 or 4
CS 450	Numerical Analysis	3 or 4
CS 457	Numerical Methods II	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 482	Simulation	3 or 4
CS 483	Applied Parallel Programming	4
CS 484	Parallel Programming	3 or 4
CS 519	Scientific Visualization	4
CS 554	Parallel Numerical Algorithms	4
CS 555	Numerical Methods for PDEs	4
CS 556	Iterative & Multigrid Methods	4
CS 558	Topics in Numerical Analysis	4

Code	Title	Hours
	Distributed Systems, Networking, and Security:	
CS 407	Cryptography	3 or 4
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 425	Distributed Systems	3 or 4
CS 431	Embedded Systems	3 or 4
CS 435	Cloud Networking	3 or 4
CS 436	Computer Networking Laboratory	3 or 4
CS 437	Topics in Internet of Things	3 or 4
CS 438	Communication Networks	3 or 4
CS 439	Wireless Networks	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 483	Applied Parallel Programming	4
CS 484	Parallel Programming	3 or 4
CS 523	Advanced Operating Systems	4
CS 524	Concurrent Progrmg Languages	4
CS 525	Advanced Distributed Systems	4
CS 537	Advanced Topics in Internet of Things (IoT)	4
CS 538	Advanced Computer Networks	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 563	Advanced Computer Security	4
	Machines:	
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 426	Compiler Construction	3 or 4
CS 431	Embedded Systems	3 or 4
CS 433	Computer System Organization	3 or 4
CS 437	Topics in Internet of Things	3 or 4
CS 484	Parallel Programming	3 or 4

Code	Title	Hours
CS 523	Advanced Operating Systems	4
CS 526	Advanced Compiler Construction	4
CS 533	Parallel Computer Architecture	4
CS 534	Advanced Topics in Computer Architecture	4
CS 536	Fault-Tolerant Dig Syst Design	4
CS 541	Computer Systems Analysis	4
CS 584	Embedded System Verification	4
CS 588	Autonomous Vehicle System Engineering	4

Computer Science Advanced Electives

Course List

Code	Title	Hours
Students must take for a letter grade a minimum of two (2) advanced elective courses comprising at least six (6) credit hours. These advanced elective courses must be distinct from courses used to satisfy the technical electives. They may be chosen from CS 397 Individual Study and the 400-level coursework offered for letter grade in ANY area offered at the University of Illinois at Urbana-Champaign. It is expected that students will select these additional advanced courses in a way that best augments their program of study. Consultation with a faculty mentors is highly encouraged. A maximum of six (6) credit hours of CS 397 may be used in the combination of technical electives and advanced electives.		6
Total Hours		6

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 3~~		~~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. 4~~		~~18~~
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.		24-25
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~~

~~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.~~

~~4~~ ~~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   110701 - Computer Science.

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

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.

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

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   Fall
matriculation
term for this
program?

Budget

Are there   No
budgetary
implications for
this revision?

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?

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.22.088
Attach Rollback/Approval Notices	ep22088_response from sponsor_20220214.pdf
This proposal requires HLC inquiry	No

DMI Documentation

Attach Final Approval Notices	
Banner/Codebook Name	BS:Computer Science -UIUC
Program Code:	10KP0112BS

Minor Code	Conc Code	Degree Code	BS	Major Code
0112				

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	**Brooke Newell (bsnewell) (01/06/22 6:23 am):** Rollback: per request **Brooke Newell (bsnewell) (01/06/22 4:44 pm):** Rollback: per discussion

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

University of Illinois at Urbana-Champaign
College of Applied Health Sciences
108 Huff Hall
1206 S Fourth | M/C 586
Champaign, IL 61820
217.333.2131 | cherylhm@illinois.edu
www.ahs.illinois.edu
(217) 333-0404 (FAX)

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

_____

I ILLINOIS

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

Under the Illinois Freedom of Information Act any written communication to or from university employees regarding university business is a public record and may be subject to public disclosure.

