New Program Proposal
Bachelor of Science in Industrial Process Engineering
University of South Carolina Aiken

Summary

The University of South Carolina Aiken requests approval to offer a program leading to the Bachelor of Science in Industrial Process Engineering to be implemented in Fall 2015. The proposed program is to be offered through traditional instruction. The following chart outlines the stages for approval of the proposal; the Advisory Committee on Academic Programs (ACAP) voted to recommend approval of the proposal. The full program proposal is attached.

Stages of Consideration	Date	Comments
Program Planning Summary received and posted for comment	5/15/14	Not Applicable
Program Planning Summary considered by ACAP through electronic review	7/30/14	ACAP members expressed support for the proposed program. Dr. W. Franklin Evans, from South Carolina State University (SCSU) noted that the institution also plans to offer a B.S. in Industrial Engineering, but that there are sufficient job opportunities for graduates of both programs. Staff encouraged the institutions to collaborate.
Program Proposal Received	9/15/14	Not Applicable
ACAP Consideration	10/16/14	ACAP members agreed there is a need for the proposed program. Dr. Priest and Dr. Evans described the ways in which their institutions' faculty might collaborate such as sharing courses and working on joint projects.
Comments and suggestions from CHE staff sent to the institution	10/28/14	Staff requested that the proposal be revised to include information about potential collaboration, more detail in the course descriptions, a statement about possible articulation agreements with the technical colleges, and a description of the other funding identified in the Sources of Financing chart.
Revised Program Proposal Received	11/25/14	The revised proposal satisfactorily addressed all of the requested revisions.

Recommendation

The staff recommends that the Committee on Academic Affairs and Licensing commend favorably to the Commission the program leading to the Bachelor of Science in Industrial Process Engineering to be implemented in Fall 2015.

1. **COVER PAGE**

a) Name of Institution - University of South Carolina Aiken

b) Name of Degree – Industrial Process Engineering

c) Date of Submission – September 15, 2014

d) Institutional Signatures

Harris Pastides, President | Date

Sandra Jordan, Chancellor | Date

e) Contact – Dr. Jeffrey M. Priest
Executive Vice Chancellor for Academic Affairs
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Aiken, SC 29801
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2. CLASSIFICATION

a) Program Title – Bachelor of Science in Industrial Process Engineering
b) Concentrations/Options/Tracks – None
c) Academic Unit in which the program resides – Department of Mathematical Sciences
d) Designation, Type, and Level of Degree – 4-year, Baccalaureate
e) Proposed Date of Implementation – Fall 2015
f) CIP Code – 14.3501
g) Site – University of South Carolina Aiken
h) Program Qualifications – Qualifies for supplemental Fellows Scholarship and Life Scholarship
i) Delivery Mode – Traditional
j) Area of Certification – Not Applicable

3. INSTITUTIONAL APPROVAL

USCA Monday Group: September 25, 2013
USCA Department of Mathematical Sciences: January 13, 2014
USCA Academic Council: March 4, 2014
USCA University Planning Committee: March 17, 2014
USCA Courses and Curricula Committee: March 17, 2014
USCA Faculty Assembly: April 2, 2014
USCA Chancellor: April 2, 2014
USC System Provost: February 27, 2014
USC System President: March 3, 2014
USC System Academic Affairs and Faculty Liaison Committee: March 28, 2014
USC System Board of Trustees: April 25, 2014

4. PURPOSE

a) Purpose

Over the past several years Aiken County has developed into a technology center for business and government. The listing of businesses in the area that depend on technology include Savannah River National Laboratory, Savannah River Nuclear Solutions, Savannah River Remediation, Tognum America Inc., BAE Systems, South Carolina Gas and Electric; Kimberly-Clark's Consumer Health Services; Bridgestone Passenger and Truck Tire Facility; AGY Materials Corporation; Shaw Industries; Washington Safety Management Solutions Corporation; Hubbell Power Systems; and Harvey Ignition Systems Engineering Corporation. Collectively these industries employ over 16,000 individuals and each industry is driven by its technology innovations, which come from the employment of its engineering and scientific staff.

In fall 2012, the University of South Carolina Aiken (USCA) conducted a visioning process that involved over 700 stakeholders in the region. The purpose of the visioning process was to get input from stakeholders on what USCA does well, where it can improve, and where it should go in the future. Through the visioning process seven themes occurred: grow the university, increase program/degree offerings, increase faculty/staff salaries, market the university more widely, improve the current funding/budget situation, improve community relations/increase partnerships, and revamp the current administrative/governance structure. Within each of these themes, numerous recommendations were made. For the increase program/degree offerings theme, an undergraduate engineering program was the top recommendation for every constituent group (students, faculty, administrators, business/industry, community leaders).

As a result, an engineering advisory group made up of engineer leaders in businesses such as Savannah River National Laboratory, Savannah River Nuclear Solutions, Savannah River Remediation, BAE Systems, Kimberly-Clark, Tognum America Inc., URS, and Bridgestone was formed. During the 2012-2013 academic school year, this group aided in the development of the proposed baccalaureate industrial process engineering program. The charge assigned to this group was to help develop a program whose graduates they would want to hire for their businesses. The result was the development of the Industrial Process Engineering Program with a mission to prepare engineering students who have the technical knowledge and skills in mathematics, science, engineering and management to analyze and solve problems in today's team oriented business environment. Through a rigorous curriculum students will be provided multiple opportunities to apply knowledge and skills learned in the classroom and laboratory in real world settings.

This same committee also suggested the name of the degree. They felt it was important for the title to describe not only the course topics but the career destinations of our graduates. The industrial process engineers will be prepared to oversee, develop, enhance, and design processes found in industry relating to people, products, economics, and knowledge. The title for our degree indicates learning to achieve knowledge in the processes of industry from multiple viewpoints: mechanical, manufacturing, and business.

b) Objectives

The goals for developing the Industrial Process Engineering Program are:

1. Provide an opportunity for local high school students and technical college students to participate in a local 4-year engineering program.
2. Address a need as identified by local businesses and industries.
3. Aid the economic development of the CSRA by providing a program that can help attract and retain industries and engineers.

