

**New Program Proposal
 Bachelor of Science in Computer Engineering
 The Citadel**

Summary

The Citadel requests approval to offer the program leading to the Bachelor of Science in Computer Engineering to be implemented in August 2019. The proposed program is to be offered through traditional delivery. The following chart outlines the stages of approval for the proposal. The Advisory Committee on Academic Programs (ACAP) voted to recommend approval of the proposal. The full program proposal and support documents are attached.

Stages of Consideration	Date	Comments
Program Proposal Received	2/1/19	Not Applicable.
Staff comments to the institution	2/25/19	Staff requested revision of the proposal.
Program Proposal Resubmitted	3/1/19	Not Applicable.
ACAP Consideration	3/28/19	<p>Representatives from The Citadel introduced the proposed Bachelor of Science in Computer Engineering, citing the expressed needs of South Carolina computer industries, especially for Charleston-based companies. The proposed program will generally prepare individuals to apply mathematical and scientific principles to the design, development and operational evaluation of computer hardware and software systems, and related equipment and facilities, and the analysis of specific programs of computer application to various tasks. Additionally, the program will prepare students with advanced mathematics skills to meet the requirements for design and manufacture of computer networks, computer hardware, microprocessor circuits, signals, and machines for the future.</p> <p>Members of the Advisory Committee on Academic Programs (ACAP) discussed the proposed program’s potential to prepare new workers for the growing job market in the field in the Charleston area, especially as the Lowcountry has become a computer-based hub (aka “Silicon Harbor”). A member inquired about the differences in enrollment headcounts in a closely related program. The Citadel representative noted the difference resulted from the change from a semester model to a seven-week model.</p> <p>After remaining inquiry and discussion about workforce needs, ACAP voted to approve the program proposal. Staff transmitted remaining questions for additional clarity.</p>

Staff comments to the institution	4/4/19	Staff transmitted remaining questions for additional clarity. Staff requested the proposal be revised to address the following information: <ul style="list-style-type: none"> • Clarify how the tuition funding is calculated; • Clarify when a new faculty member will be added; • Provide employment projection data from a local source such as SCWorks.org in addition to the BLS projections; • A letter of support from the partner technical institution, Trident Technical College.
Revised Program Proposal Received	4/8/19	The revised proposal satisfactorily addressed the requested revisions.

Recommendation

The staff recommends the Committee on Academic Affairs and Licensing approve the program leading to the Bachelor of Science in Computer Engineering to be implemented in August 2019.

The Citadel Undergraduate Student and Program Data

Undergraduate In-State/Out-of-State Enrollment, Fall 2018	1862 (63.96%) / 1049 (36.04%)
Number of Approved Programs in 10 Yrs. (FY 2009- 2018)	18
Number of Terminated Programs in 10 Yrs. (FY 2009- 2018)	2

Industry related Occupational Wages and Projections in South Carolina, 2016 – 2026*

Occupational Field¹	2016 Median Income²	2016 Estimated Employment³	2026 Projected Employment	Total 2016-2026 Employment Change	2016-2026 Annual Avg. Percent Change	Total Percent Change
Computer and Mathematical	\$66,270	39,597	45,397	5,800	1.38%	14.65%

¹ “Occupational Field” represents the closest related occupation category that includes the occupations aligned with the program proposal.

² SC Department of Employment & Workforce (DEW), Labor Market Information. (2018). Occupational Employment and Wage Rates (OES) for All Major Groups in South Carolina in 2016 [Data file]. Retrieved from <https://jobs.scworks.org/vosnet/lmi/default.aspx?pu=1>

³ SC Department of Employment & Workforce (DEW), Labor Market Information. (2018). Occupational Projections (Long-term) for Multiple Occupations in South Carolina in 2016-2026 [Data file]. Retrieved from <https://jobs.scworks.org/vosnet/lmi/default.aspx?pu=1>

* Data downloaded October 8, 2018; Most recent data available.

NEW PROGRAM PROPOSAL FORM

Name of Institution: The Citadel

Name of Program (include degree designation and all concentrations, options, or tracks):
Bachelor of Science in Computer Engineering (BSCmpE)

Program Designation:

- | | |
|---|--|
| <input type="checkbox"/> Associate's Degree | <input type="checkbox"/> Master's Degree |
| <input checked="" type="checkbox"/> Bachelor's Degree: 4 Year | <input type="checkbox"/> Specialist |
| <input type="checkbox"/> Bachelor's Degree: 5 Year | <input type="checkbox"/> Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA) |
| <input type="checkbox"/> Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.) | |

Consider the program for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

Proposed Date of Implementation: August 2019

CIP Code: 14.0901

Delivery Site(s): Courses delivered on campus

Delivery Mode:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Traditional/face-to-face
*select if less than 25% online | <input type="checkbox"/> Distance Education |
| | <input type="checkbox"/> 100% online |
| | <input type="checkbox"/> Blended/hybrid (50% or more online) |
| | <input type="checkbox"/> Blended/hybrid (25-49% online) |
| | <input type="checkbox"/> Other distance education (explain if selected) |

Program Contact Information (name, title, telephone number, and email address):

Dr. Ronald Welch
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Institutional Approvals and Dates of Approval (include department through Provost/Chief Academic Officer, President, and Board of Trustees approval):

Undergraduate Curriculum Committee: 8 January 2019
Faculty Senate: 11 January 2019
President: 25 January 2019
Board of Visitors: 25 January 2019

Background Information

State the nature and purpose of the proposed program, including target audience, centrality to institutional mission, and relation to the strategic plan.

The BSCmpE is intended to meet the expressed needs of South Carolina computer industries, especially Charleston based companies. Computer Engineering programs generally prepare individuals to apply mathematical and scientific principles to the design, development and operational evaluation of computer hardware and software systems and related equipment and facilities; and the analysis of specific problems of computer applications to various tasks. Nationally, Computer Engineering positions are broken out within a number of categories by the Department of Labor that details projected growth of nearly 5 percent overall between 2016 and 2026 for the following detailed occupations titles: Computer Systems Analysts (4.3%), Software Developers: Applications (9.0%) and Systems Software (4.7%), Database Administrators (4.9%), Network and Computer Systems Administrators (3.2%), Computer Network Architects (2.6%), Computer Hardware Engineers (2.6%) and Electrical Engineers (7.1%). With the rapid growth in computer systems controlling manufacturing, self-driving vehicles, etc., the continued growth for computer skills from engineering to programming will be consistent for many years to come. However, a national trend is the movement of computer programs to decrease the mathematics requirements to focus more on the programming and information systems. Computer Engineering programs will benefit those students having and desiring the necessary mathematical skills to gain more difficult talents to meet the necessary design and manufacture of computer networks, computer hardware, microprocessor circuits, signals and machines for the future. A computer engineering program in the Lowcountry will provide talent to the growing Silicon Harbor, while providing an opportunity for computer technicians to add computer engineering credentials to support upward movement.

