EXECUTIVE VICE PRESIDENT AND PROVOST
THE UNIVERSITY OF TEXAS AT AUSTIN

110 Inner Campus Drive, Suite 201 • G1000 • Austin, Texas 78712-1701 • (512) 471-4363 • FAX (512) 475-7385

November 24, 2015

Dr. Steven Leslie
Executive Vice Chancellor for Academic Affairs
The University of Texas System
OHH 304 (P4300)

Dear Dr. Leslie:

Enclosed for your approval is the proposal to add a Computational Engineering Degree Program in the Cockrell School of Engineering chapter of the *Undergraduate Catalog 2016-2018* (D 13373-13380). The proposal was approved unanimously by the Faculty Council on November 16, 2015. The proposal has been reviewed by public institutions within 50 miles of The University of Texas at Austin, with no objections. The authority to grant final approval on this change resides with Texas Higher Education Coordinating Board.

Sincerely,

Judith H. Langlois
Executive Vice President and Provost, *ad interim*

JHL: lac

Enclosure

cc: Gregory L. Fenves, President of the University

ec: Hillary Hart, Secretary, Office of the General Faculty
Carol Longoria, Assistant Deputy to the President
Sharon L. Wood, Dean, Cockrell School of Engineering
Gerald Spietel, Associate Dean, Cockrell School of Engineering
Brenda Schumann, Associate Registrar
Linda Dickens, Sr. Director, Institutional Accreditation and Effectiveness
Cynthia Cruz, Administrative Manager, Provost's Office
IRRIS Team
Suzanne Revisore, Assistant to the EVCAA, UT System
Debbie Roberts, Executive Assistant, Office of the General Faculty
Victoria Cervantes, Sr. Administrative Associate, Office of the General Faculty

New Program Request Form for Bachelor's and Master's Degrees

Directions: An institution shall use this form to propose a new bachelor's or master's degree program that is in the field of engineering or has costs exceeding $2 million for the first five years of operation. In completing the form, the institution should refer to the document *Standards for Bachelor's and Master's Programs,* which prescribes specific requirements for new degree programs. Note: This form requires signatures of (1) the Chief Executive Officer or Chief Academic Officer, certifying adequacy of funding for the new program and the notification of other institutions; (2) a member of the Board of Regents (or designee), certifying Board approval. NOTE: Preliminary notification is required for all engineering programs. Prior to submission of an engineering program proposal, the institution should notify the Division of Workforce, Academic Affairs and Research of its intent to request such a program.

For more information: Contact the Division of Workforce, Academic Affairs and Research at 512/427-6200.

Administrative Information

1. Institution:
The University of Texas at Austin

2. Program Name – Show how the program would appear on the Coordinating Board's program inventory (*e.g., Bachelor of Business Administration degree with a major in Accounting*):
Bachelor of Science in Computational Engineering

3. Proposed CIP Code: 30.3001

4. Number of Required Semester Credit Hours (SCHs) (*If the number of SCHs exceeds 120 for a Bachelor's program, the institution must request a waiver documenting the compelling academic reason for requiring more SCHs*): **122**

5. Brief Program Description – Describe the program and the educational objectives:
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.

6. Administrative Unit – Identify where the program would fit within the organizational structure of the university (*e.g., The Department of Electrical Engineering within the College of Engineering*):
The Department of Aerospace Engineering and Engineering Mechanics within the Cockrell School of Engineering

7. Proposed Implementation Date – Report the date that students would enter the program (MM/DD/YY): **08/24/16**

8. Contact Person – Provide contact information for the person who can answer specific questions about the program:

Name: **Dr. Clint N. Dawson**
Title: **Professor**

E-mail: **clint@ices.utexas.edu**
Phone: **(512) 475-8627**

Program Information

I. Need

A. Job Market Need – Provide short- and long-term evidence of the need for graduates in the job market.

Companies that indicated an interest in hiring Computational Engineering graduates include: Emergent, NASA, Northrup/Grumman, Southwest Research, JPL, Chevron, Bell Helicopter, Shell, Micron Research, and Lockheed Martin among others. Additional documentation of conversations with representatives from these companies may be provided if necessary.

B. Student Demand – Provide short- and long-term evidence of demand for the program.

Over the past five years, we have collected input from graduating seniors in senior exit interviews. Every year, the students indicate a greater need for more computational engineering as they are frequently asked for these skills in job interviews. We receive this same information from our External Advisory Committee which consists of industry and government professionals, all of whom hold responsible engineering positions in industry or government laboratories. In addition, many of our students have chosen to pursue joint degrees in engineering and mathematics, or to obtain undergraduate certificates in scientific computing, currently offered through the math department or through the Institute for Computational Engineering and Sciences.

