

PROGRAM MODIFICATION PROPOSAL FORM

Name of Institution: Coastal Carolina University (CCU)

Nature of the Proposed Modification: The proposed modifications adjust the physics preparation in the foundational courses, update the choices for a science elective, strengthen the communications requirement, and update the list of major electives.

Current Name of Program: Bachelor of Science (B.S.) in Engineering Science
Proposed Name of Program: Bachelor of Science (B.S.) in Engineering Science

Program Designation:

- Associate's Degree Master's Degree
 Bachelor's Degree: 4 Year Specialist
 Bachelor's Degree: 5 Year Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
 Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Does the program currently qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

If No, should the program be considered for supplemental Palmetto Fellows and LIFE Scholarship awards?

- Yes
 No

Proposed Date of Implementation: Fall 2019

CIP Code: 14.1301

Current delivery site(s) and modes: CCU Main Campus, Traditional/face-to-face
Proposed delivery site(s) and modes: CCU Main Campus, Traditional/face-to-face

Program Contact Information:

Dr. T. Brian Bunton
Chair of the Department of Physics and Engineering Science
843-349-2066
bbunton@coastal.edu

Institutional Approvals and Dates of Approval:

Department Chair	11/15/2018
College Curriculum Chair	11/15/2018
College Dean	11/15/2018
Academic Affairs Chair	11/15/2018
Faculty Senate Chair	12/06/2018
Provost	12/18/2018
President	12/18/2018

Background Information

Several curricular changes are being proposed for the B.S. in Engineering Science program. Specific modifications include:

- PHYS 212/212L will be replaced with PHYS 213/213L in the foundation section
- PHYS 214/214L will be added in the foundation section
- PHYS 214/214L, CSCI 130/131L, and GEOL 111/111L will be removed from the foundation section (science options)
- ENGR 398 will be replaced with PHYS 250 in the major requirements
- ENGR 315 and ENGR 450 will be added as major requirements (science electives) options.
- The number of major requirements (science electives) will be reduced from five (15-20 credits) to four (12-16 credits)

The proposed modifications benefit current and future students in several ways. By strengthening the quality of the degree program, this modification directly supports CCU's mission to offer "undergraduate and graduate degree programs of national and/or regional significance in the arts and sciences, business, humanities, education, and health and human services." It further supports the Institution's mission by preparing knowledgeable, productive, and responsible graduates to contribute positively to society and to economic development.

This modification supports Objective 1.4.5 of the Coastal Carolina University Strategic Plan 2016-2021: "CCU will support high-quality innovative programs and curricula aligned with student demands, accreditation and standards expectations, regulatory requirements, and supportive professional preparation such that the CCU graduate student FTE population can reach 18 percent of the student population and the CCU undergraduate student FTE population can increase by 5 percent over 2015-2016."

Assessment of Need

The B.S. in Engineering Science began in 2016 and was designed by the faculty in the Applied Physics program. The program requirements were modeled after similar programs at other schools. Now that the program has been in place for a few years, proposed modifications are being made based on the following observations. Currently, Engineering Science majors are required to take an introductory physics sequence of PHYS 211/211L and PHYS 212/212L in their introductory sequence. The instructors of the PHYS 211/211L course, including an Assistant Professor of Engineering, have observed that the goals of the course are different for engineering students and students who are not engineers. The level of detail and difficulty appropriate for engineering students is better served by the PHYS 213/213L and PHYS 214/214L sequence, which is currently populated by Applied Physics students. This sequence covers much of the same material as PHYS 212/212L, but with increased depth and rigor. In addition to PHYS 214/214L being moved from a science option to a required foundation course, two of the other science options are no longer offered. These courses, CSCI 130/131L and GEOG 111/111L, should be removed. The three courses that remain, BIOL 121/121L, CHEM 112/112L, and MSCI 111/111L, cover a broad enough range of science at the introductory level for all engineering students. The course PHYS 250: Communication in STEM, was designed as a replacement for PHYS 398: Physics Seminar in the Applied Physics program. Part of the intention of creating this course was to offer a course appropriate for any student in a STEM major. Since this three-hour course was created after the Engineering Science program began, it was not in the original Engineering Science Program, and it is felt that it is a better fit for engineering students than ENGR 398, a one-hour seminar-style class, in serving program SLO 7: communicate effectively. Finally, as the recommendation is to require PHYS 214/214L in addition to another science option in the foundation, it is proposed to drop the number of science electives in the major requirements from five courses to four. This change will allow the program to remain at 120 total hours. Also, new courses have been created, ENGR 315: Electric Power and Renewable Energy and ENGR 450: Radiation Detection and Measurement, which are appropriate as science electives. The proposed changes have been checked against the Accreditation Board for Engineering and Technology (ABET) accreditation requirements, and CCU's application for accreditation should not be affected.