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

University of Illinois at Urbana-Champaign
College of Applied Health Sciences
108 Huff Hall
1206 S Fourth | M/C 586
Champaign, IL 61820
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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

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 Technical GPA: 2.0
TGPA is required for CS and Math courses. See Technical GPA to clarify 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.

Orientation and Professional Development

CS 100	Freshman Orientation (optional course highly recommended may be used to help meet free elective requirements)	1
CS 210	Ethical & Professional Issues	2 or 3
or CS 211	Ethical and Professional Conduct	
ENG 100	Engineering Orientation [1]	0
Total Hours		**3-4**

Foundational Mathematics and Science

Total Hours chosen from the following:		25
	Calculus I [2]	4
MATH 221		
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 415	Applied Linear Algebra	3
or MATH 257	Linear Algebra with Computational Applications	
or MATH 416	Abstract Linear Algebra	
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
One Science elective course:		**3**

Students must take one course from the Natural Science & Technology (NST) list, in addition to those taken as part of the General Education requirements. The course must be a course that is allowed for credit by the Grainger College of Engineering.

Exceptions to the list are: ASTR 100, PHYS 101 and PHYS 102, and CHEM 101.

Students who select either ASTR 121, ASTR 122, or ASTR 150 to satisfy the Science Elective requirement will not be allowed to take ASTR 131 and ASTR 132 as free elective (maximum of 4 credit hours of ASTR 100-level can count towards graduation requirements for all Grainger College of Engineering Undergraduates)

Computer Science Technical Core

CS 124	Introduction to Computer Science I	3
CS 128	Introduction to Computer Science II	3
CS 173	Discrete Structures	3
CS 222	Software Design Lab	1
CS 225	Data Structures	4
CS 233	Computer Architecture	4
CS 241	System Programming	4
CS 361	Probability & Statistics for Computer Science	3
CS 357	Numerical Methods I	3
CS 374	Introduction to Algorithms & Models of Computation	4
CS 421	Programming Languages & Compilers	3
Total Hours		**35**

Technical Electives

Students must take a minimum of (6) six additional technical electives with at least eighteen (18) cumulative credit hours and chosen from CS 397 and the CS 400-level courses, not including CS 400, CS 401, CS 402, CS 403 or CS 491. CS 500-level courses may be used as technical electives, but only with special permission from the CS Academic Office. CS 397 and CS 499 may be used with a cumulative maximum of six (6) credits from them counting as technical electives. One "CS-like" course in another department (e.g., ECE) may also be counted as a CS 400-level course with permission of the CS Academic Office. Non-CS tech electives will not be considered in focus areas.   18

At least one (1) of the CS courses used for technical electives must be chosen from the list below of CS courses satisfying the team project requirement

Team Project Course List:

CS 417	Virtual Reality	3
CS 427	Software Engineering I	3 or 4
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 437	Topics in Internet of Things	3
CS 465	User Interface Design	3
CS 467	Social Visualization	3 or 4
CS 493	Senior Project II, ACP	3
CS 494	Senior Project II	3
CS 497	CS Team Project	1 to 3

At least three (3) of the CS courses used for technical electives must be chosen from a single focus area, from among the list of focus areas listed below. The team project course may be used as one of them.

CS 498 Special Topics and CS 598 Special Topics classes may be included in a focus area by department approval

Software Foundations:		
CS 407	Cryptography	3 or 4
CS 409	The Art of Web Programming	3
CS 422	Programming Language Design	3 or 4
CS 426	Compiler Construction	3 or 4
CS 427	Software Engineering I	3 or 4
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 474	Logic in Computer Science	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 492	Senior Project I	3
CS 521	Advanced Topics in Programming Systems	4
CS 522	Programming Language Semantics	4
CS 524	Concurrent Progrmg Languages	4
CS 526	Advanced Compiler Construction	4
CS 527	Topics in Software Engineering	4
CS 528	Obj-Oriented Progrmg & Design	4
CS 576	Topics in Automated Deduction	2 to 4
Algorithms and Models of Computation:		
CS 407	Cryptography	3 or 4
CS 413	Intro to Combinatorics	3 or 4
CS 473	Algorithms	4
CS 474	Logic in Computer Science	3 or 4
CS 475	Formal Models of Computation	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 481	Advanced Topics in Stochastic Processes & Applications	3 or 4

New Program of Study

Graduation Requirements

Minimum Technical GPA: 2.0
TGPA is required for CS and Math courses. See Technical GPA to clarify 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. If the option of CS 211 is chosen, it will satisfy a core course requirement and the Campus General Education Advanced Composition requirement.