The computer (engineering) related job market in the Charleston area has exploded in recent years, especially as the Lowcountry has become a computer hub with the establishment of the so called Silicon Harbor. The Charleston Digital Corridor established in 2001 supports computer industry growth through talent search vice centralized job posting, skill development through code camps to meet needs not met by state universities and colleges, and augmenting business, networking, and education at their Flagship facilities that support incubation of new companies. The BSCmpE supports The Citadel's LEAD 2024 Objective 2 (academic programs of distinction), Objective 3 (expand enrollment in The Citadel Graduate College), and Objective 6 (provide outreach to the region and serve as a resource in its economic development). The program is being developed based on current student numbers taking computer engineering courses as electives within the Electrical Engineering Program, the current growth of the Computer Science programs at The Citadel, the College of Charleston, and Charleston Southern University, the movement of computer programs to decrease the required mathematics and to focus more on programming and information services, and local companies searching for talent with computer engineering skill sets. The desire to hire local talent and educate an existing workforce drives the need for a local undergraduate Computer Engineering program to complement the other existing undergraduate engineering programs in civil, construction, electrical, and mechanical engineering. Our ability to offer undergraduate courses within The Citadel BSCmpE is complementary to other undergraduate courses/programs being offered in the Lowcountry in providing a fuller undergraduate engineering education. Engineering problem solving coupled with computer science is in increased demand and computer engineers are a necessary and diverse core engineering skill set that are primarily focused on designing, building and maintaining the computer systems within all engineering, manufacturing, and service industries.

Centrality of the Program

Given The Citadel's history, reputation, and affiliation with the military, federal, corporations, and state agencies, it is strategically placed to take a prominent leadership role in this growing field. In addition to the outstanding academic preparation students receive, Citadel graduates are especially attractive in the computer engineering field for the following reasons:

- The Citadel's focus on Principled Leadership is highly valued in the engineering field;
- Citadel students learn and are expected to retain high ethical standards, as are licensed engineers; and,
- The Citadel's rigid standards of conduct help ensure that graduates can pass the rigorous background checks required for computer engineering positions.

Program Objectives:

- Succeed in the practice of computer engineering, by ethically and judiciously applying knowledge of science, mathematics and engineering methods to solve problems facing a technologically complex society.
- Apply and operate current hardware and software tools, equipment, and development environments to conduct and/or lead engineering analysis, design and research.
- Value and pursue lifelong learning, not only to keep current in computer engineering fields, but also to sustain an awareness of engineering-related issues facing contemporary society.
- Pursue graduate education and/or professional registration as desired or required.
- Be principled leaders with strong communications and team-building skills.

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Graduates of the Bachelor of Science degree program in Computer Engineering will, by the time of graduation demonstrate:

- apply knowledge of mathematics, science, and engineering
- design and conduct experiments, as well as to analyze and interpret data
- 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
- function on multidisciplinary teams
- identify, formulate, and solve engineering problems
- comprehend professional and ethical responsibility
- communicate effectively
- comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education
- recognize the need for and engage in life-long learning
- apply knowledge of contemporary issues within solutions
- use the techniques, skills, and modern engineering tools necessary for engineering practice.

Assessment of Need

Provide an assessment of the need for the program for the institution, the state, the region, and beyond, if applicable.

The number of students taking engineering courses at The Citadel has increased dramatically from 2012-2018. For example, the number of undergraduate engineering students within the Corps of Cadets has grown from 356 in 2012 to 524 students in 2018 (see table below). All of this growth is based on analyzing the need and then meeting the engineering needs of the Lowcountry and the State of SC through new programs such as Mechanical Engineering in 2014 and Construction Engineering in 2018. Currently, The Citadel has over 650 undergraduate engineering students in its day and evening programs. However, there is always 15-20 students each year arriving at The Citadel looking for a greater Computer Engineering focused program than the current BS in Electrical Engineering and BS in Computer Science programs can offer. The continuous growth of computer focused companies within the Silicon Harbor of Charleston is supported by the Charleston Digital Corridor with its networking events and incubator space. There is no other computer engineering programs in the Lowcountry, and with The Citadel being the sole undergraduate engineering college in the Lowcountry, we must step up to provide the degrees needed like Computer Engineering. In the state, both Clemson University and the University of South Carolina have Computer Engineering programs, but as stated before, there is still a shortage of talent and The Citadel experiences applicants that are looking for Computer Engineering. Local companies are looking for the talent that spans the science and engineering fields in the computer industry: Computer Engineering. There are over 150 computer companies within Charleston, and many have loyal employees who want to move into upper management or have the credentials necessary to take on the ever-changing roles within the industry. Some of these positions require engineering computer skills, but without the ability to gain the necessary skills through education while working and living within the Lowcountry, they are prevented.

Growth in Number of Engineering Students at The Citadel

Student Type	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018*
Active Duty Students	19	14	10	13	9	8	9
Evening Undergraduate Students	65	66	64	127	95	99	76
Fifth Year Students	12	16	22	21	26	17	21
SC Corps of Cadets	356	370	423	412	497	535	524
Veteran Students	20	42	43	37	33	30	30
Total	472	536	562	610	660	689	660

The Charleston Digital Corridor, which has 89 members and growing, supports talent search through CharlestonWorks where regional companies can be reviewed and can post open positions, development through code camps to meet needs not met by state universities, and augmenting business, networking, and education at their Flagship facilities that support incubation of new companies. With this effort, Charleston is ranked 8th best for Tech cities with a few of the companies listed: Benefitfocus, Blackbaud, BoomTown, FusionPoint, Google, Life Cycle Engineering, PHISHLabs, TalkTools, TBG Security, Vizbii, WaveSciences, Zeriscope.

The Department of Labor statistics show a 13.7 percent growth in computer and mathematical occupations over the next ten years, while engineering will have a 9.6 percent growth over the same time period. Specifically there will be 10 percent growth in computer and information analysts needs and a 5.5 percent in growth for Computer hardware engineers nationally with details for South Carolina at over 6 percent on average in the key areas of Computer Systems Analysts (4.3%), Software developers: applications (9.0%), systems software (4.7%), and Computer Network Architects (5.3%) with most of the effort in the Charleston area.

Transfer and Articulation

Identify any special articulation agreements for the proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.

Once the program is approved, the articulation agreement with Trident Technical College for Civil, Construction, Electrical, and Mechanical engineering will be updated to include Computer Engineering (We have already discussed the need for updating the MOU to add Computer Engineering – Letter of Support from Trident Technical College submitted with Proposal).