Program educational objectives:

1. Provide students with the technical knowledge and skills in mathematics, science, and engineering to analyze and solve problems.
2. Provide engineering students with a strong liberal arts background.
3. Provide students with practical experience and organizational skills, enabling them to interact and communicate both orally and in writing to others.
4. Provide students with the skills to work effectively in cross-functional team environments.

Long-term program objectives: Within 3-5 years of graduation, graduates of this program will have:

1. Attained positions that utilize the skills learned in this program.
2. Roles of increasing responsibility leading to leadership positions.
3. Pursued professional development, certifications, and/or licenses in engineering or related areas by attending graduate school or continuing education opportunities.
4. Served the profession, community, and society by demonstrating professional and ethical responsibilities.

5. **JUSTIFICATION**

a) Employability of Graduates:

In the fall 2012, USCA hired Carnegie Communications to do a productivity demand study and an environmental scan for a series of possible degree programs, one of which was engineering. According to the study, which drew heavily from the Bureau of Labor Statistics Occupational Employment Statistics Classification system, over the next 10 years, 68,000 new engineering jobs and 38,000 replacement jobs will become available. In the Central Savannah River Area, the Carnegie study indicates that there will be an estimated 333 engineering job openings (114 new, 219 replacement). Potential employers for our graduates will be URS Corporation, Savannah River Remediation, Energy Solutions, BUNTY LLC Engineered Solutions, Savannah River Nuclear Solutions, Southeastern Clay Company, Kimberly Clark, Bridgestone Tire, AGY Materials, Shaw Industries, and Tognum America, to name a few.

A job search conducted on November 8, 2013 through Careerbuilder.com indicates more engineering related job openings as predicted by the Bureau of Labor Statistics. A search on that website yielded the following results:

Job Prompt	CSRA	South Carolina	Georgia	North Carolina
Industrial Engineer	8	181	270	171
Process Engineer	39	415	879	466
Mechanical Engineer	19	211	269	173

b) Centrality with Mission:

USC Aiken was founded in 1961 as a result of the local community coming together to ask the state legislature to approve a degree granting institution to meet the needs of the area. Since it opened its doors, USC Aiken has developed into a comprehensive liberal arts institution committed to active learning through excellence in teaching, faculty and student scholarship, research, creative activities, and service. The University offers degrees in the arts and sciences and in the professional disciplines of business, education, and nursing. All courses of study are grounded in a liberal arts and sciences core curriculum. USCA also encourages interdisciplinary studies and collaborative endeavors. As a community based institution, USCA strives to meet the needs of the community.

Historically, there has been a significant demand for engineering degree opportunities among non-traditional students who are employed in the Central Savannah River Area. Recognizing this demand, USC Aiken has for more than twenty years offered a schedule of engineering courses which includes evening study, however USCA currently offers only freshman- and sophomore-level engineering courses. However, after completion of the courses that are available at the Aiken campus, both non-traditional and traditional students are faced with the need to complete their degree programs through daytime study at USC Columbia or some other institution that has a four year degree, a situation that usually presents the students with unsolvable logistic and financial problems. Traditional and non-traditional students who, due to financial, family, or other circumstances, are unable to relocate also find themselves with no alternative means of earning an engineering degree. We also believe that students educated in Aiken are more likely to stay in Aiken for their career in engineering.

c) Relationship to Related Programs Within the Institution:

As mentioned in the previous section, for the past 20 years, USC Aiken has offered the freshman and sophomore years of a general engineering program that enabled students to transfer to USC Columbia or other engineering programs throughout the state. The proposed program builds on the current program so that students who want to transfer to another institution may continue to do so.

d) List of Similar Programs within South Carolina

Currently Clemson University is the only ABET accredited institution in the state that offers Industrial Engineering. Francis Marion University was just approved for an Industrial Engineering program this past year. Of the two programs, Francis Marion's program is of similar size and scope. However because of the geographic distance between our campuses and the emphasis of regional recruitment, we don't believe we will be in direct competition. There are no other similar programs in the state. A complete listing of the engineering programs as taking from the CHE program inventory are listed in the table below.

Since the submission of this proposal, South Carolina State has submitted a similar program. USC Aiken and South Carolina State has been in discussion on how the two institutions can collaborate. Both institutions agree that similar courses within each program will be accepted by both institutions. Both institutions also agree that, if appropriate, students from each institution can take courses at either institution if course enrollment prevents an institution from offering a course.

Table 1 – Engineering Degrees available in South Carolina as listed in CHE program inventory

	Bob Jones	Clemson	USC Columbia	The Citadel	Claflin	Benedict College	Anderson	Furman	USC Upstate	Francis Marion	South Carolina State
Engineering	x										
Biosystems Engineering		x									
Biomedical Engineering			X								
Chemical Engineering		x	x								
Civil Engineering		x	x	x							
Computer Engineering	x	x	x		x	x					
Broadcast Engineering Management	x										
Electrical Engineering	x	x	x	x							
Engineering Physics						x					
Engineering Science	x										
Environmental Engineering		x									
Materials Science and Engineering		x									
Mechanical Engineering		x	x	x							
Nuclear Engineering											x
Industrial Engineering		x								x	
Pre-Engineering							x	x			
Civil Engineering Technology											x
Electrical Engineering Technology											x

Electrical and Electronic Engineering Technologies											
Industrial Engineering Technology											x
Mechanical Engineering Technology											x
Engineering Technology Management									x		
Engineering Technology										x	
Materials Science and Engineering		x									

e) Similarity and Differences with other programs – Private, SREB ACM, & Proprietary:

A search on the ABET program listing site indicates that there are 97 institutions within the United States that offer Industrial Engineering at the undergraduate level. Clemson is the only institution within South Carolina that is listed. There are two institutions in North Carolina (North Carolina Agricultural and Technical State University and North Carolina State University in Raleigh) and one institution in Georgia (Georgia Institute of Technology).

A search of the Southern Regional Education Board's Academic Common Market yielded no results for industrial engineering.

