DOCUMENTS OF THE GENERAL FACULTY

PROPOSED ADDITION OF A COMPUTATIONAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG 2016-2018*

Dean Sharon L. Wood in the Cockrell School of Engineering has filed with the secretary of the Faculty Council the following addition to the *Undergraduate Catalog, 2016-2018*. On August 26, 2014, the Department of Aerospace Engineering and Engineering Mechanics approved the proposal. On April 27 and April 29, 2015, the faculty in the college and the dean approved the proposal, respectively. The secretary has classified this proposal as legislation of *general* interest to more than one college or school.

The Committee on Undergraduate Degree Program Review recommended approval of the new degree program on October 8, 2015, and forwarded the proposal to the Office of the General Faculty. The Faculty Council has the authority to approve this legislation on behalf of the General Faculty. The authority to grant final approval on this legislation resides with Texas Higher Education Coordinating Board.

The Faculty Council will discuss and take action on the proposal at its meeting on December 7, 2015.

Hillary Hart, Secretary
General Faculty and Faculty Council

Posted on the Faculty Council website <http://www.utexas.edu/faculty/council/> on October 19, 2015.

PROPOSED ADDITION OF A COMPUTATIONAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG 2016-2018*

Type of Change ☐ Academic Change
☒ Degree Program Change (THECB form required)

Proposed classification ☐ Exclusive ☒ General ☐ Major

1. IF THE ANSWER TO ANY OF THE FOLLOWING QUESTIONS IS YES, THE COLLEGE MUST CONSULT LINDA DICKENS, DIRECTOR OF ACCREDITATION AND ASSESSMENT, TO DETERMINE IF SACS-COC APPROVAL IS REQUIRED.

- Is this a new degree program? Yes ☒ No ☐
- Does the program offer courses that will be taught off campus? Yes ☐ No ☒
- Will courses in this program be delivered electronically? Yes ☐ No ☒

2. EXPLAIN CHANGE TO DEGREE PROGRAM AND GIVE A DETAILED RATIONALE FOR EACH INDIVIDUAL CHANGE:

We are proposing a new degree program, the Bachelor of Science in Computational Engineering, to be administered within the Department of Aerospace Engineering and Engineering Mechanics. Engineering applications are becoming increasingly complex and interdisciplinary, and solutions often rely on the efficient use of computer software and hardware. There is a need for a degree program which combines fundamental engineering principles with more advanced knowledge of mathematics, computational methods and programming techniques, beyond what is currently offered in most engineering disciplines. The computational engineering program is designed in response to this need.

3. THIS PROPOSAL INVOLVES (Please check all that apply)

☒ Courses in other colleges	☐ Courses in proposer's college that are frequently taken by students in other colleges	☒ Flags
☒ Courses in the core curriculum	☐ Change in course sequencing for an existing program	☒ Courses that have to be added to the inventory
☐ Change in admission requirements (external or internal)	☐ Requirements not explicit in the catalog language (e.g., lists of acceptable courses maintained by department office)	

4. SCOPE OF PROPOSED CHANGE

a. Does this proposal impact other colleges/schools? Yes ☒ No ☐
If yes, then how? There will be a slight impact on the College of Natural Sciences with the demand for seats in Statistics and Data Sciences classes (SDS 322 and 329C) and Mathematics (M 362K), however this number may be in line with the numbers of students already pursuing the CSE Certificate.

b. Do you anticipate a net change in the number of students in your college? Yes ☐ No ☒
If yes, how many more (or fewer) students do you expect?

c. Do you anticipate a net increase (or decrease) in the number of students from outside of your college taking classes in your college? Yes ☐ No ☒
If yes, please indicate the number of students and/or class seats involved.

d. Do you anticipate a net increase (or decrease) in the number of students from your college taking courses in other colleges? Yes ☒ No ☐
If yes, please indicate the number of students and/or class seats involved.
How many students do you expect to be impacted?

If 4 a, b, c, or d was answered with yes, please answer the following questions. If the proposal has potential budgetary impacts for another college/school, such as requiring new sections or a non-negligible increase in the number of seats offered, at least one contact must be at the college-level.

In answer to both 4a and 4d:

How many students do you expect to be impacted? We expect thirty students per academic year to be added to SDS and Mathematics classes, specifically SDS 322, SDS 329C and M 362K.