Orientation and Professional Development

ENG 100	Engineering Orientation (External transfer students take ENG 300.)	1
Highly recommended, optional 1 credit hour course, CS 100 Freshman Orientation. Credit hour counts toward free		
CS 210	Ethical & Professional Issues	2 or 3
or CS 211	Ethical and Professional Conduct	
Total Hours		**3-4**

Foundational Mathematics and Science

Total Hours chosen from the following:		25
	Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count toward degree.)	4
MATH 221		
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications	3
or MATH 415	Applied Linear Algebra	
or MATH 416	Abstract Linear Algebra	
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
One Science elective course:		**3**

Students must take one course from the Natural Science & Technology (NST) list, in addition to those taken as part of the General Education requirements. The course must be a course that is allowed for credit by the Grainger College of Engineering.

Exceptions to the list are: ASTR 100, PHYS 101 and PHYS 102, and CHEM 101.

Students who select either ASTR 121, ASTR 122, or ASTR 150 to satisfy the Science Elective requirement will not be allowed to take ASTR 131 and ASTR 132 as free elective (maximum of 4 credit hours of ASTR 100-level can count towards graduation requirements for all Grainger College of Engineering Undergraduates)

Computer Science Technical Core

CS 124	Introduction to Computer Science I	3
CS 128	Introduction to Computer Science II	3
CS 173	Discrete Structures	3
CS 222	Software Design Lab	1
CS 225	Data Structures	4
CS 233	Computer Architecture	4
CS 341	System Programming	4
CS 357	Numerical Methods I	3
CS 361	Probability & Statistics for Computer Science	3
CS 374	Introduction to Algorithms & Models of Computation	4
CS 421	Programming Languages & Compilers	3
Total Hours		**35**

Technical Electives

Students must take a minimum of (6) six additional technical electives with at least eighteen (18) cumulative credit hours and chosen from CS 397 and the CS 400-level courses, not including CS 400, CS 401, CS 402, CS 403 or CS 491. CS 500-level courses may be used as technical electives, but only with special permission from the CS Academic Office. CS 397 and CS 499 may be used with a cumulative maximum of six (6) credits from them counting as technical electives. One "CS-like" course in another department (e.g., ECE) may also be counted as a CS 400-level course with permission of the CS Academic Office. Non-CS tech electives will not be considered in focus areas.   18

At least one (1) of the CS courses used for technical electives must be chosen from the list below of CS courses satisfying the team project requirement

Team Project Course List:

CS 417	Virtual Reality	3
CS 427	Software Engineering I	3 or 4
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 437	Topics in Internet of Things	3
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 493	Senior Project II, ACP	3
CS 494	Senior Project II	3
CS 497	CS Team Project	1 to 3

At least three (3) of the CS courses used for technical electives must be chosen from a single focus area, from among the list of focus areas listed below. The team project course may be used as one of them.

CS 498 Special Topics and CS 598 Special Topics classes may be included in a focus area by department approval