6. **ADMISSION CRITERIA**

Admission requirements to the engineering program will be those of entering freshman at USC Aiken. High school course selection, standardized test scores, and an Admissions Index are all used to determine admissibility. In addition to these students must have taken the following in high school: English (4 units), mathematics (4 units), laboratory science (3 units), social science (3 units), foreign language (2 units), academic electives (4 units), and physical education or ROTC (1 unit).

Engineering majors must have a grade of "C" or better in all mathematics, science, and engineering courses. If a student fails to receive a "C" or better, they must repeat the courses until they receive a "C" or better.

7. **ENROLLMENT**

a) Projected Enrollment

Table A – Projected Total Enrollment

PROJECTED TOTAL ENROLLMENT						
YEAR	**FALL**		**SPRING**		**SUMMER**	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2015-16	90	1575	90	1525	0	0
2016-17	102	1755	102	1705	0	0
2017-18	102	1755	102	1705	0	0
2018-19	102	1755	102	1705	0	0
2019-20	102	1755	102	1705	0	0

b) Origin of Students

Our current pre-engineering program averages 100 students each year. Conservatively, we expect that number to stay consistent. Based on surveying our students, we are making an assumption that approximately 60% of the sophomores will continue with us for their junior year. Then most of those will succeed and continue to the senior year.

Year 1 - 50 freshman, 25 sophomores, 15 juniors (Assumes 15 current sophomores stay with the program)
Year 2 – 50 freshman, 25 sophomores, 15 juniors, 12 seniors
Year 3 – 50 freshman, 25 sophomores, 15 juniors, 12 seniors
Year 4 - 50 freshman, 25 sophomores, 15 juniors, 12 seniors
Year 5 - 50 freshman, 25 sophomores, 15 juniors, 12 seniors

We don't expect many, if any, transfers from other programs on campus.

c) New and Transfer Students

To be conservative, we don't expect an influx of many new or transfer students into the program. There may be a handful, but we are being conservative on the estimates.

8. **CURRICULUM**

a) Sample Curriculum

USC Aiken Proposed Industrial Process Engineering Program of Study

Year 1 (35 Credit Hours)					
Fall			Spring		
ENGL 101	Composition	3	ENGL 102	Composition	3
MATH 141	Calculus I	4	MATH 142	Calculus II	4
ENCP 101	Introduction to Engineering I	3	ENCP 102	Intro to Engineering II	3
CHEM 111	Chemistry I	4	CHEM 112	Chemistry II	4
Elective	Humanities	3	ECON 221/222	Micro or Macro Economics Elective	3
AFCI	Critical Thinking	1			
Total Semester Credit Hours		18	Total Semester Credit Hours		17
Year 1 Summer Internship Opportunity					
Year 2 (34 Credit Hours)					
Fall			Spring		
PHYS 211	Physics I	4	PHYS 212	Physics II	4
MATH 241	Calculus III	4	MATH 242	Calculus IV (Differential Equations)	4
ENCP 200	Statics	3	ENGR 290	Thermodynamics	3
EMCH 371	Engineering Materials	3	ENGR 260	Mechanics of Solids	3
COMM	COMM 201 or 241	3	Elective	Humanities	3
Total Semester Credit Hours		17	Total Semester Credit Hours		17
Year 2 Summer Internship Opportunity					

Year 3 (30 Credit Hours)					
Fall			Spring		
BADM 371	Principles of Management and Leadership	3	ENCP 310	Dynamics (ENCP 210)	3
ELCT 221	Electrical Circuits	3	EMCH 327	Design of Mechanical Elements	3
EMCH 360	Fluid Mechanics	3	ENGR 380	Intro to Systems Engineering	3
ENGR 361	Instrumentation, Measurements, & Statistics	3	ENGR 334	Quality Planning and Control	3
STAT 509	Statistics	3	Elective	History 101 or 102	3
Total Semester Credit Hours		15	Total Semester Credit Hours		15
Year 3 Summer Internship Opportunity					
Year 4 (30 Credit Hours)					
Fall			Spring		
ENGR 498	Capstone Design I	3	ENGR 499	Capstone Design II	3
ENGR 316	Control Systems	3	BADM 494	Project Management	3
Elective	Technical Elective	3	Elective	Technical Elective	3
Elective	Social/ Behavioral Science Elective	3	ENGR 421	Engineering Economics	3
Elective	American Political Institutions Elect.	3	PHIL 325	Engineering Ethics	3
Total Semester Credit Hours		15	Total Semester Credit Hours		15

Technical Elective Courses (6 Credit Hours)					
EMCH 354	Heat Transfer	3	ENGR 477	Advanced Manufacturing	3
ENGR 454	Unit Operations	3	STAT 510	Statistical Quality Assurance	3
EMCH 377	Manufacturing Processes	3	MGMT 475	Production/Operations Management	3

*b) New Courses**

Year 1

ENCP 101 – Introduction to Engineering I
Engineering problem solving using computers and other engineering tools. This course introduces the engineering profession, professional concepts, ethics, and responsibility; reviews the number system and unit conversions; and introduces computer programs. It also prepares students for success through the integration of the following important skills: technical problem solving and engineering design, ethical decision-making, teamwork, and communicating to diverse audiences.
Outcomes:

1. Students will be able to describe the different engineering disciplines, career opportunities in engineering, and the roles engineers perform in society. Students will display proficiency by demonstrating the following competencies:
    a. Define the work of an engineer;
    b. Describe the different types of engineers and identify which types best suit the student's own skill set;
    c. Identify ethical problems facing engineers.
2. Students will be able to work effectively on a team to plan, execute, and apply a structured engineering design process to a project using basic project management techniques. Students will display proficiency by demonstrating the following competencies:
    a. Demonstrate how to use engineering paper, engineering journals/lab books, and the engineering design process to outline a project;
    b. Complete two to three group projects;
    c. Participate in a group presentation demonstrating the completed project;
    d. Complete a peer review on classmates' projects.
3. Students will be able to solve elementary engineering problems using a systematic approach and present these problems and solutions in an effective oral presentation. Students will display proficiency by demonstrating the following competencies:
    a. Perform an individual oral presentation;
    b. Complete formal lab reports;
    c. Use Microsoft Word, Excel, and PowerPoint for labs and presentations;
    d. Demonstrate an understanding various units of measure and an ability to convert between them.
4. Students will be able to identify available resources and opportunities that assist in achieving unique educational and life goals. Students will display proficiency by demonstrating the following competencies:
    a. Identify the skills and attributes needed to successfully complete a degree in engineering;
    b. Identify the college resources available to help them decide on a course of study and a path to success in those courses.