Employment Opportunities

Occupation	State		National		Data Type and Source
	Expected Number of Jobs	Employment Projection	Expected Number of Jobs	Employment Projection	
Computer Industry	3163	1731			South Carolina Job Skills Gap Update 2018 by Business Intelligence Department (BID) of the South Carolina Department of Employment and Workforce (SCDEW).
Computer Systems Engineers/Architects	3473				SC Works Online Services
Computer and mathematical overall		10%		11.7%	Department of Labor
Engineering Fields		10%		9.6%	Department of Labor
Electrical Engineering		7.1%	13,900	8.6%	Department of Labor
Computer Hardware		6%	5,100	5.5%	Department of Labor
Computer Systems Analysts		4.3%			Department of Labor
Database Admin		4.9%			Department of Labor
Network and Computer Systems Admin		3.2%			Department of Labor
Computer Occupations overall		3.6%	44,900	9.3%	Department of labor
Software Developers, applications		9.0%			Department of Labor
Systems Software		4.7%			Department of Labor
Computer Network Architects		5.3%	11,700	6.5%	Department of Labor

Supporting Evidence of Anticipated Employment Opportunities

Provide supporting evidence of anticipated employment opportunities for graduates.

With limited specific data beyond the South Carolina Job Skills Gap Update 2018 by Business Intelligence Department (BID) of the South Carolina Department of Employment and Workforce (SCDEW), we have provided additional discussion here on the available data in the report. Page 17 of this report states: Considering wages per hour in SC, management (\$48.44), engineering (\$37.35), legal (\$35.48), **computer (\$34.94)**, and finance (\$30.18) are the top hourly wage earners in the state with an overall average of \$20.31.

Projected growth from 2016-2026 shows a 11.9% overall state growth with the technological, management, healthcare, and construction occupations having the highest levels of growth, while computer occupations growing by 14.1% over the same time period.

The state's ten fastest growing occupations were all health care except for statisticians, operation research analysts, and application software developers (all three part of the computer and mathematics occupations, which are projected to grow at 14.1%).

Of the 33 South Carolina projected job openings by job knowledge needed, computer and engineering were listed in the top thirteen which also include English speaking, mechanical engineering, construction, medical and mathematics, which also highlight the available mathematical, computer and engineering skills within the computer engineering degree.

Overall projections of graduates versus openings show an 11,100 shortage within information technology as well as other areas (transportation, logistics, construction, computer system administration, etc.) where a computer engineering degree would be desired to meet the list of personnel shortages.

The fact that there is documented growth of current computer companies within the Silicon Harbor is undeniable. The very impressive list of companies with membership in/support for the Charleston Digital Corridor (CDC) to assist in talent search, talent development, and incubation of new companies, supports future vibrant growth and a very rosy outlook for the area and the growing need for computer degrees to include Computer Engineering. Listed below are the companies and open positions who are part of the Charleston Digital Corridor. Listed below are the companies and open positions that are part of the Charleston Defense Contractors Association supporting SPAWAR Atlantic.

Many of the students that will be taking the courses within the BSCmpE degree will be desiring to be computer engineers, and also to attend a military focused school (day program). However many live in the Lowcountry and cannot afford to relocate elsewhere to gain their education, as well as there are many current Lowcountry computer company employees who desire to work toward improving their current skill set and add additional responsibilities and financial resources (evening Undergraduate program). Our industry contacts as well as our robust electrical engineering industry advisory board have been asking for a number of years for a computer engineering level bachelor's degree in the Lowcountry to support not only improved technical competence and company advancement, but also promotion opportunities for the current workforce. As noted in many locations to include Forbes Magazine, the bachelor's degree helps distinguish a candidate for promotion and advancement within the company and computer industry. The argument within the State House for many years is the need for a comprehensive university in the Lowcountry to be able to offer those already here the ability to obtain MS/PhD level degrees, but also a fuller set of undergraduate degrees in fields not currently available, such as computer engineering. To support the long-term goal to offer more engineering

BS/MS/PhD's in the Lowcountry, The Citadel is positioned with its all PhD faculty team to offer a BSCmpE degree.

Currently the Dean of Engineering and the Chair of the Electrical and Computer Engineering Department are the faculty leads for this new program. There are two computer engineers within the electrical engineering department that have had significant computer engineering careers prior to returning to school for their PhD. There are no new courses associated with the Computer Engineering BS degree since the courses have been added slowly over the last 20 years. Current faculty education and experiences in both Electrical Engineering and Computer Science provide the expertise to teach the required courses. We anticipate the new program will grow in popularity due to its direct link to computer industry located in the Charleston Silicon Harbor. Just as the inclusion of any new program, the desires of the students as to which major they decide to pursue directs internal resources. We view the faculty team as a whole to meet teaching requirements throughout the School of Engineering. Additionally, we need to show for ABET we have faculty duplication in coverage of all topics to be taught within this degree. The teaching load for faculty at The Citadel is 8 courses per academic year or 24 credit hours. The computer engineering courses are already being taught and future growth that moves the needle from the current 10-14 students per section to 30-35 will be the tipping point for additional hires as faculty retire. Initially, electrical engineering faculty who have computer engineering experience and educational focus will do advising. With a finite number of cadets in the Corps, we expect some increase in advising overall for the day program to mirror the overall growth in engineering within the Corps during the last 5 years. Current electrical and computer lab space is not fully used during the day because of the specificity of certain labs. The primary growth in students is seen within the evening (2+2) program and we have the capacity in both classroom and lab space.

Charleston Digital Corridor (As of 21 Jan 2019)

Name	Size	Location	# of Positions
Anatta Design	Mid	Charleston, National, International	8
Atlatti Software	Small	Charleston	1
AVOXI	Mid	Charleston, International	3
Belimed	Mid	Charleston, International	4
Benefitfocus	Mid	Charleston	7
BlueKey, Inc.	Small	Charleston	2
BoomTown	Small	Charleston	5
Catalytic Data Science	Small	Charleston	2
Booz Allen Hamilton	Large	Charleston, National, International	40
Comcast	Large	Charleston, National	33
CSS International, Inc.	Small	Charleston	1
eGroup	Small	Charleston	1
Elevar	Small	Charleston	1
GOOGLE SC	Large	Charleston	2
Immedion	Small	Charleston	5
Interclipse, Inc.	Med	Charleston, East Coast	1
KOPIS, LLC	Med	Charleston	1
Life Cycle Engineers	Med	Charleston, National	3
Netrist Solutions	Small	Charleston	2
Omatic Software	Small	Charleston	1
PhishLabs	Med	Charleston	3

Seller Labs	Small	Charleston	2
SNAG	Mid	Charleston/Richmond/Arlington	9
STEM Premier	Small	Charleston	3
StraCon Services Group LLC	Med	Texas	1
Tabula Rasa Healthcare	Large	New Jersey	11
Thesys Technologies	Med	East Coast	1
Webair, Inc.	Small	East Coast	1
Workiva	Mid	National/International	4