Impacted schools must be contacted and their response(s) included:

For SDS:

Person communicated with: Dr. Dan Stanzione and Dr. Mike Daniels

Date of communication: February 9, February 10, 2015; responses received Feb. 10, July 16, July 10

Response: “I'm happy to go ahead and commit Intro to Scientific Computing; we provide pretty much all the resources for that course anyway." “SDS 329 and 322 should be fine to include for now.” “It is OK to list these as electives.” (see attached)

For Math:

Person communicated with: Dr. Alan W, Reid, chair, Department of Mathematics

Date of communication: February 9 and 11, 2015, response received February 20, 2015

Response: “You have Math’s approval on this with two caveats. The new version of 427K that was worked out with Engineering is 427J so you should replace 427K by 427J. Also it should be M340L and not M341 since the students are not math majors." (see attached)

Other CNS courses should not be affected since there is no net growth in the number of engineering students taking these courses.

Approved electives are pre-approved electives that are SDS classes. They are already pre-approved for ASE majors. Page 9 of the attached emails PDF shows that approval was received to list those courses for the Computational Engineering degree program.

e. Does this proposal involve changes to the core curriculum or other basic education requirements (42-hour core, signature courses, flags)? If yes, explain:

No, there are no changes to the core curriculum or other basic education requirements.

f. Will this proposal change the number of hours required for degree completion? If yes, explain:

The total number of hours required for the Bachelor of Science in Computational Engineering will be 122. This is different from the 126 hours required for the current major in our department, the Bachelor of Science in Aerospace Engineering.

5. COLLEGE/SCHOOL APPROVAL PROCESS

Department approval date: August 26, 2014
College approval date: March 27, 2015
Dean approval date: April 29, 2015

BACHELOR OF SCIENCE IN COMPUTATIONAL ENGINEERING

Computational engineering is a relatively new field in engineering that recognizes the increasing demand for advanced computational methods in engineering practice. Computational engineering in this context refers to the study and development of computer algorithms that translate mathematical and physical descriptions of engineering problems into languages that computers can process. This emphasis distinguishes computational engineering from computer science and computer engineering. Computational engineers must have basic knowledge of fundamental engineering and science, with more advanced knowledge of mathematics, algorithms and computer languages. Because of their extensive education in these disciplines, computational engineers can work in a variety of areas.

The objectives of the computational engineering degree program are to prepare students for professional practice in engineering; to prepare students for such post-baccalaureate study as their aptitudes and professional goals may dictate; to instill in students a commitment to lifelong education and to ethical behavior throughout their professional careers; and to make students aware of the global and societal effects of technology. To meet these objectives, the faculty has designed a rigorous curriculum that emphasizes fundamentals in the basic sciences and the humanities, integrates classroom and laboratory experiences in engineering, with advanced instruction in mathematics, statistics and computational science. The curriculum requires students to use modern engineering tools and computer technology, to work individually, and to practice teamwork.

The first two years of the computational engineering curriculum emphasize fundamental material along with engineering sciences, while the third and fourth years provides further depth in mathematics, algorithms, computer languages, and experimentation. The major offers technical electives in the third and fourth years where students may choose an industrial track or a post-baccalaureate track. The industrial track focuses on the applications of computer methods in industry, while the post-baccalaureate track prepares students for graduate study and research.

Program Outcomes

Computational engineering graduates should demonstrate:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multidisciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand what impact engineering solutions have in global, economic, environmental, and societal contexts
- A recognition of the need for and an ability to engage in lifelong learning
- A knowledge of contemporary issues
- An ability to use techniques, skills, and modern engineering tools necessary for engineering practice

Program Educational Objectives

Within a few years of graduation, computational engineering graduates should:

- Contribute to the economic development of Texas and beyond through the ethical practice of computational engineering in industry and public service
- Exhibit leadership in technical or business activity through engineering ability, communication skills, and knowledge of contemporary and global issues
- Continue to educate themselves through professional study and personal research
- Be prepared for admission to, and to excel in, the best graduate programs in the world
- Design systems to collect, encode, store, transmit, and process energy and information, and to evaluate system performance, either individually or in teams

- Use their engineering ability and creative potential to create technology that will improve the quality of life in society

Portable Computing Devices
Students entering computational engineering are required to have access to a portable computing device capable of running the software tools required for undergraduate engineering analyses (MatLab, Word, Excel, etc). This device does not need to be brought to campus on a daily basis, but individual courses may require that the device be brought to certain lectures, labs, and/or exams. Once admitted, students will be informed by the Aerospace Engineering and Engineering Mechanics Department office about specific device requirements.

Curriculum
Course requirements are divided into three categories: basic sequence courses, major sequence courses, and other required courses. In addition, each student much complete the University's Core Curriculum. In some cases, a course that fulfills one of the following requirements may also be counted toward core curriculum or flag requirements; these courses are identified below. To ensure that courses used to fulfill the social and behavioral sciences and visual and performing arts requirements of the core curriculum also meet ABET criteria, students should follow the guidance given in ABET Criteria.