ENCP 102 – Introduction to Engineering II
Principles and practice of visualization and graphical representation using modern computer-aided design software.
Outcomes:
1. Students will demonstrate the ability to model using a 3-dimensional modeling program.
2. The students will demonstrate the ability to make freehand sketches.
3. The students will demonstrate the ability to carry out an engineering project including design, model, analysis, and fabrication of a product.
4. The students will apply a numerical analysis program to structural and heat sink analysis.
5. The students will become familiarized with the manufacturing process.

Topics Covered:
1. Introduction of engineering graphics and 3-Dimensional modeling.
2. Model development using extrude, revolve, sweep, and blend.
3. Adding fillets, rounds, and chambers.
4. Assembly of parts.

5. Heat transfer analysis.
6. Structural analysis.
7. Manufacturing machine code development.

Year 2

ENCP 200 – Statics (pre: MATH 141)
Introduction to the principles of mechanics; equilibrium of particles and rigid bodies; distributed forces, centroids, and centers of gravity; moments of inertia of areas; analysis of simple structures and machines; and friction.
Outcomes:
1. Students will demonstrate the ability to describe position, forces, and moments in terms of vector components in two and three dimensions.
2. Students will demonstrate the ability to select suitable reference coordinate axes, construct free body diagrams, and understand the relation between constraints imposed by supports and support forces.
3. Students will demonstrate the ability to formulate static equilibrium equations for a rigid body and evaluate member forces in trusses, frames, and machines.
4. Students will demonstrate the ability to apply Coulomb's dry friction laws to engineering problems.

Topics Covered:
1. Introduction
2. Forces and particle equilibrium
3. Moment of a force; resultants
4. Cross products
5. Moments, couples, moments about a line
6. Equivalent systems
7. Distributed loading
8. Analysis of general equilibrium problems
9. Free-body diagrams
10. Fundamental application of equilibrium equations
11. Interacting bodies or parts of a structure
12. Structural applications
13. Plane trusses
14. Space trusses
15. Systems containing multiforce members
16. Friction

ENCP 260 – Introduction to the Mechanics of Solids (pre: MATH 241, ENCP 200 with a C or better)
developments for stresses. Tension, torsion, axial load, and pressure. Deformations of elastic relationships between stress and strain.
Outcomes:
1. Students will demonstrate understanding of the basic concepts of stress and strain at a point.
2. Students will demonstrate the ability to apply stress and strain transformations at points.
3. Students will demonstrate the ability to understand and use basic equations for stress in simple components subjected to axial loading, torsional loading or cylindrical shafts, bending of bars, shear in bars, and internal pressure applied to thin walled structures.

4. Students will demonstrate the ability to understand and use the elastic relationship between stress and strain at a point.
5. Students will demonstrate the ability to solve simple statically indeterminate problems for axial loading, torsional loading, and bending of bars.

Topics Covered:
1. Concepts of stress
2. Stress and strain relations
3. Torsion
4. Bending
5. Analysis and design of beams for bending
6. Shear stresses in beams and thin-walled members
7. Transformation of stress and strain
8. Deflection beams
9. Buckling of columns

ENCP 290 – Thermodynamic Fundamentals
Definitions, work, heat, and energy. First law analyses of systems and control volumes. Second law analysis and design.
Outcomes:
1. Students will demonstrate the ability to determine the thermodynamic properties of simple compressible substances.
2. Students will demonstrate an understanding of the concepts of conservation of mass, conservation of energy and the second law of thermodynamics.
3. Students will demonstrate the ability to perform availability analysis for closed systems and control volumes.
4. Students will demonstrate the understanding of concepts of irreversibility, isentropic efficiencies and effectiveness and the application of these concepts in solving thermodynamic problems.

Topics Covered:
1. Definitions: thermodynamic systems, properties, state, process, equilibrium, pressure, temperature and specific volume. Units.
2. Energy concept: kinetic, potential, and internal. Energy transfer by heat and by work.
3. First Law for closed systems. Energy analysis of cycles.
4. Properties of simple compressible pure substances. Incompressible substances. Steam tables, quality. Gas tables.
5. First law for control volumes.
6. Second law and entropy. Kelvin-Planck and Clausius statements. Kelvin temperature scale. Carnot cycle.
7. Second law analysis of closed systems and control volumes. Irreversibility.
8. Availability analysis for closed systems and for control volumes

EMCH 371 – Engineering Materials* (pre: ENCP 260)
Structures and properties of engineering metals, ceramics, and polymers; atomic bonding, crystalline structures and microstructures; mechanical behavior and deformation mechanisms; processes for controlling structures and properties; corrosion.
Outcomes:
1. Students will demonstrate an understanding of the nature of bonding in solids and how the bonding relates to the macroscopic behavior.
2. Students will demonstrate a rudimentary knowledge of how materials can be “engineered” through alloying, heat treatment, or other types of processing to produce desired properties.

3. Students will demonstrate an understanding of how materials selection is critical to optimization of a device or structure.
4. Students will demonstrate an understanding of the basic experimental techniques used in materials characterization

Topics Covered:
1. Primary and secondary bonding
2. Arrangement of atoms in solids
3. Elastic moduli
4. Stress/strain behavior of ductile materials
5. Fracture and fracture toughness
6. Time dependent phenomena
7. Phase diagrams: thermodynamics
8. Heat treatment: kinetics
9. Corrosion/oxidation/abrasion/wear

<u>Year 3</u>

ELCT 221 – Circuits (pre: MATH 142)
Linear circuit analysis and design.
Outcomes:
1. Students will reliably demonstrate the knowledge of Kirchhoff's Current and Voltage Laws (KCL and KVL)
2. Students will reliably demonstrate the ability to solve DC circuits using nodal and mesh analysis and Thevenin and Norton transformations.
3. Students will reliably demonstrate the ability to find the complex impedances of network components.
4. Students will reliably demonstrate the ability to solve AC circuits using the complex forms of KCL, KVL, nodal and mesh analysis as well as Thevenin and Norton transformations.
5. Students will demonstrate the ability to using PSPICE and MATLAB for DC and AC circuit analysis.