Charleston Defense Contractors Association (As of 25 Jan 2019)

Name	Size	Location	# of Positions
Accelera Solutions	Small	Virginia	2
ActionNet	Mid	Virginia, National	6
AECOM	Large	National, International	10+
Akima	Large	International	20+
Alion	Mid	Intrenational	20+
ATI (Advanced Technology International)	Mid	Summerville, SC	3
AT&T	Large	National, International	40+
Amelex	Small	California	1
Atlas Technologies	Small	Charleston, VA, CA	4
Ausgar Technologies	Small	CA	3
BAE Systems	Large	National, International	50+
Booz Allen Hamilton	Large	National, International	50+
Broadcom	Mid	National	10+
CACI	large	VA	30+
CDW	Large	National	40+
Colsa Corporation	Mid	Alabama	35+
Centurum	Small	VA	5
Cyber Cloud Technologies	Small	MD	3
Deloitte	Large	National	6
DKW Communications	Mid	DC	10
F5	Mid	National, International	8
Force 3	Small	MD	3
Frontier Technology	Large	HQ VA, but national locations	19
General Dynamics	Large	National, International	50+
Geocent	Mid	National	5
Geodesicx	Small	Charleston	2
Geologics	Mid	VA, National	20+
Geowireless	Small	Charleston	4
Gigamon	Mid	GA, National, International	15
Harris	Mid	National, International	3
Huntington Ingalls Industries	Large	VA	4
IBM	Large	National	50+
Imagine-One	Mid	Charleston, VA	9
Indus Technology	Mid	International	8
IDSI	Small	VA, FL	3

IOmaxis	Mid	National	7
Juniper Networks	Mid	National, International	40+
KPMG	Large	National, International	30+
Leidos	Large	National, International	35+
Life Cycle Engineering	Mid	Charleston, National	3
MANDEX	Mid	Charleston, National	4
ManTech	Large	National, International	30+
McAfee	Large	National	5
Mercom Corp	Small	SC	2
Metrostar Systems	Small	VA	12
Micro Focus	Mid	National, International	100+
Microsoft	Large	National, International	300+
MIL Corporation	Mid	Charleston, National	30+
Modulant	Mid	Charleston, National	7
Moseley Technical Services	Small	AL	14
NSSPULS Network Security Systems Plus	Small	Charleston, GA, VA	2
NexGen data Systems	Small	Charleston	5
Northrop Grumman	Large	National	4
NTT Data	Large	National, International	20+
Oracle	Large	National, International	30+
Patrico Enterprises	Mid	International	5
Parsons	Large	National, International	16
PEMCCO	Small	Charleston, VA	2
PeopleTEC	Mid	AL, GA, CO, DC	15
Perspecta	Large	VA, National	50+
Predicate Logic	Small	VA	2
PSI Pax	Small	MD	2
PWC	Small	National	3
Quest	Small	National	12
Red Hat	Mid	National, International	23
Red River	Small	NH, National	2
Resource Management Concepts	Small	MD	4
Rite Solutions	Small	RI	7
Rollout Systems	Small	VA, CA	6
Rubrik	Small	CA, India	7
SAIC	Large	National, Charleston	20+
SRC	Large	Charleston, National	30+
Sentar	Small	AL	9
Serco	Mid	VA, National	14
SimVentions	Mid	VA	13
Spin Sys	Small	VA	1
Stratas Corp	Mid	Virginia	15+
Strategic Operational Solutions	Small	VA	6
Systems Technology Forum	Mid	VA, Charleston, National	4
Systek	Small	Mid	6
TripWire	Small	OR	2
Unanet	Small	VA	3

UNISYS	Large	National, International	40+
Vickers Nolan Enterorises	Small	VA	2
Veritas	Large	CA	15
Vista Defense Technologies	Small	National	2
VPSI	Small	CA, VA	2
WMware	Mid	National, International	7
WR Systems	Mid	Virginia	5
World Wide Technology	Mid	National, INternational	10

Description of the Program

Projected Enrollment			
Year	Fall Headcount	Spring Headcount	Summer Headcount
2019-20	12	12	5
2020-21	20	20	8
2021-22	25	25	12
2022-23	30	30	15
2023-24	35	35	18

Projected Enrollment –Evening Program Only			
Year	Fall Headcount	Spring Headcount	Summer Headcount
2019-20	6	6	2
2020-21	8	8	4
2021-22	10	10	6
2022-23	15	15	8
2023-24	18	18	10

Explain how the enrollment projections were calculated.

The projected enrollment includes both evening students (estimated at nine credit hours, one course of 3 credit hours in the summer) and Corps of Cadets (estimated at 18 credit hours). The enrollment chart is aggregate. Based on the number of students and lowcountry workers waiting for this type of program, 25 percent attrition in engineering during the freshman year and the addition of new students each year, the aggregated table represents our lower bound estimate for students during the first five years of the program.

Besides the general institutional admission requirements, are there any separate or additional admission requirements for the proposed program? If yes, explain.

Yes

No

Curriculum

New Courses

List and provide course descriptions for new courses.

There are no new Courses. The courses have been developed over the last 20 years as the Electrical Engineering (EE) Program began to develop Computer Engineering courses that lead to the Computer Engineering Minor. The courses not in EE are in the existing Computer Science (CS) Program.

Total Credit Hours Required: 131

Curriculum by Year					
Course Name	Credit Hours	Course Name	Credit Hours	Course Name	Credit Hours
Year 1					
Fall		Spring		Summer	
Core: Freshman Seminar	3	Core: Health and Fitness	3		
Core: Linked Freshman Composition and Literature	3	Major: Engineering Economics	2		
Core: Analytic Geometry and Calculus I	4	Major: Analytic Geometry and Calculus II	4		
Core: First Year Leadership Seminar	1	Core: Chemistry for Engineers	3		
Major: Fundamentals of Electrical Engineering	3	Core: Chemistry for Engineers Lab	1		
Major: Biology for Engineers	3	Major: Introduction to Computer Science I	4		
Major: Biology for Engineers Lab	1				
Total Semester Hours	18	Total Semester Hours	17	Total Semester Hours	
Year 2					
Fall		Spring		Summer	
Major: Electrical Circuit Analysis I	3	Core: English (Strand)	3		
Major: Digital Logic and Circuit	3	Major: Electric Circuit Analysis II	3		
Core: Professional Communication	3	Major: Electrical Laboratory	1		
Major: Introduction to Computer Science II	3	Major: Applied Mathematics I	4		
Core: Physics with Calculus I	3	Major: Physics with Calculus II	3		
Core: Physics with Calculus I Lab	1	Major: Physics with Calculus II Lab	1		
Core: Sophomore Leadership Seminar/Lab	1	Major: Digital Systems Engineering	3		
		Core: Required Physical Education	0		
Total Semester Hours	17	Total Semester Hours	18	Total Semester Hours	