C. Enrollment Projections – Use this table to show the estimated cumulative headcount and full-time student equivalent (FTSE) enrollment for the first five years of the program. (*Include majors only and consider attrition and graduation.*)

YEAR	1	2	3	4	5
Headcount	10	30	50	75	100
FTSE	10	30	50	75	100

II. Quality

A. Degree Requirements – Use this table to show the degree requirements of the program. *(Modify the table as needed; if necessary, replicate the table for more than one option.)*

Category	Semester Credit Hours	Clock Hours
General Education Core Curriculum *(bachelor's degree only)*	43	
Required Courses	73	

Prescribed Electives	6	
Free Electives	0	
Other *(Specify, e.g., internships, clinical work)*	(if not included above)	0
TOTAL	122	

B. Curriculum – Use these tables to identify the required courses and prescribed electives of the program. Note with an asterisk (*) courses that would be added if the program is approved. *(Add and delete rows as needed. If applicable, replicate the tables for different tracks/options.)*

Prefix and Number	Required Courses	SCH
M 408D	Sequences, Series and Multivariable Calculus	4
COE 301	Introduction to Computer Programming	3
M E 320	Applied Thermodynamics	3
M 427J	Differential Equations with Linear Algebra	4
E M 306	Statics	3
M E 210	Engineering Design Graphics	2
M 427L	Advanced Calculus for Applications II	4
COE 211K	Engineering Computation	2
*COE 111L	Engineering Computation Lab*	1
E M 311M	Dynamics	3
E M 319	Mechanics of Solids	3
ASE 320	Low-Speed Aerodynamics	3
ASE 330M	Linear System Analysis	3
SDS 329C	Practical Linear Algebra I	3
M 362K	Probability I	3
ASE 347	Introduction to Computational Fluid Dynamics	3
ASE 321K	Computational Methods for Structural Analysis	3
SDS 322	Introduction to Scientific Programming	3
*COE 371	Applied Mathematics I*	3
*COE 352	Advanced Scientific Computation*	3
*COE 373	Senior Design I*	3
ASE 375	Electromechanical Systems	3
*COE 372	Applied Mathematics II*	3
*COE 374	Senior Design II*	3
PHY 103M	Laboratory for Physics 303K	1
PHY 103N	Laboratory for Physics 303L	1

Prefix and Number	Prescribed Elective Courses	SCH
SDS 335	Scientific and Technical Computing	3
SDS 339	Applied Computational Science	3
M 378K/SDS 378	Introduction to Math Statistics	3
SDS 374C	Parallel Computing for Science & Engineering	3
SDS 374D	Grid and Distributed Computing	3
SDS 374D	Visualization and Data Analysis	3
E M 360	Finite Element Methods	3

C. Faculty – Use these tables to provide information about Core and Support faculty. Add an asterisk (*) before the name of the individual who will have direct administrative responsibilities for the program. *(Add and delete rows as needed.)*

Name of *Core* Faculty and Faculty Rank	**Highest Degree and Awarding Institution**	**Courses Assigned in Program**	**% Time Assigned To Program**
Bui-Thanh, Tan Asst. Professor	PhD. in Computational Fluid Dynamics Massachusetts Institute of Technology	COE 211K	50
*Dawson, Clint Professor	PhD. in Mathematical Sciences Rice University	COE 371, 372, 373, 374	50
Demkowicz, Leszek Professor	PhD. in Engineering Mechanics Cracow Univ. of Technology	COE 371, 372, 373, 374	50
Hughes, Thomas Professor	PhD. in Engineering Science University of California-Berkeley		33
Oden, J. Tinsley Professor	PhD. in Engineering Mechanics Oklahoma State University		33
Rodin, Gregory Professor	PhD. in Mechanical Engineering Massachusetts Institute of Technology	E M 306	33
Wheeler, Mary Professor	PhD. in Mathematics Rice University		33

Name of *Support* Faculty and Faculty Rank	**Highest Degree and Awarding Institution**	**Courses Assigned in Program**	**% Time Assigned To Program**
Acikmese, Behcet Asst. Professor	PhD. in Aeronautics and Astronautics Purdue University	ASE 330M	16
Landis, Chad Professor	PhD. in Mechanical and Environmental Engineering U of California-Santa Barbara	ASE 321K, E M 306, E M 319	25
Huang, Rui Professor	PhD. in Civil and Environmental Engineering Princeton University	E M 306, E M 319	25
Mear, Mark Professor	PhD. in Engineering Science Harvard University	ASE 321K, E M 319	25
Goldstein, David Professor	PhD. in Aeronautics California Institute of Technology	ASE 320	16
Akella, Maruthi Professor (effective 9/1/15)	PhD. in Aerospace Engineering Texas A&M University	ASE 330M	16
Russell, Ryan Assoc. Professor (effective 9/1/15)	PhD. in Aerospace Engineering The University of Texas at Austin	COE 353	16
New Faculty in Year 2015	Computational Fluids Area	ASE 347	16

D. Students – Describe general recruitment efforts and admission requirements. In accordance with the institution's Uniform Recruitment and Retention Strategy, describe plans to recruit, retain, and graduate students from underrepresented groups for the program.