The Engineering Science B.S. degree at Coastal Carolina University is a general engineering degree, without specific specialization in a particular area. It is the only general engineering degree at a public institution in the state. In the current engineering landscape, jobs are highly interdisciplinary in nature. Because of that, this degree focuses on providing graduates with a skillset that allows them to take their general knowledge and apply it to disciplines as needed. The practice of engineering is also international in nature. This requires cultural awareness and sensitivity to client norms and expectations. As a program at a liberal arts institution, the degree allows students to be client-centered as opposed to design-centered.

Transfer and Articulation

This change should not affect existing agreements with Clemson University and Horry-Georgetown Technical College.

Description of the Program

Projected Enrollment						
Year	Fall Headcount		Spring Headcount		Summer Headcount	
	New	Total	New	Total	New	Total
2018-2019	30	103	4	94	0	0
2019-2020	30	110	6	101	0	0
2020-2021	31	118	7	108	0	0
2021-2022	33	126	8	115	0	0
2022-2023	34	134	9	122	0	0

The modifications adjust the physics preparation in the foundational courses, update the choices for a science elective, strengthen the communications requirement, and update the list of major electives. No new enrollment is projected based on this curriculum modification.

Engineering Science began as a new program in Spring 2016. This last two years, this program has experienced a growth of 68%. The first row of the table above, that is 2018-2019, is based on actual student enrollment at CCU in the Engineering Science program. The remaining years (2019-2020 to 2022-2023) were estimated using a linear growth model of 18% from 2018-2019 to 2022-2023.

Curriculum

B.S. in Engineering Science (120 Credit Hours)

- University Core Curriculum Requirements (38-40 credits)
- Graduation Requirements (3-7+ credits) *
- Foundation Courses (27-45 Credits) *

- Complete the following courses:
 - ENGR 101 - Introduction to Engineering (3 credits) *
 - PHYS 211 - Essentials of Physics I (3 credits) AND
 - PHYS 211L - Essentials of Physics I Laboratory (1 credit)
 - PHYS 213 – Fundamentals of Physics I (3 credits) AND
 - PHYS 213L – Fundamentals of Physics I Laboratory (1 credit)
 - PHYS 214 - Fundamentals of Physics II (3 credits) AND
 - PHYS 214L - Fundamentals of Physics II Laboratory (1 credit)
 - CHEM 111 - General Chemistry I (3 credits) * AND
 - CHEM 111L - General Chemistry Laboratory I (1 credit) *
 - MATH 160 - Calculus I (4 credits) *
 - MATH 161 - Calculus II (4 credits)
 - MATH 260 - Calculus III (4 credits)
 - MATH 320 - Elementary Differential Equations (3 credits)
 - PHIL 102 - Introduction to Ethics (3 credits) *
- Choose one from the following: (3-4 Credits)
 - MATH 174 - Introduction to Discrete Mathematics (3 credits)
 - MATH 242 - Modeling for Scientists I (3 credits) AND
 - MATH 242L - Modeling for Scientists I Laboratory (1 credit)
 - MATH 344 - Linear Algebra (3 credits)
 - STAT 201 - Elementary Statistics (3 credits) * AND
 - STAT 201L - Elementary Statistics Computer Laboratory (1 credit) *
- Choose one from the following (4 Credits)
 - CHEM 112 - General Chemistry II (3 credits) AND
 - CHEM 112L - General Chemistry Laboratory II (1 credit)
 - MSC1 111 - Introduction to Marine Science (3 credits) * AND
 - MSC1 111L - Introduction to Marine Science Laboratory (1 credit) *
 - BIOL 121 - Biological Science I (3 credits) * AND
 - BIOL 121L - Biological Science I Laboratory (1 credit) *

NOTE: *Course credit hours only count once toward the total university graduation credit hour requirement

● Major Requirements (45-50)