Topics Covered:
1. Circuit variables and elements
2. Simple resistive circuits
3. Techniques of circuit analysis
4. Operational amplifier
5. Inductance, capacitance, and mutual inductance
6. Response of first-order RL and RC circuits
7. Response of second order RLC circuits
8. Sinusoidal Steady-state analysis
9. Sinusoidal Steady-state power calculations

EMCH 327 – Design of Mechanical Elements* (pre: ENCP 260)
Design against static failure and fatigue failure of structural members and machine parts: design and selection of components including fasteners, welds, shafts, springs, gears, bearings, and chain drives.
Outcomes:
1. Students will demonstrate the ability to formulate stress analysis problems in multidimensions and to estimate principal stresses.
2. Students will demonstrate the ability to apply multi-dimensional static failure criteria in the analysis and design of mechanical components.

3. Students will demonstrate the ability to apply stress-life fatigue failure criteria in the analysis and design of mechanical components.
4. Students will demonstrate the ability to design a structural joint such as produced by welding, bolting or riveting.
5. Students will demonstrate the ability to select mechanical elements such as bearings, gears, chain drives and shafts for rotating machinery elements.

Topics Covered:
1. Stresses in Mechanical Elements
2. Stress-based Static Design Criteria
3. Stress-Life Fatigue Design Criteria
4. Structural Joints
5. Rotating Machinery Elements

ENCP 310(210) – Dynamics (pre: ENCP 200 with a C or better)
Kinematics of particles and rigid bodies. Kinetics of particles with emphasis on Newton's second law: energy and momentum methods for the solution of problems. Applications of plane motion of rigid bodies.
Outcomes:
1. Students will demonstrate the ability to describe and analyze the kinematics of particles and rigid bodies.
2. Students will demonstrate the ability to describe and analyze the kinetics of particles and kinetics of rigid bodies in plane motion using Newton's Second Law.
3. Students will demonstrate the ability to describe and analyze the kinetics of particles using energy and momentum methods.

Topics Covered:
1. Dynamics of Particles - introduction to dynamics, kinematics of particles, kinetics of particles, kinetics of systems of particles;
2. Dynamics of Rigid Bodies – plane kinematics of rigid bodies, plane kinetics of rigid bodies

ENGR 334 – Quality Planning and Control* (pre: STAT 509)
Introduction to quality management philosophies, tools, and approaches. Six Sigma philosophy, roadmap, tools, and techniques of planning and executing quality improvement programs and the LEAN continuous improvement approach that focuses on reducing waste. Application of Design for Six Sigma approach to design or improve products and processes.
Outcomes:
1. Students will demonstrate an understanding of the importance of methodology of controlling quality in manufacturing. Methodology includes statistical thinking, statistically based tools, precision measurement, quality planning, the Six Sigma approach and Total Quality Management techniques.
2. Student will explain the nature of variation in the design and manufacture of products and the statistically based methods used to characterize and reduce this variation.
3. Students will select and apply the appropriate methodologies to examine quality related issues in a variety of manufacturing or business process situations, design an approach to gather data and reach conclusions, and make recommendations to resolve the issue or plan further actions.
4. Students will use and apply precision measurement tools and statistical analysis of the measurement system.
5. Students will understand how to successfully select and apply the tools and concepts of business excellence and quality management system models within a team model.

6. Students will understand quality planning methods and develop a quality plan for a manufactured product.

Topics Covered:
1. Quality improvement in the modern business environment
2. Describing variation, discrete distributions, continuous distributions, probability plots, approximations
3. Sampling distributions, point estimation of process parameters, statistical inference for a single sample/two samples
4. Methods and philosophy of statistical process control
5. Control charts for variables
6. Control charts for attributes
7. Process and measurement system capability anaylsis

EMCH 360 – Fluid Mechanics* (pre: MATH 241, ENCP 200 with a C or better)
Mechanical engineering applications of fluid statics and dynamics. Conservation of mass, momentum, and energy. Similitude and dimensional analysis, open channel flow, lift and drag. Introduction to turbulent flow.
Outcomes:
1. Students will demonstrate the ability to use conservation principles (mass, momentum, energy, Bernoulli, work-energy) to analyze a variety of problems in fluid statics and dynamics.
2. Students will demonstrate the ability to apply conservation principles in the design of simple processes involving fluid statics and dynamics.
3. Students will demonstrate the ability to use dimensional analysis for organization and rationalization of experimental data and for scale-up or scale-down of processes involving fluid flow.

Topics Covered:
1. Introduction to Fluid Mechanics: Fluid properties and ideal gas law
2. Fluid Statics
3. Elementary Fluid Dynamics
4. Fluid Kinematics
5. Integral Analysis of Fluid Flow
6. Differential Analysis of Fluid Flow
7. Similitude and Dimensional Analysis
8. Brief Introduction to Viscous Flow: Boundary Layer and Turbulence

ENGR 361 – Instrumentation, Measurements, & Statistics* (pre: STAT 509, PHYS 212, ELCT 221; co: ENCP 260, ENCP 290)
Principles of measurement, analysis of data, experimental planning. Correlations of experimental data, experimental variance, and uncertainty analysis. Lab and lecture.
Outcomes:
1. Students will demonstrate the ability to organize and write a laboratory report.
2. Students will demonstrate the ability to organize and give an oral presentation.
3. Students will demonstrate the ability to explain the operating principles of common instrumentation and interpret the output.
4. Students will demonstrate the ability to apply statistical skills in creating an experiment and interpret the results.