Course Name	Credit Hours	Course Name	Credit Hours	Course Name	Credit Hours
Year 3					
Fall		Spring		Summer	
Core: Organizational Leadership	3	Core: History (Strand)	3		
Major: Electronics I	3	Major: Systems I	3		
Major: Introduction to Discrete Systems	3	Major: Data Structures and Algorithms	3		
Major: Signals and Systems	3	Major: Database Design	3		
Major: Electronics Lab	1	Major Project Management	3		
Major: Computer Architecture	3	Core: Required Physical Education	0		
Core: Junior Ethics Enhancement Seminar	0				
Total Semester Hours	16	Total Semester Hours	15	Total Semester Hours	
Year 4					
Fall		Spring		Summer	
Core: Social Sciences (Strand)	3	Core: Elective (Strand)	3		
Major: Senior Design I	3	Major: Senior Design II	3		
Major: Applied Probability and Statistics for Engineers	3	Major: Technical Elective	3		
Major: Operating Systems	3	Major: CmpE Elective	3		
Major: Software Engineering	3	Major: CmpE Elective	3		
Core: Senior Leadership Integration Seminar	0				
Total Semester Hours	15	Total Semester Hours	15	Total Semester Hours	
Year 5					
Fall		Spring		Summer	
Total Semester Hours		Total Semester Hours		Total Semester Hours	

The Citadel engineering programs have had 2+2 programs in engineering since the mid 1980's. The Citadel will utilize the same process we have for our CE, EE, ME and most recently CONE 2+2 programs and provide the program for only the last two years while the first

two years are taken at Trident Technical College or similar schools. We have numerous working adults in our evening programs competing the last two years in two years (example table below) or over three or four years as their work and family schedules allow. They complete the first two years in the same fashion before transferring to The Citadel, completing courses as their schedule allows. Our department heads advise these evening students to ensure, based on their schedules, that they take the right course in the right sequence to ensure they can take as large of a load as they desire each semester. Normally the last two years starts with courses in the summer they transfer in (plan provided in the table below), four in the fall and spring, one or two in the following summer (depending on the program), and four in the fall and spring to complete in two years after matriculation. Our working adults are each on their own journey based on the life requirements they have. Trident Technical College offers all of the required courses within the first two years of the Computer Engineering program.

Course Name	Credit Hours	Course Name	Credit Hours	Course Name	Credit Hours
Year 0					
Fall		Spring		Summer	
				Major: Technical Elective	3
				Major: Introduction to Discrete Systems	3
Total Semester Hours		Total Semester Hours		Total Semester Hours	6
Year 1					
Fall		Spring		Summer	
Major: Electronics I	3	Major: Systems I	3	Core: Social Science, English, History	3
Major: Digital Logic and Circuits	3	Major: Data Structures and Algorithms	3	Major: Engineering Economics	2
Major: Signals and Systems	3	Major: Database Design	3		
Major: Electronics Lab	1	Major Digital Systems Engineering	3		
Major: Computer Architecture	3				
Total Semester Hours	13	Total Semester Hours	12	Total Semester Hours	5
Year 2					
Fall		Spring		Summer	
Major: Senior Design I	3	Major: Senior Design II	3		
Major: Applied Probability and Statistics for Engineers	3	Major: Technical Elective	3		
Major: Operating Systems	3	Major: CmpE Elective	3		
Major: Software Engineering	3	Major: CmpE Elective	3		
Total Semester Hours	12	Total Semester Hours	12	Total Semester Hours	
Year 3					
Fall		Spring		Summer	

Course Name	Credit Hours	Course Name	Credit Hours	Course Name	Credit Hours
Total Semester Hours		Total Semester Hours		Total Semester Hours	

Similar Programs in South Carolina offered by Public and Independent Institutions

Identify the similar programs offered and describe the similarities and differences for each program.

Program Name and Designation	Total Credit Hours	Institution	Similarities	Differences
BS Computer Engineering	127	Clemson University	The program in Computer Engineering leading to the B.S. degree provides an in-depth education in a wide range of computer topics including computer hardware, software, and applications. The Computer Engineering curriculum encompasses three basic threads: the software thread, the computer hardware and architecture thread, and the electrical engineering thread. Senior electives allow students to build on this foundation.	The Citadel BSCmpE will provide a strong focus on foundational engineering analysis and design (hardware, software, architectural, electrical, and applications) while integrating these students within electrical engineering and computer science courses. Additionally the day students will grow as leaders within the Corps of Cadets.
Computer Engineering BSE	125	The University of South Carolina	The Computer Engineering degree is for students interested in both programming and hardware. The required classes cover software engineering, computer science, and electric and digital circuit designs.	The Citadel BSCmpE will provide a strong focus on foundational engineering analysis and design (hardware, software, architectural, electrical, and applications) while integrating these students within electrical engineering and computer science courses. Additionally the day students will grow as leaders within the Corps of Cadets.

Faculty

Rank and Full- or Part-time	Courses Taught for the Program	Academic Degrees and Coursework Relevant to Courses Taught, Including Institution and Major	Other Qualifications and Relevant Professional Experience (e.g., licensures, certifications, years in industry, etc.)
Associate Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 311 Digital Logic and Circuits (3) • Spring ELEC 330 Digital Systems Engineering (3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Spring ELEC 418 Advanced Digital Systems (3) • Fall ELEC 428 Computer Architecture (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	BS Computer Science, PhD and MS in Electrical engineering & computer hardware	Microprocessor and Digital expert
Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 311 Digital Logic and Circuits (3) • Fall ELEC 313 Electronics Lab (1) • Spring ELEC 330 Digital Systems Engineering (3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Spring ELEC 418 Advanced Digital Systems (3) • Fall ELEC 428 Computer Architecture (3) • Spring ELEC 419 Computer Network Architecture (3) • Fall ELEC 421 Design I (3) • Spring ELEC 422 Design II (3) • Spring ELEC 424 Solid State Devices (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	PhD EE University of South Carolina Practical experience includes 20 years in the computer industry.	Registered Professional Engineer in South Carolina
Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 306 Electronics I (3) • Fall ELEC 311 Digital Logic and Circuits (3) • Fall ELEC 313 Electronics Lab (1) • Spring ELEC 330 Digital Systems Engineering (3) • ELEC 405 Electrical Measurements (3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Fall ELEC 421 Design I (3) • Spring ELEC 422 Design II (3) • Spring ELEC 424 Solid State Devices (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	PhD EE University of South Carolina	Digital Electronics and Software
Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 306 Electronics I (3) • Fall ELEC 309 Signals and Systems (3) 	PhD EE Naval Postgraduate School	Signals and Systems