- Complete the following courses:

- ENGR 201 - Engineering Problem Solving (3 credits)
 - ENGR 202 - Engineering Graphics (3 credits)
 - ENGR 234 - Statics (3 credits)
 - ENGR 235 - Electric Circuits (3 credits)
 - PHYS 250 – Communication in STEM (3 credits)
 - PHYS 310 - Mathematical Methods in Physics (3 credits)
 - PHYS 351 - Computational Methods in Physics (3 credits)
 - PHYS 352 - Experimental Methods in Physics (3 credits)
 - ENGR 399 Q* - Integrated Science and Design (1 to 3 credits) (3 credits required)
 - ENGR 499 Q - Senior Design (3 credits)
- Choose four from the following: (12-16 Credits)
- ENGR 315 – Electric Power and Renewable Energy (3 credits)
 - ENGR 321 - Electronics (3 credits)
 - ENGR 430 - Fluid Mechanics (3 credits)
 - ENGR 450 – Radiation Detection and Measurement (3 credits)
 - PHYS 301 - Analytical Mechanics (3 credits)
 - PHYS 302 - Electricity and Magnetism (3 credits)
 - PHYS 303 - Quantum Mechanics (3 credits)
 - PHYS 341 - Thermodynamics and Statistical Mechanics (3 credits)
 - CSCI 210 - Computer Organization and Programming (3 credits)
 - CSCI 310 - Introduction to Computer Architecture (3 credits)
 - CSCI 330 - Systems Analysis & Software Engineering (3 credits)
 - CSCI 473 - Introduction to Parallel Systems (3 credits)
 - CSCI 485 - Introduction to Robotics (3 credits)
 - Other 300 level or above Science or Engineering courses with prior approval from the department (3-4 Credits)

Curriculum Changes

Courses Eliminated from Program	Courses Added to Program	Core Courses Modified
PHYS 212, PHYS 212L	PHYS 213, PHYS 213L	PHYS 214, PHYS 214L
CSCI 130, CSCI 131L	PHYS 250	
GEOL 111, GEOL 111L	ENGR 315	
ENGR 398	ENGR 450	

New Courses

PHYS 213: Fundamentals of Physics I (3 credits) (Prereq: PHYS 211/PHYS 211L with a grade of 'C' or better) (Coreq: PHYS 213L) A continuation of PHYS 211 for physics, engineering, and other interested science students. Topics covered include oscillation, fluids, thermodynamics, wave motion, and optics. F

PHYS 213L: Fundamentals of Physics I Laboratory (1 credit) (Coreq: PHYS 213) The laboratory will demonstrate the topics and principles presented in the lecture. F

PHYS 250: Communicating STEM (3 credits) This course introduces students to effective forms of communication in the disciplines of science, technology, engineering, and mathematics. Students learn about available tools for researching and writing academic papers, the proper structure for a journal article, and the publication process. Students are also exposed to the various styles for delivering an oral presentation including effective strategies for each style. Time is also spent on learning best practices for designing and presenting a scholarly poster. S

ENGR 315: Electric Power and Renewable Energy (3 credits) (Prereq: A grade of 'C' or better in PHYS 212 or PHYS 214; or permission of the instructor) This course focuses on the role of renewable power generation in today's electricity power grid. This course has three main sections. The first section introduces the topology and operation of the current power grid. The second section is an in-depth analysis of wind, solar, and hydro, the three major renewable sources in use today, from an electrical engineering perspective. Finally, we conclude with the future of renewable energy: experimental technologies and the challenges of operating the power grid in the 21st century. F

ENGR 450: Radiation Detection and Measurement. (3 credits) (Prereq: permission of the instructor, and PHYS 212 or PHYS 214) A course in the fundamentals of radiation detection and measurement covering topics including nuclear instability, radioactive sources, interaction of radiation with matter, processing of radiation-induced signals, biological effects of radiation, dosimetry, attenuation of charged particles, gamma rays and neutrons and effectiveness of shielding methods. S

Similar Programs in South Carolina offered by Public and Independent Institutions

The program at Coastal Carolina University is the only general engineering program at a public institution in the state. The program is client-centered, as opposed to design-centered. Opportunities exist to integrate engineering with the science of coastal regions.