Topics Covered:

1. Organizing and writing the laboratory report
2. Presentation of data and uncertainty analysis
3. Linear measurements
4. Electrical measurements
5. Measurement of dynamic systems
6. Linear regression and curve fitting
7. Organizing and making the technical oral presentation
8. Thermodynamic and heat transfer measurements.
9. Force, Stress, strain and torque measurements
10. Designing an experiment for measuring specified parameters

BADM 371 - Principles of Management and Leadership (pre: Junior standing)
This course focuses on the basic principles of management used by all types of organizations. It serves to provide a foundation of knowledge concerning the theoretical framework of management as well as integrating the practical concerns of reality. Contemporary issue topics and exercises are used to help students synthesize course materials and apply the management concepts and theories. Emphasis and understanding of leadership principles are an integral part of the course. After completion of this course, students should be able:

1. To gain understanding of the nature of management, including study of the four management functions, namely planning, organizing, leading, and controlling, and the concepts of efficiency and effectiveness.
2. To acquaint the student with the historical forces that have influenced management and to gain an understanding of the complexity and importance of managing in today's global environment.
3. To examine the general, task, and internal environments of an organization, including discussion of corporate culture, managerial ethics, and corporate social responsibility.
4. To comprehend the planning process and its link to organizational mission, strategic goals, tactical goals, and operational goals, including a general understanding of the strategic management process, strategy formulation, and strategy implementation.
5. To gain and understanding of the decision making process and its importance to effective management.
6. To explain the fundamental issues in organizing, including chain of command, line and staff, formalization, work specialization, delegation process, span of management, and centralization/decentralization.
7. To cover the basic approaches for structural design of the organization and to understand the relationship between structural design and achievement of strategic objectives.
8. To comprehend the nature of organizational change and the concept of managing the process and overcoming resistance.
9. To gain an understanding of the relationship between human resource management (HRM) and strategic planning, including coverage of major laws and social trends that impact HRM.
10. To understand the complex issues relating to managing cultural diversity in the organization.

11. To discuss the nature of leadership, including the trait, behavioral, and situational approaches with their major respective theoretical basis.
12. To comprehend the nature of motivation including the content theories, process theories, and reinforcement theory of motivation.
13. To explain the nature and importance of communication in the organization, including the communication process and barriers to communication as well as the concept of active listening.
14. To gain an understanding of teamwork in organizations. Include concepts of team formation and stages of development, roles within teams, team cohesiveness, and team conflict along with its causes and styles for resolving it.
15. To understand the importance, purpose, and levels of control in organizations including the steps in the control process and to discuss structural, operations, and financial control, including preliminary, screening, and post-action control forms in operations control.
16. To participate appropriately in other assignments used to enhance the learning process.

ENGR 380 – Introduction to Systems Engineering* (pre: MATH 242, STAT 509, ENGR 334)
An integrated introduction to systems methodology, design, and management. An overview of systems engineering as a professional and intellectual discipline, and its relation to other disciplines, such as operations research, management science, and economics. An introduction to selected techniques in systems and decision sciences, including mathematical modeling, decision analysis, risk analysis, and simulation modeling. Overview of contemporary topics relevant to systems engineering such as reengineering and total quality management. Elements of systems management, including decision styles, human information processing, organizational decision processes, and information system design for planning and decision support.

<u>Year 4</u>

ENGR 316 –Control Systems (pre: MATH 242, ENGR 330, ELCT 221)
An introduction to closed-loop control systems; development of concepts, including transfer function, feedback, frequency response, and system stability by examples taken from mechanical engineering practice; control system design methods. Also an introduction to programmable logic controllers (PLCs).
[EMCH 516 Control Theory]
Outcomes:
1. Students will demonstrate understanding of the basic concepts of feedback control systems and design and analysis methods.
2. Students will demonstrate the ability to apply the classical control theory in the design of mechanical engineering systems.

Covered Topics:
1. The use of Laplace transform for engineering computation
2. Modeling of mechanical systems with sensors and actuators using block diagrams
3. Time response of electromechanical systems
4. Programmable logic controllers
5. Performance indicators for time response of electromechanical systems; steady state errors and response stability
6. System ID, poles, zeros, stability modeling and stability criteria
7. Feedback, servomotor control, steady-state feedback errors
8. PID controllers, phase compensators, filters and prefilters

9. Root locus techniques for feedback control analysis and design
10. Frequency response and transfer function analysis; Bode diagram
11. Nyquist (polar) plots, stability criteria, gain and phase margins
12. Frequency response methods for feedback control analysis and design
13. MATLAB single-input single-output (SISO) control system design tools
14. MATLAB SIMULINK control system design tools

PHIL 325 - Engineering Ethics*

An investigation of ethical issues in engineering and engineering-related technology. Topics include whistleblowing, employee/employer relations, environmental issues, issues related to advances in information technology, and privacy. Engineering ethics involves two related skills: the ability to analyze complex socio-political problems concerning the design, manufacturing, and use of technologies and their technological systems and the ability to communicate reasonably and persuasively about such analyses. In this course we develop both sets of skills through lectures, discussions, written and oral assignments, focusing on the examination of several case studies concerning real technologies in society.

Outcomes:

1. Identify the source and function of values through the investigation of technology in society.
2. Demonstrate an understanding of the importance of values, ethics, and social responsibility for the self and contemporary society within the framework of the engineering profession.
3. Demonstrate the ability to reflect on how values shape personal, professional, and community ethics and decision-making.
4. Identify and demonstrate appropriate means of communication for varied audiences and purposes.
5. Demonstrate the ability to reason clearly in speaking and writing to inform, persuade, and exchange views.
6. Articulate a critical and informed position on an issue and engage in productive and responsible intellectual exchanges that demonstrate the ability to grasp and respond to other positions as well as set forth their own.

Topics Covered:

1. Framing engineering ethics
2. Ethical Theories
3. Public Speaking
4. Reasoning and presenting case studies

ENGR 421 – Engineering Economics & Finance* (pre: ECON 221 or 222)

Decision making with respect to capital goods, with emphasis on such decision making in governmental activities and public utilities. Intended primarily for engineering students, the course emphasizes the types of investment decisions that engineers are often called upon to make.