In the process of fulfilling engineering degree requirements, students must also complete coursework to satisfy the following flag requirements: one independent inquiry flag, one quantitative reasoning flag, one ethics and leadership flag, one global cultures flag, one cultural diversity in the United States flag, and two writing flags. The independent inquiry flag, the quantitative reasoning flag, the ethics and leadership flag, and both writing flags are carried by courses specifically required for the degree; these courses are identified below. Courses that may be used to fulfill flag requirements are identified in the *Course Schedule*.

Courses used to fulfill technical elective requirements must be approved by the computational engineering faculty before the student enrolls in them.

The student must take all courses required for the degree on the letter-grade basis and must earn a grade of at least *C-* in each course, except for those listed as Remaining Core Curriculum Courses. He or she must also maintain grade point averages of at least 2.00 in the major area of study and in required technical courses as described in Academic Standards, and a cumulative University grade point average of at least 2.00 as described in *General Information*.

Requirements		Hours
Computational Engineering		
COE 301	Introduction to Computer Programming	3
COE 211K	Engineering Computation	2
COE 111L	Engineering Computation Laboratory	1
COE 371	Applied Mathematics I	3
COE 372	Applied Mathematics II	3
COE 352	Advanced Scientific Computation	3
COE 373	Senior Design I	3
COE 374	Senior Design II	3
Aerospace Engineering		
ASE 333T	Engineering Communication (writing flag and ethics and leadership flag)	3

ASE 320	Low-Speed Aerodynamics	3
ASE 321K	Computational Methods for Structural Analysis	3
ASE 330M	Linear System Analysis	3
ASE 347	Introduction to Computational Fluid Dynamics	3
ASE 375	Electromechanical Systems	3
Chemistry		
CH 301	Principles of Chemistry I (part II science and technology)	3
Engineering Mechanics		
E M 306	Statics	3
E M 311M	Dynamics	3
E M 319	Mechanics of Solids	3
Mathematics		
M 408C	Differential and Integral Calculus (mathematics; quantitative reasoning flag)	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427J or K	Differential Equations with Linear Algebra	4
M 427L	Advanced Calculus for Applications II	4
M 362K	Probability I	3
Physics		
PHY 303K	Engineering Physics I (part I science and technology; quantitative reasoning flag)	3
PHY 303L	Engineering Physics II (part I science and technology; quantitative reasoning flag)	3
PHY 103M	Laboratory for Physics 303K	1
PHY 103N	Laboratory for Physics 303L	1
Other required courses		
M E 210	Engineering Design Graphics	2
M E 320	Applied Thermodynamics	3
SDS 322	Introduction to Scientific Programming	3
SDS 329C	Practical Linear Algebra	3
Approved technical electives		6
Remaining Core Curriculum Courses		
E 316L	British Literature (humanities)	3
or E 316M	American Literature	
or E 316N	World Literature	
or E 316P	Masterworks of Literature	
RHE 306	Rhetoric and Writing (English composition)	3
American and Texas government		6

American history		6
Social and behavioral sciences		3
Visual and performing arts		3
UGS 302	First-Year Signature Course (some sections carry writing flag)	3
or UGS 303	First-Year Signature Course	
Total Hours		122

Suggested Arrangement of Courses

First Year

First Term	Hours	Second Term	Hours
UGS 302 or 303	3	COE 301	3
CH 301	3	M 408D	4
M 408C	4	PHY 303K	3
RHE 306	3	PHY 103M	1
Social and behavioral science	3	American and Texas Government	3
		American History	3
	16		17

Second Year

First Term	Hours	Second Term	Hours
E M 306	3	COE 211K	2
M E 320	3	COE 111L	1
M 427J or 427K	4	M 427L	4
PHY 303L	3	E M 311M	3
PHY 103N	1	E M 319	3
M E 210	2	ASE 333T	3
	16		16

Third Year

First Term	Hours	Second Term	Hours
ASE 320	3	ASE 347	3
M 362K	3	ASE 321K	3
ASE 330M	3	SDS 322	3
SDS 329C	3	American Government	3
E 316L/M/N/P	3	Visual and performing arts	3
	15		15

Fourth Year

First Term	Hours	Second Term	Hours
COE 373	3	COE 374	3
COE 371	3	COE 372	3
COE 352	3	Technical Elective	3
ASE 375	3	American History	3
Technical Elective	3		
	15		12

Total credit hours: 122