Program Name and Designation	Total Credit Hours	Institution	Similarities	Differences
Engineering Science	120+	University of South Carolina (USC) – Columbia	USC - Columbia offers a degree program in Engineering Science which has many similarities to the proposed program.	The proposed program is designed to complement other programs in the state and provides the opportunity to integrate engineering with the science of coastal regions.
Engineering (multiple programs)	120+	University of South Carolina (USC) – Columbia	USC – Columbia offers engineering degrees through multiple programs leading to the ability to sit for the FE exam.	The proposed program is designed to complement other programs in the state and provides the opportunity to integrate engineering with the science of coastal regions.
Engineering	134	Bob Jones University (BJU)	BJU offers a general engineering degree with concentrations in mechanical, electrical, and computer engineering.	BJU is a private institution. The proposed program is designed to complement other state programs and has a focus on the integration of engineering and applied science.
Engineering (multiple programs)	120+	Clemson University (CU)	CU offers engineering degrees through multiple programs leading to the ability to sit for the Fundamentals of Engineering (FE) exam.	The proposed program is designed to complement other programs in the state and provides the opportunity to integrate engineering with the science of coastal regions.
Engineering (multiple programs)	129	The Citadel	The Citadel offers engineering degrees through multiple programs leading to the ability to sit for the FE exam.	The proposed program is designed to complement other programs in the state and provides the opportunity to integrate engineering with the science of coastal regions.
Industrial Engineering	122	Francis Marion University (FMU)	FMU offers a degree program in Industrial Engineering.	The proposed program is designed to complement other programs in the state and provides the opportunity to integrate engineering with the science of coastal regions.

Faculty

No new faculty are required to implement this program modification.

Resources

Library Resources: No new resources

Equipment: No new resources

Facilities: No new resources

Impact on Existing Programs

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

Yes

No

Financial Support

Estimated Sources of Financing for the New Costs						
Category	1 st	2 nd	3 rd	4 th	5 th	Total
Tuition Funding						
Program-Specific Fees						
Special State Appropriation						
Reallocation of Existing Funds						
Federal, Grant, or Other Funding						
Total	0	0	0	0	0	0
Estimated New Costs by Year						
Category	1 st	2 nd	3 rd	4 th	5 th	Total
Program Administration and Faculty and Staff Salaries						
Facilities, Equipment, Supplies, and Materials						
Library Resources						
Other (specify)						
Total	0	0	0	0	0	0
Net Total (i.e., Sources of Financing Minus Estimated New Costs)						

Budget Justification

The program modification is for a curriculum change. The modification adjusts foundational courses, science electives, strengthens the communication requirement, and updates the list of major objectives. No new costs are associated with this curriculum modification.

Evaluation and Assessment

Program Objectives	Student Learning Outcomes Aligned to Program Objectives	Methods of Assessment
(1) obtain a range of positions in industry or government facilities, or pursue graduate education in engineering, science or related fields;	(h) understand the impact of engineering solutions in a global, economic, environmental, and societal context (i) engage in life-long learning (k) use the techniques, skills, and modern engineering tools necessary for engineering practice	(h) Senior Exit Interview (i) Senior Exit Interview (k) Faculty Course Assessment Reports (FCARs)
(2) participate, communicate and collaborate effectively and ethically within the criteria of their chosen careers	(d) function on multidisciplinary teams (f) demonstrate professional and ethical responsibility (g) communicate effectively	(d) FCARs (f) FCAR in Project Management and Communication (g) Presentation rubric in Senior Design and Senior Exit Interview
(3) continually integrate science with engineering practice to solve technical problems, contributing to the benefit of society	(a) apply knowledge of mathematics, science, and engineering (b) design and conduct experiments, as well as to analyze and interpret data (c) design a system, component, or process to meet desired needs within realistic constraints (e) identify, formulate, and solve engineering problems (j) apply knowledge and skills to contemporary issues	(a) FCARs and Senior Exit Exam (b) FCARs and Senior Exit Exam (c) FCAR in Senior Design (e) FCARs and Senior Exit Exam (j) FCAR in Integrated Science and Design

Will any the proposed modification impact the way the program is evaluated and assessed?

- Yes
 No

Will the proposed modification affect or result in program-specific accreditation?

- Yes
 No

The Engineering Science program will be seeking ABET accreditation in the 2019-2020 cycle, which if successful would result in accreditation in late summer of 2021.

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

- Yes
 No