	<ul style="list-style-type: none"> • Spring ELEC 312 Systems I (3) • Fall ELEC 311 Digital Logic and Circuits (3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Spring ELEC 423 Digital Signal Processing (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 		
Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 311 Digital Logic and Circuits (3) • Fall ELEC 309 Signals and Systems (3) • Spring ELEC 312 Systems I (3) • Fall ELEC 313 Electronics Lab (1) • ELEC 405 Electrical Measurements (3) • Fall ELEC 412 Probability and Statistics for Engineers(3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Fall ELEC 421 Design I (3) • Spring ELEC 422 Design II (3) • Spring ELEC 423 Digital Signal Processing(3) • Fall ELEC 428 Computer Architecture (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	PhD EE Purdue	Signals, Systems and Software
Associate Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 311 Digital Logic and Circuits (3) • Fall ELEC 309 Signals and Systems (3) • Spring ELEC 312 Systems I (3) • Fall ELEC 412 Probability and Statistics for Engineers(3) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Spring ELEC 419 Computer Network Architecture (3) • Spring ELEC 423 Digital Signal Processing(3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	PhD EE Clemson University	Registered Professional Engineer in South Carolina. Digital Communications and Computer Systems, and Software
Associate Professor, Full-time	<ul style="list-style-type: none"> • Fall ELEC 313 Electronics Lab (1) • Spring ELEC 413 Advanced Topics in Electrical Engineering (3) • Spring ELEC 430 Independent Research (3) • Spring ELEC 450 Internship (3) 	PhD EE North Carolina State University	Circuits, Electronics and laboratory measurements
Associate Professor, Full-Time	<ul style="list-style-type: none"> • Fall CSCI 420 Software Engineering (3) 	PhD CS Arizona state University	Computer Systems and Software
Professor, Full-Time	<ul style="list-style-type: none"> • Spring CSCI 320 Data Base Design (3) • Fall CSCI 420 Software Engineering (3) 	PhD University of South Carolina	Computer Science
Professor, Full-Time	<ul style="list-style-type: none"> • Fall CSCI 405 Operating Systems (3) 	PhD CS University of Oklahoma	Computer Systems and Software

Associate Professor, Full- Time	<ul style="list-style-type: none"> • Spring CSCI 320 Data Base Design (3) • Fall CSCI 405 Operating Systems (3) • Fall CSCI 420 Software Engineering (3) 	PhD University of Nebraska	Computer Science
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Total FTE needed to support the proposed program: 8.5 existing FTE

Faculty: 8.5 existing FTE

Staff: 0

Administration: .25 existing

Faculty, Staff, and Administrative Personnel

Discuss the Faculty, Staff, and Administrative Personnel needs of the program.

The faculty already exist (2 faculty in EE with Computer Engineering degrees/experience) and are teaching the courses within the degree, but within the Electrical Engineering and Computer Engineering department. The faculty in CS and EE are teaching courses with the ability to double current student numbers before needing multiple sections. The staff and administrative support have capacity and are already working with these students within EE.

Faculty are required to teach a full load – 12 credit hours each semester. Each faculty member may consult one day per week and can gain teaching release time for successful research proposals. Additionally, The Citadel has a foundation grant that provides funding (\$2500 each area/year for individual faculty members) in the following three areas: research seed funding, result presentations at conferences, and/or participate in faculty development opportunities. Last year, the majority of Citadel faculty received this funding support. The new BSCmpE program will start with current available faculty teaching courses within the program (similar courses in Electrical Engineering and Computer Science). As seen above, there are existing faculty with required skills for all existing courses within the electrical and computer science BS programs as shown in the faculty table. The program will be housed in the Department of Electrical and Computer Engineering.

Resources

Library and Learning Resources

Explain how current library/learning collections, databases, resources, and services specific to the discipline, including those provided by PASCAL, can support the proposed program. Identify additional library resources needed.

Given that library resources have been sufficient for the computer engineering courses taught within the Electrical Engineering program and the computer courses taught within the Computer Science program, The Citadel does not anticipate requiring additional library resources in support of the new Computer Engineering degree.

The Citadel currently spends approximately \$70,000 on library resources per year on engineering and computer science.

Student Support Services

Explain how current academic support services will support the proposed program. Identify new services needed and provide any estimated costs associated with these services.

The Citadel currently has strong student support services for existing undergraduate programs, graduate programs and veterans. These same services would provide support for the day and evening students

who would be taking courses within the BSCmpE degree. The Corps of Cadets size is currently limited by beds and dining facility size (full residential model). Cadets (day) students moving into computer engineering will decrease the students in other majors on campus during the day; i.e., current student support services are sufficient. It is expected that a majority of the evening students will be full time employed.

There are no academic support services required for this program beyond the already robust services The Citadel offers to all students and no additional fees are anticipated. The Citadel's numerous student support programs, services, and activities are highlighted in the academic catalog. These services include The Citadel Academic Support Center, Academic Advising, Office of Multicultural Student Services, Student Activities, the Krause Center for Leadership and Ethics, and the Study Abroad Office. Two offices are dedicated to supporting students with academic projects or assignments that require the use of technology or training in oral presentations. Multimedia Services helps students with such things as video and audio production, web page design, and graphics production. The Oral Communications Lab offers support services for students who wish to improve their presentation skills. The Academic Support Center is open in the evening and is available for all of our students. Also all of our Supplemental Instruction (SI) which is student led tutoring occurs in the evening after 8:30 PM. Our evening courses start at 5:30 and end between 8:30 and 9 PM depending if the course is a lab or lecture only. These SI sessions are available for all of our students, day or evening.

Physical Resources/Facilities

Identify the physical facilities needed to support the program and the institution's plan for meeting the requirements.

The physical resources have already been supporting the computer engineering track and minor and the numerous electrical engineering students taking many of the computer engineering courses as part of their electrical engineering degree. The Program requires no new offices since all faculty needed are already teaching computer engineering courses as part of load in other programs. These courses are not fully subscribed to at this point. The current lab space in EE and CS areas are sufficient to support labs through scheduling. When the program exceeds current available course space in 4-5 years, new faculty will be hired (expect after 2023). Based on student distributions at that time, retirements will provide the FTE and office space. No new physical resources/facilities are anticipated.

Equipment

Identify new instructional equipment needed for the proposed program.

The robust equipment in electrical engineering and computer science and the cyber range in computer science will sufficiently support the needs of the computer engineering degree. No new instructional equipment is anticipated.

Impact on Existing Programs

Will the proposed program impact existing degree programs or services at the institution (e.g., course offerings or enrollment)? If yes, explain.