Software Foundations:		
CS 407	Cryptography	3 or 4
CS 409	The Art of Web Programming	3
CS 422	Programming Language Design	3 or 4
CS 426	Compiler Construction	3 or 4
CS 427	Software Engineering I	3 or 4
CS 428	Software Engineering II	3 or 4
CS 429	Software Engineering II, ACP	3
CS 474	Logic in Computer Science	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 492	Senior Project I	3
CS 493	Senior Project II, ACP	3
CS 494	Senior Project II	3
CS 521	Advanced Topics in Programming Systems	4
CS 522	Programming Language Semantics	4
CS 524	Concurrent Progrmg Languages	4
CS 526	Advanced Compiler Construction	4
CS 527	Topics in Software Engineering	4
CS 528	Obj-Oriented Progrmg & Design	4
CS 576	Topics in Automated Deduction	2 to 4
Algorithms and Models of Computation:		
CS 407	Cryptography	3 or 4
CS 413	Intro to Combinatorics	3 or 4
CS 473	Algorithms	4
CS 474	Logic in Computer Science	3 or 4
CS 475	Formal Models of Computation	3 or 4
CS 476	Program Verification	3 or 4
CS 477	Formal Software Development Methods	3 or 4
CS 481	Advanced Topics in Stochastic Processes & Applications	3 or 4

Left (current):

Course	Title	Credits
CS 482	Simulation	3 or 4
CS 571	Combinatorial Mathematics	4
CS 572	Extremal Graph Theory	4
CS 573	Algorithms	4
CS 574	Randomized Algorithms	4
CS 575	Methods of Combinatorics	4
CS 576	Topics in Automated Deduction	2 to 4
CS 579	Computational Complexity	4
CS 580	Topics in Algorithmic Game Theory	4
CS 583	Approximation Algorithms	4
CS 584	Embedded System Verification	4

Intelligence and Big Data:

Course	Title	Credits
CS 410	Text Information Systems	3 or 4
CS 411	Database Systems	3 or 4
CS 412	Introduction to Data Mining	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 416	Data Visualization	3 or 4
CS 440	Artificial Intelligence	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 445	Computational Photography	3 or 4
CS 446	Machine Learning	3 or 4
CS 447	Natural Language Processing	3 or 4
CS 448	Audio Computing Laboratory	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 467	Social Visualization	3 or 4
CS 469	Computational Advertising Infrastructure	3
CS 510	Advanced Information Retrieval	4
CS 511	Advanced Data Management	4
CS 512	Data Mining Principles	4
CS 514	Advanced Topics in Network Science	4
CS 540	Deep Learning Theory	4
CS 542	Statistical Reinforcement Learning	4
CS 543	Computer Vision	4
CS 544	Optimiz in Computer Vision	4
CS 545	Machine Learning for Signal Processing	4
CS 546	Advanced Topics in Natural Language Processing	4
CS 548	Models of Cognitive Processes	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 567	Social Signals and Social Media	4
CS 576	Topics in Automated Deduction	2 to 4

Human and Social Impact:

Course	Title	Credits
CS 409	The Art of Web Programming	3 or 4
CS 416	Data Visualization	3 or 4
CS 417	Virtual Reality	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 465	User Interface Design	3
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3
CS 500	Current Topics in Computing Education Research	4
CS 514	Advanced Topics in Network Science	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 563	Advanced Computer Security	4
CS 565	Human-Computer Interaction	4
CS 566	(Experimental HCI)	4
CS 567	Social Signals and Social Media	4

Media:

Course	Title	Credits
CS 409	The Art of Web Programming	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 417	Virtual Reality	3 or 4
CS 418	Interactive Computer Graphics	3 or 4
CS 419	Production Computer Graphics	3 or 4
CS 445	Computational Photography	3 or 4
CS 448	Audio Computing Laboratory	3 or 4
CS 465	User Interface Design	3
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3 or 4
CS 519	Scientific Visualization	4
CS 545	Machine Learning for Signal Processing	4
CS 565	Human-Computer Interaction	4
CS 567	Social Signals and Social Media	4

Scientific, Parallel, and High Perfomance Computing:

Course	Title	Credits
CS 419	Production Computer Graphics	3 or 4
CS 435	Cloud Networking	3 or 4
CS 450	Numerical Analysis	3 or 4
CS 457	Numerical Methods II	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 482	Simulation	3 or 4
CS 483	Applied Parallel Programming	
CS 484	Parallel Programming	3 or 4
CS 519	Scientific Visualization	4
CS 554	Parallel Numerical Algorithms	4
CS 555	Numerical Methods for PDEs	4
CS 556	Iterative & Multigrid Methods	4
CS 558	Topics in Numerical Analysis	4