In the first year, admission will likely be done internally with students entering their third year to go straight into the program. There will be a minimum GPA requirement (likely 3.0) among the first two years of coursework in order to be admitted to the major. We plan to thoroughly describe and outline the program on our website and begin admitting FTIC students in Fall 2017. In an effort to be in accordance with the institution's strategy, we will work on incorporating this program into current efforts made with the Equal Opportunity in Engineering office and Women in Engineering Program.

E. Library – Provide the library director's assessment of library resources necessary for the program. Describe plans to build the library holdings to support the program.

There will be no new relevant material; existing material is sufficient.

F. Facilities and Equipment – Describe the availability and adequacy of facilities and equipment to support the program. Describe plans for facility and equipment improvements/additions.

The program will fit in the current environments for the ASE/E M department.

G. Accreditation – If the discipline has a national accrediting body, describe plans to obtain accreditation or provide a rationale for not pursuing accreditation.

Per Wallace Fowler (ASE Professor and ABET evaluator), we will be working with ABET in a process that occurs for new programs. We will need to start the program and run it for up to four years or until a student graduates from the program and then the program can be retroactively accredited.

H. Evaluation – Describe the evaluation process that will be used to assess the quality and effectiveness of the new degree program.

We will use the established ABET evaluation process per ABET standards. We will also follow the procedures for SACS.

III. Costs and Funding[1]

Five-Year Costs and Funding Sources - Use this table to show five-year costs and sources of funding for the program.

No new funding is needed as the overall enrollment in ASE-EM will not increase. The program will be funded by reallocation of current ASE-EM instructional resources.

Five-Year Costs		Five-Year Funding	
Personnel[1]	$0	Reallocated Funds	$0
Facilities and Equipment	$0	Anticipated New Formula Funding[3]	$0
Library, Supplies, and Materials	$0	Special Item Funding	$0
Other[2]	$0	Other[4]	$0
Total Costs	**$0**	**Total Funding**	**$0**

1. Report costs for new faculty hires, graduate assistants, and technical support personnel. For new faculty, prorate individual salaries as a percentage of the time assigned to the program. If existing faculty will contribute to program, include costs necessary to maintain existing programs (e.g., cost of adjunct to cover courses previously taught by faculty who would teach in new program).
2. Specify other costs here (e.g., administrative costs, travel).
3. Indicate formula funding for students new to the institution because of the program; formula funding should be included only for years three through five of the program and should reflect enrollment projections for years three through five.
4. Report other sources of funding here. In-hand grants, "likely" future grants, and designated tuition and fees can be included.

[1] Please use the "Program Funding Estimation Tool" found on the CB website to correctly estimate state funding.

Signature Page

1. Adequacy of Funding and Notification of Other Institutions – The chief executive or chief academic officer shall sign the following statements:

   I certify that the institution has adequate funds to cover the costs of the new program. Furthermore, the new program will not reduce the effectiveness or quality of existing programs at the institution.

   I certify that my institution has notified all public institutions within 50 miles of the teaching site of our intention to offer the program at least 30 days prior to submitting this request. I also certify that if any objections were received, those objections were resolved prior to the submission of this request.

Chief Executive Officer/Chief Academic Officer _____ Date 12.3.2015

2. Board of Regents or Designee Approval – A member of the Board of Regents or designee shall sign the following statement:

   On behalf of the Board of Regents, I approve the program.

Board of Regents (Designee) _____ Date of Approval _____

OFFICE OF THE FACULTY COUNCIL

THE UNIVERSITY OF TEXAS AT AUSTIN

P. O. BOX 7816 • Austin, TX 78713-7816
(512) 471-5934 • Fax: (512) 471-5984 • http://www.utexas.edu/faculty/council

November 17, 2015

Judith H. Langlois
Interim Executive Vice President and Provost
The University of Texas at Austin
MAI 201
Campus Mail Code: G1000

Dear Dr. Langlois:

Enclosed for your consideration and action is a proposal to add an Computational Engineering Degree Program in the Cockrell School of Engineering chapter in the *Undergraduate Catalog, 2016-18* (D 13373-13380). On November 16, 2015, the Faculty Council unanimously approved the legislation. The proposal was classified as being of *general* application and of primary interest to more than one college or school. The authority to grant final approval resides with the Texas Higher Education Coordinating Board.

Please let me know if you have questions or if I can provide other information concerning these items of legislation.

Sincerely,

Hillary Hart, Secretary
General Faculty and Faculty Council

HH:dlr

Enclosure

xc: Gregory L. Fenves., president
Janet Dukerich, senior vice provost for faculty affairs

ec (letter only): Sharon L. Wood, dean, Cockrell School of Engineering
Gerald Speitel, associate dean for academic affairs, Cockrell School of Engineering
Carol Longoria, deputy to the president
Allen Walser, manager of reporting and analysis, IRRIS
Brenda Schumann, associate registrar
Lydia Cornell, Program Coordinator
Michelle George, administrative manager for faculty affairs, provost's office

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. On October 29, 2015, the Cockrell School of Engineering requested the presentation of the proposal be postponed until December 7, 2015.

13374

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

13380

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