Yes

No

Financial Support

Sources of Financing for the Program by Year												
Category	1st		2nd		3rd		4th		5th		Grand Total	
	New	Total	New	Total	New	Total	New	Total	New	Total	New	Total
Tuition Funding	55,290	55,290	75,660	75,660	96,030	96,030	142,590	142,590	171,690	171,690	541,260	541,260
Program-Specific Fees	0	0	0	0	0	0	0	0	0	0	0	0
Special State Appropriation	0	0	0	0	0	0	0	0	0	0	0	0
Reallocation of Existing Funds	0	0	0	0	0	0	0	0	0	0	0	0
Federal, Grant, or Other Funding	0	0	0	0	0	0	0	0	0	0	0	0
Total	55,290	55,290	75,660	75,660	96,030	96,030	142,590	142,490	171,690	171,690	541,260	541,260
Estimated Costs Associated with Implementing the Program by Year												
Category	1st		2nd		3rd		4th		5th		Grand Total	
	New	Total	New	Total	New	Total	New	Total	New	Total	New	Total
Program Administration and Faculty/Staff Salaries	6000	6000	6000	6000	6000	6000	6000	6000	110,000	110,000	134,000	134,000
Facilities, Equipment, Supplies, and Materials	500	500	500	500	500	500	500	500	500	500	2500	2500
Library Resources	0	0	0	0	0	0	0	0	0	0	0	0
Other (specify)	0	0	0	0	0	0	0	0	0	0	0	0
Total	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	110,500	110,500	136,500	136,500
Net Total (Sources of Financing Minus Estimated Costs)	48,790	48,790	69,160	69,160	89,530	89,530	136,090	136,090	61,190	61,190	404,760	404,760

Note: New costs - costs incurred solely as a result of implementing this program. Total costs - new costs; program's share of costs of existing resources used to support the program; and any other costs redirected to the program.

Budget Justification

Provide an explanation for all costs and sources of financing identified in the Financial Support table. Include an analysis of cost-effectiveness and return on investment and address any impacts to tuition, other programs, services, facilities, and the institution overall.

The first few years have only material costs and two adjunct positions since all courses exist and faculty teach them almost every year. When the courses are taught, they are currently not at capacity. The adjunct positions will allow for unexpected teaching conflicts and rapid growth. No new FTE hires will be needed until at least six or seven years after launching the program. At that time, the annual tuition revenue will cover the cost of the FTE faculty lines. Additionally, the long-term goal is to supplement current FTE faculty with adjunct faculty available with the Silicon Harbor of Charleston.

The revenue projections are based on the projected evening student enrollment (estimated at nine credit hours, one course of 3 credit hours in the summer). Based on the number of students and lowcountry workers waiting for this type of program, 25 percent attrition in engineering during the freshman year and the addition of new students each year, the aggregated enrollment table represents our lower bound estimate for students during the first five years of the program.

Evaluation and Assessment

Program Objectives	Student Learning Outcomes Aligned to Program Objectives	Methods of Assessment
Succeed in the practice of computer engineering, by ethically and judiciously applying knowledge of science, mathematics and engineering methods to solve problems facing a technologically complex society	1) apply knowledge of mathematics, science, and engineering 2) design and conduct experiments, as well as to analyze and interpret data 3) 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 4) function on multidisciplinary teams 5) identify, formulate, and solve engineering problems 6) comprehend professional and ethical responsibility 7) comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education 8) use the techniques, skills, and modern engineering tools	1) Exams, design projects, homework in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 309, ELEC 311, ELEC 312, ELEC 330, ELEC 412, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 420 2) Reports, lab work, design projects, homework in Courses: ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422 3) Exams, design projects, homework in Courses: ELEC 311, ELEC 312, ELEC 330, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405, CSCI 420 4) Design projects, presentations, reports in Courses: ELEC 204, ELEC 313, ELEC 330, ELEC 421, ELEC 422, CSCI 320, CSCI 420

	<p>necessary for engineering practice</p>	<p>5) Exams, design projects, homework in Courses: ELEC 201, ELEC 202, ELEC 306, ELEC 309, ELEC 311, ELEC 312, ELEC 330, ELEC 412, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405</p> <p>6) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 204, ELEC 306, ELEC 313, ELEC 421, ELEC 422</p> <p>7) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422</p> <p>8) Exams, design projects, homework, presentations in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 311, ELEC 330, ELEC 421, ELEC 422, CSCI 202, CSCI 223, CSCI 420</p>
<p>Apply and operate current hardware and software tools, equipment, and development environments to conduct and/or lead engineering analysis, design and research</p>	<p>1) apply knowledge of mathematics, science, and engineering</p> <p>2) design and conduct experiments, as well as to analyze and interpret data</p> <p>3) 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</p> <p>4) function on multidisciplinary teams</p> <p>5) identify, formulate, and solve engineering problems</p> <p>6) comprehend professional and ethical responsibility</p> <p>7) comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education</p> <p>8) use the techniques, skills, and modern engineering tools</p>	<p>1) Exams, design projects, homework in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 309, ELEC 311, ELEC 312, ELEC 330, ELEC 412, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 420</p> <p>2) Reports, lab work, design projects, homework in Courses: ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422</p> <p>3) Exams, design projects, homework in Courses: ELEC 311, ELEC 312, ELEC 330, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405, CSCI 420</p> <p>4) Design projects, presentations, reports in Courses: ELEC 204, ELEC 313, ELEC 330, ELEC 421, ELEC 422, CSCI 320, CSCI 420</p>

	<p>necessary for engineering practice</p>	<p>5) Exams, design projects, homework in Courses: ELEC 201, ELEC 202, ELEC 306, ELEC 309, ELEC 311, ELEC 312, ELEC 330, ELEC 412, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405</p> <p>6) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 204, ELEC 306, ELEC 313, ELEC 421, ELEC 422</p> <p>7) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422</p> <p>8) Exams, design projects, homework, presentations in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 311, ELEC 330, ELEC 421, ELEC 422, CSCI 202, CSCI 223, CSCI 420</p>
<p>Value and pursue lifelong learning, not only to keep current in computer engineering fields, but also to sustain an awareness of engineering-related issues facing contemporary society</p>	<p>1) 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</p> <p>2) function on multidisciplinary teams</p> <p>3) comprehend professional and ethical responsibility</p> <p>4) comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education</p> <p>5) recognize the need for and engage in life-long learning</p> <p>6) apply knowledge of contemporary issues within solutions</p>	<p>1) Exams, design projects, homework in Courses: ELEC 311, ELEC 312, ELEC 330, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405, CSCI 420</p> <p>2) Design projects, presentations, reports in Courses: ELEC 204, ELEC 313, ELEC 330, ELEC 421, ELEC 422, CSCI 320, CSCI 420</p> <p>3) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 204, ELEC 306, ELEC 313, ELEC 421, ELEC 422</p> <p>4) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 420</p> <p>5) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC</p>