Distributed Systems, Networking, and Security:

Course	Title	Credits
CS 407	Cryptography	3 or 4
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 425	Distributed Systems	3 or 4
CS 431	Embedded Systems	3 or 4
CS 435	Cloud Networking	3 or 4
CS 436	Computer Networking Laboratory	3 or 4
CS 437	Topics in Internet of Things	3 or 4
CS 438	Communication Networks	3 or 4
CS 439	Wireless Networks	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 483	Applied Parallel Programming	
CS 484	Parallel Programming	3 or 4
CS 523	Advanced Operating Systems	4
CS 524	Concurrent Progrmg Languages	4
CS 525	Advanced Distributed Systems	4
CS 537	Advanced Topics in Internet of Things (IoT)	
CS 538	Advanced Computer Networks	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 563	Advanced Computer Security	4

Machines:

Course	Title	Credits
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 426	Compiler Construction	3 or 4
CS 431	Embedded Systems	3 or 4
CS 433	Computer System Organization	3 or 4

Right (proposed):

Course	Title	Credits
CS 482	Simulation	3 or 4
CS 571	Combinatorial Mathematics	4
CS 572	Extremal Graph Theory	4
CS 573	Algorithms	4
CS 574	Randomized Algorithms	4
CS 575	Methods of Combinatorics	4
CS 576	Topics in Automated Deduction	2 to 4
CS 579	Computational Complexity	4
CS 580	Topics in Algorithmic Game Theory	4
CS 581	Algorithmic Genomic Biology	4
CS 583	Approximation Algorithms	4
CS 584	Embedded System Verification	4
CS 586	Combinatorial Optimization	4

Intelligence and Big Data:

Course	Title	Credits
CS 410	Text Information Systems	3 or 4
CS 411	Database Systems	3 or 4
CS 412	Introduction to Data Mining	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 416	Data Visualization	3 or 4
CS 440	Artificial Intelligence	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 442	Trustworthy Machine Learning	3 or 4
CS 444	Deep Learning in Computer Vision	3 or 4
CS 445	Computational Photography	3 or 4
CS 446	Machine Learning	3 or 4
CS 447	Natural Language Processing	3 or 4
CS 448	Audio Computing Laboratory	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 467	Social Visualization	3 or 4
CS 469	Computational Advertising Infrastructure	3
CS 470	Social and Information Networks	3
CS 510	Advanced Information Retrieval	4
CS 511	Advanced Data Management	4
CS 512	Data Mining Principles	4
CS 514	Advanced Topics in Network Science	4
CS 540	Deep Learning Theory	4
CS 542	Statistical Reinforcement Learning	4
CS 543	Computer Vision	4
CS 544	Optimiz in Computer Vision	4
CS 545	Machine Learning for Signal Processing	4
CS 546	Advanced Topics in Natural Language Processing	4
CS 548	Models of Cognitive Processes	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 567	Social Signals and Social Media	4
CS 576	Topics in Automated Deduction	2 to 4
CS 582	Machine Learning for Bioinformatics	4

Human and Social Impact:

Course	Title	Credits
CS 409	The Art of Web Programming	3 or 4
CS 416	Data Visualization	3 or 4
CS 417	Virtual Reality	3 or 4
CS 441	Applied Machine Learning	3 or 4
CS 442	Trustworthy Machine Learning	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 464	Topics in Societal and Ethical Impacts of Computer Technology	3
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3
CS 470	Social and Information Networks	3
CS 500	Current Topics in Computing Education Research	4
CS 514	Advanced Topics in Network Science	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 563	Advanced Computer Security	4
CS 565	Human-Computer Interaction	4
CS 567	Social Signals and Social Media	4

Media:

Course	Title	Credits
CS 409	The Art of Web Programming	3 or 4
CS 414	Multimedia Systems	3 or 4
CS 416	Data Visualization	3 or 4
CS 417	Virtual Reality	3 or 4
CS 418	Interactive Computer Graphics	3 or 4
CS 419	Production Computer Graphics	3 or 4
CS 445	Computational Photography	3 or 4
CS 448	Audio Computing Laboratory	3 or 4
CS 465	User Interface Design	4
CS 467	Social Visualization	3 or 4
CS 468	Tech and Advertising Campaigns	3
CS 469	Computational Advertising Infrastructure	3 or 4
CS 519	Scientific Visualization	4
CS 545	Machine Learning for Signal Processing	4
CS 565	Human-Computer Interaction	4
CS 567	Social Signals and Social Media	4

Scientific, Parallel, and High Perfomance Computing:

Course	Title	Credits
CS 419	Production Computer Graphics	3 or 4
CS 435	Cloud Networking	3 or 4
CS 450	Numerical Analysis	3 or 4
CS 457	Numerical Methods II	3
CS 466	Introduction to Bioinformatics	3 or 4
CS 482	Simulation	3 or 4
CS 483	Applied Parallel Programming	
CS 484	Parallel Programming	3 or 4
CS 519	Scientific Visualization	4
CS 554	Parallel Numerical Algorithms	4
CS 555	Numerical Methods for PDEs	4
CS 556	Iterative & Multigrid Methods	4
CS 558	Topics in Numerical Analysis	4

Distributed Systems, Networking, and Security:

Course	Title	Credits
CS 407	Cryptography	3 or 4
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 425	Distributed Systems	3 or 4
CS 431	Embedded Systems	3 or 4
CS 435	Cloud Networking	3 or 4
CS 436	Computer Networking Laboratory	3 or 4
CS 437	Topics in Internet of Things	3 or 4
CS 438	Communication Networks	3 or 4
CS 439	Wireless Networks	3 or 4
CS 460	Security Laboratory	3 or 4
CS 461	Computer Security I	4
CS 463	Computer Security II	3 or 4
CS 483	Applied Parallel Programming	
CS 484	Parallel Programming	3 or 4
CS 523	Advanced Operating Systems	4
CS 524	Concurrent Progrmg Languages	4
CS 525	Advanced Distributed Systems	4
CS 537	Advanced Topics in Internet of Things (IoT)	
CS 538	Advanced Computer Networks	4
CS 562	Advanced Topics in Security, Privacy, and Machine Learning	4
CS 563	Advanced Computer Security	4

Machines:

Course	Title	Credits
CS 423	Operating Systems Design	3 or 4
CS 424	Real-Time Systems	3 or 4
CS 426	Compiler Construction	3 or 4
CS 431	Embedded Systems	3 or 4
CS 433	Computer System Organization	3 or 4
CS 437	Topics in Internet of Things	3

CS 484	Parallel Programming	3 or 4
CS 523	Advanced Operating Systems	4
CS 526	Advanced Compiler Construction	4
CS 533	Parallel Computer Architecture	4
CS 534	Advanced Topics in Computer Architecture	4
CS 536	Fault-Tolerant Dig Syst Design	4
CS 541	Computer Systems Analysis	4
CS 584	Embedded System Verification	4

Computer Science Advanced Electives

Students must take for a letter grade a minimum of two (2) advanced elective courses comprising at least six (6) credit hours. These advanced elective courses must be distinct from courses used to satisfy the technical electives. They may be chosen from CS 397 Individual Study and the 400-level coursework offered for letter grade in ANY area offered at the University of Illinois at Urbana-Champaign. It is expected that students will select these additional advanced courses in a way that best augments their program of study. Consultation with a faculty mentors is highly encouraged. A maximum of six (6) credit hours of CS 397 may be used in the combination of technical electives and advanced electives.	6
Total Hours	**6**

Electives

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.³	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. ⁴	18
Total Hours of Curriculum to Graduate	**128**

¹ *External transfer students take ENG 300 instead.*
² *MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.*
³ *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.*
⁴ *The Grainger College of Engineering restrictions to free electives can be found here.*

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,

German Bollero, Interim Dean

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

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

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

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

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

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