Outcomes:

1. To introduce each student to the basic engineering economic concepts including time value of money, the meaning of equivalence, rate of return comparisons, replacement analysis, economic life, and the cost of government.
2. To give students a sound introduction to cost and revenue estimation and economic modeling in order to permit them to select the best alternative using bother engineering and economic criteria.
3. Students will demonstrate the ability to analyze situations and apply appropriate techniques to solve problems

Topics Covered:

1. Time value of money
2. Equivalence
3. Geometric gradients and spreadsheets

4. Present worth
5. Equivalent annual worth
6. Rate of return
7. Benefit/cost ratios
8. Constrained project selection
9. Mutually-exclusive alternatives
10. Replacement analysis
11. Depreciation
12. Income taxes
13. Uncertainty and probability

BADM 494 Project Management (pre: BADM 371)
A study of general principles of project management which includes concepts related to management of technology, people, stakeholders and other diverse elements necessary to successfully complete the project. The student will explore both technical and managerial challenges involved in managing projects.

Project Management Learning Objectives include the following:

1. Understand the nature of project management.
2. Understand the major knowledge areas and processes. The historical development and framework of the labor movement in America.
3. Provide an overview of the various certifications and their importance related to project management and the global business environment.
4. Provide experience with MS Project Software.
5. Utilize cases, readings, and/or exercises as applicable to gain further perspective of project management.

ENGR 498 - Capstone Design I*
An integral part of the education provided to undergraduates in engineering is a senior two-semester course sequence in "capstone" design. The objectives of the sequence are to:

1. Require application of the knowledge gained in earlier courses to the design process.
2. Familiarize the student with the engineering design process: Definition, Synthesis, Analysis and Implementation.
3. Improve communication skills.
4. Promote organizational skills.
5. Stress importance of other influences on design such as economics, reliability, performance, safety, ethics and social impacts.
6. Simulate the post graduate job environment.

The design projects are selected from problems submitted by the students, faculty and local industry. Industry projects are given preference since these projects are best suited for meeting the course objectives.

ENGR 499 – Capstone Design II*
An integral part of the education provided to undergraduates in engineering is a senior two-semester course sequence in "capstone" design. The objectives of the sequence are to:

1. Require application of the knowledge gained in earlier courses to the design process.
2. Familiarize the student with the engineering design process: Definition, Synthesis, Analysis and Implementation.
3. Improve communication skills.
4. Promote organizational skills.
5. Stress importance of other influences on design such as economics, reliability, performance, safety, ethics and social impacts.
6. Simulate the post graduate job environment.

The design projects are selected from problems submitted by the students, faculty and local industry. Industry projects are given preference since these projects are best suited for meeting the course objectives.

Technical Electives

EMCH 354 – Heat Transfer* (pre: MATH 242, ENCP 290, EMCH 360,)
One- and two-dimensional steady and unsteady conduction; free and forced convection; boiling and condensation; heat exchangers.
Outcomes:
1. Differentiate among three basic modes of heat transfer.
2. Analyze thermal systems. They will be able to assess the feasibility of a design and estimate efficiency of a configured system.
3. Apply calculus and linear algebra procedures appropriate to solve specific heat transfer problems in an engineering setting
4. Identify important engineering terms and basic thermal concepts to be used in other engineering courses.

Topics Covered:
1. Introduction to heat transfer
2. Introduction to conduction
3. 1-D Steady state conduction
4. 2-D Steady state conduction
5. Transient conduction
6. Radiation: processes and properties
7. Introduction to convection
8. Boiling and condensation
9. Heat exchangers

ENGR 454 – Unit Operations* (pre: EMCH 354, EMCH 360, ENCP 290)
This course presents the standard unit operations in chemical and metallurgical systems and discusses the principles governing fluid flow, heat transfer, mass transfer, thermodynamic and mechanical processes. The design and operation of the devices for these unit operations is emphasized and the course will discuss the application to such areas as fluid transportation, evaporation, distillation, refrigeration and solids.

EMCH 377 – Manufacturing Processes (pre: EMCH 371)
Basic principles of metal processing; applied mechanics of metal cutting and forming; cost analysis of manufacturing operations.
Outcomes:
1. Students will describe a variety of major manufacturing processes, such as casting, bulk metal working, plastics processing, machining and welding.
2. Students will apply concepts from engineering materials, heat transfer, fluid mechanics and solid mechanics to understand the origin of, and to estimate the value of, the relevant process parameters for major manufacturing processes.
3. Students will demonstrate understanding of quality concepts including the Taguchi Loss Function and Shewhart Control Charts.
4. Students will use Shewhart Control Charts and associated statistics to identify in control and out of control processes.

Topics Covered:
1. Metal Casting
2. Metal Forming
3. Plastics Processing
4. Machining
5. Process Selection and Economics
6. Design for Manufacturing Considerations

ENGR 477 – Advanced Manufacturing (co: ENGR 334)
In-depth study of the planning and method of selection and sequencing of various chip generating and assembly processes in order to produce a product with the highest usable quality at the lowest cost. Workplace design, assembly, and inspection features and positioning devices analyzed. Advanced techniques involving robotics and computers used in developing manufacturing processes.
Outcomes:
1. Students will design and implement robotic applications for manufacturing processes
2. Students will write and implements numerical control and computer numerical control programs.
3. Students will understand and apply the concepts of a safe work environment
4. Students will interpret and analyze dimensions and tolerances on an engineering drawing
5. Students will distinguish the essential skills necessary for success in teamwork and in communication.
6. Students will apply process planning, group technology, and stochastic analysis to determine optimal plant layout and part sequence
7. Students will identify and implement the most effective methods of material handling.
8. Students will identify the key elements of the professions’ code of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world

Topics Covered:
1. Robotics
2. Numerical Control Programming
3. OSHA in the workplace
4. Geometric Tolerances
5. Group Technology
6. Process Planning
7. Queuing Theory
8. Material Handling
9. Virtual Manufacturing

STAT 510 – Statistical Quality Assurance (pre: STAT 509 with C or better)
Basic graphical techniques and control charts. Experimentation in quality assurance. Sampling issues. Other topics include process capability studies, error analysis, estimation and reliability.
Outcomes:

1. Develop and demonstrate the ability to collect and analyze data in order to monitor and improve quality, and clearly communicate those findings.