		<p>311, ELEC 330, ELEC 421, ELEC 422, ELEC 428</p> <p>6) Exams, design projects, homework, presentations in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 311, ELEC 330, ELEC 421, ELEC 422, CSCI 202, CSCI 223, CSCI 420</p>
<p>Pursue graduate education and/or professional registration as desired or required</p>	<ol style="list-style-type: none"> 1) identify, formulate, and solve engineering problems 2) comprehend professional and ethical responsibility 3) comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education 4) use the techniques, skills, and modern engineering tools necessary for engineering practice 	<ol style="list-style-type: none"> 1) Exams, design projects, homework in Courses: ELEC 201, ELEC 202, ELEC 306, ELEC 309, ELEC 311, ELEC 312, ELEC 330, ELEC 412, ELEC 421, ELEC 422, ELEC 428, CSCI 202, CSCI 223, CSCI 320, CSCI 405 2) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 204, ELEC 306, ELEC 313, ELEC 421, ELEC 422 3) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422 4) Exams, design projects, homework, presentations in Courses: ELEC 201, ELEC 202, ELEC 204, ELEC 306, ELEC 311, ELEC 330, ELEC 421, ELEC 422, CSCI 202, CSCI 223, CSCI 420
<p>Be principled leaders with strong communications and team-building skills</p>	<ol style="list-style-type: none"> 1) communicate effectively 2) comprehend the impact of engineering solutions in a global, economic, environmental, and societal context through a broad education 	<ol style="list-style-type: none"> 1) Reports, papers, design projects, homework, presentations in Courses: ELEC 106, ELEC 204, ELEC 306, ELEC 313, ELEC 330, ELEC 421, ELEC 422 2) Exams, design projects, homework, presentations in Courses: ELEC 106, ELEC 201, ELEC 204, ELEC 313, ELEC 421, ELEC 422

Explain how the proposed program, including all program objectives, will be evaluated, along with plans to track employment. Describe how assessment data will be used.

The Citadel is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools. The undergraduate engineering programs are accredited by ABET (CE/EE completed their official reaccreditation in July 2015). The ME program had its initial accreditation visit in Nov 2016 with final successful results in July 2017. The

BSCONE program will undergo accreditation when the CE/EE/ME programs go through reaccreditation in 2020. The BSCmpE program will track accomplishment of Program Outcomes through the Taskstream software and go up for accreditation the year the program has its first graduate (2023-2024). Taskstream's platforms provide a centralized information and communication hub for assessment, accreditation, and planning activities across an institution. These include academic and non-academic outcomes assessment, planning, and program review. Taskstream offers specialized tools that enable users to document learning outcomes, align outcomes to institutional goals and standards, develop assessment plans, create curriculum maps, manage faculty credentials, and improve education based on findings. Taskstream's suite of tools facilitates the collection of student work, student reflections on the learning process, and faculty or peer rubric-based assessment. Rubrics, which are used to clarify expectations and scoring criteria, may also be aligned with established learning outcomes, standards, and competencies. The software provides reporting capabilities to support the aggregation and analysis of student performance data for the review of program and institutional effectiveness, as well as for reporting to accrediting agencies and other external stakeholders.

Assessment data over multiple years provides trends pointing to areas for improvement to address as well as areas of strength to maintain.

All programs within the School of Engineering track employment or employment changes after completion of each degree. The BSCmpE will track employment data in a similar way, but will also track from where students are initiating their BSCmpE (full-time students, evening full-time or part-time students). Surveys from employers will be part of the post-graduation assessment data. Additionally, Fundamental Engineer (FE) and Professional Engineering (PE) success rates will be used to assess the program.

Accreditation and Licensure/Certification

Will the institution seek program-specific accreditation (e.g., CAEP, ABET, NASM, etc.)? If yes, describe the institution's plans to seek accreditation, including the expected timeline.

Yes

No

The program will seek ABET EAC accreditation after its first graduate that is expected in May 2023 when the program begins in fall 2019. With four ABET accredited programs at The Citadel and a fifth receiving its initial accreditation visit in Nov 2020, The Citadel has the processes and systems in place to achieve accreditation. Computer Engineering will be using the same assessment methods and systems

Will the proposed program lead to licensure or certification? If yes, identify the licensure or certification.

Yes

No

Explain how the program will prepare students for this licensure or certification.

The program does not lead directly to engineering licensure by simple completion of the degree, but graduates will be prepared and required to take the Fundament Engineering (FE) exam prior to graduation. They will be encouraged to apply for Engineer-in-Training (EIT) registration upon passing the FE and

graduating as well as apply to take the Professional Engineering (PE) exam within the four years after passing the FE and becoming an EIT.

There are several opportunities for students to gain practical experience necessary for eventual licensure. Here is a summary of a few significant examples:

Two- Semester Capstone Experience – The computer engineering curriculum culminates in senior capstone experience. The plan is to model this from the existing capstone experience in the electrical and computer engineering curriculum. The two-semester course focuses on a current major design project in the Charleston Area (Charleston Silicon Harbor Companies) and brings together professionals, faculty, and students to model the life of the project in the classroom. Students, working in teams, are stretched to apply all they have learned through the curriculum to accomplish the scope of the project. Professionals are involved in all phases of the experience and it culminates in the students giving formal presentations of their project to a board of professionals. The Electrical Engineering program experience has been recognized nationally multiple times by The Department Heads council and the Civil Engineering program has been recognized by the NCEES (National Council of Examiners for Engineering and Surveying) with an Engineering Award given to school for incorporating practicing engineers and practical experiences in the education of undergraduates.

Internships – The Electrical and Computer Engineering Department currently has a robust relationship with companies interested in hiring students for both summer and during the school year internship experiences. Last summer for example, the department had 100% of the rising seniors and over 90% of the rising juniors who were seeking this type of experience employed in internships. Many of these opportunities were in the electrical area, but a number were with computer companies.

Full Time Employment – Many companies are interested in hiring students from our evening program to work full time during the day. The Citadel helps to make these connections as student leave summer internship opportunities and companies still have workforce demands during the school year. There is historically more opportunities than students who wish to take advantage of them.

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution's plans to seek national recognition, including the expected timeline.

Yes

No



15 January 2019

Dr. Ronald W. Welch
Dean of Engineering
The Citadel
171 Moultrie Street
Charleston, SC 29409

Dean Welch,

This letter is to confirm Trident Technical College's support for a B.S. in Computer Engineering at The Citadel as well as our excitement for another four-year engineering degree completion option in the Lowcountry. A review of the draft degree plan validates that all of the required courses in the first two years of the Computer Engineering program are offered at Trident Technical College. We see no issues in incorporating this additional 2+2 option into our current programs. In fact, we have had students in the recent past looking for just such a program.

We look forward continuing and growing our relationship with The Citadel and the development of engineers for the Lowcountry, South Carolina, and the nation. Please contact me if you have any additional questions.

Sincerely,

Timothy Fulford
Dean, Engineering and Construction
Trident Technical College