Topics Covered:

1. Linear Regression, SLR, Multiple Regression
2. Analysis of Variance (ANOVA): one-factor and multi-factor experiments
3. Statistical Quality Control: Variables Control Charts, Attributes Control Charts

MGMT 475 Production/Operations Management (pre: BADM 296 and BADM 371)
A study of the strategic, operating, and control decisions involved in manufacturing and service organizations. Topics include forecasting, process development, production technology, resource allocation, facility planning, facility layout, planning systems, inventory systems, resource requirements planning systems, shop floor planning, scheduling operations, just-in-time manufacturing, materials management, productivity control, quality management, quality control, project management, and maintenance management. Students will be able to:

1. Understand the role of operations function in the organizations
2. Understand the relationship between operations function and supply chain
3. Learn to compute basic performance measures for the line
4. Learn to create to process maps for a business process
5. Learn to calculate and interpret measures of process performance
6. Learn to apply expected value and break-even analysis, decision trees, learning curves, the Theory of constraints, waiting line theory and Little's law.
7. Learn to calculate percentage of perfect orders and landed costs
8. Learn to use Microsoft Excel Solver function
9. Learn to apply optimization modeling techniques to the S&OP process
10. Learn to compute economic order quantity, reorder point, best order quantity for various types of inventory systems
11. Understand the common approaches to improving product/service design – Define-Measure-Analyze-Design-Verify, quality function deployment, design for manufacturability and target costing

9. **ASSESSMENT**

a) Student Learning Outcomes

ABET requires the following student learning outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) 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
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

b) Programmatic Assessment:

USC Aiken will take the following measures to assess the engineering program:

1. Continue the engineering advisory board that consists of engineers from local businesses and industry. The role of the advisory board will be to help USCA review the curriculum, review assessment data, and provide recommendations to ensure our graduates remain relevant to local business and industry.
2. Monitor the number of majors and program graduates.
3. Survey employers of our engineering graduates.
4. Survey our graduates.
5. Monitor the number of graduates who obtain Professional Engineering Certification.
6. Regularly monitor facilities and equipment.

c) Data Driven Programmatic Changes:

1. Student and program data will be reviewed on an annual basis and changes made as appropriate.
2. Although ABET will not accredit a program until there are program graduates, USCA will seek accreditation as soon as it can. As with all accreditation processes, this will provide another form of program assessment.

10. **FACULTY**

a) Faculty List

Table B – Engineering Faculty List

List Staff by Rank	Highest Degree Earned	Field of Study	Teaching in Field (Yes/No)
Assistant Professor #1	Ph.D.	Mechanical Engineering	Yes
Assistant Professor #2	Ph.D.	Industrial/Process Engineering	Yes
Assistant Professor #3	Ph.D.	Industrial/Process Engineering	Yes

b) New Faculty:

USC Aiken will hire two additional tenure track faculty for the program. Expectation is for each to have a terminal degree (Ph.D.) in Industrial Engineering or other engineering discipline that supports the program. One hire will be made for Fall 2015 and one for Fall 2016.

c) *Existing Faculty:*

Currently, USCA has one tenure track faculty member on staff who currently teaches the freshman and sophomore level engineering classes for our current two year program. The business/management classes, (Engineering Economics and Finance, Supply Chain Management and Logistics, Business Relationships) will be taught by current faculty in the School of Business. Classes will be part of current teaching load. If necessary, qualified part-time faculty will be used to teach classes.

d) *Faculty Development:*

Each unit on campus is allocated $400 per full time faculty member for professional development. In addition to this amount, the university, through it's partnership funds, has provided additional funding that faculty can apply for. This amount has averaged approximately $65,000/year over the past five years. Therefore faculty, on average, get approximately $800-$1000 for professional development activities.

e) *Full-time Equivalent Definition:*

A full-time equivalent faculty member for a full-time instructor, tenure track and tenured faculty at USCA teaches 12 contact hours each fall and spring semester for a total of 24 contact hours per academic school year. This normally equates to 4 courses each semester.

f) Unit Administration, Faculty, and Staff Support:

UNIT ADMINISTRATION, FACULTY, AND STAFF SUPPORT						
YEAR	NEW		EXISTING		TOTAL	
	Headcount	FTE	Headcount	FTE	Headcount	FTE
Administration						
2015-2016			1	.5	1	.5
2016-2017			1	.5	1	.5
2017-2018			1	.5	1	.5
2018-2019			1	.5	1	.5
2019-2020			1	.5	1	.5
Faculty						
2015-2016	1	1	1	1	2	2
2016-2017	1	1	2	2	3	3
2017-2018			3	3	3	3
2018-2019			3	3	3	3
2019-2020			3	3	3	3
Staff						
2015-2016			1	.33	1	.33
2016-2017			1	.33	1	.33
2017-2018			1	.33	1	.33
2018-2019			1	.33	1	.33
2019-2020			1	.33	1	.33

11. <u>**PHYSICAL PLANT**</u>

a) Existing Facility

USCA has six buildings that house academic units. There are 41 classrooms, 5 auditoriums, 14 labs, and 8 computer classrooms that are designated as academic areas. All classrooms and auditoriums are wired for computers and have LCD projection systems. The 8 computer classrooms house 141 computers.

The program will be part of the Department of Mathematical Science which is housed in the Penland Building. Engineering classes will continue to be held in the Penland Building as they have for the past 25 years. Classroom space is adequate.

b) Facility Modification

A classroom has been identified that will be outfitted with lab tables and electricity to accommodate for additional engineering activities. Additional lab space is available in the science building in the physics classroom if needed. Funding for this modification will be a reallocation of internal resources as well as some external funding that has been raised for the program.

12. EQUIPMENT

The following materials/equipment/software will be purchased over the next few years to support the program:

Software – Pro/ENGINEER (Creo Parametric), MatLab - $75,000
Measuring Equipment - $25,000
Laboratory Equipment - $65,000
3D Printer - $125,000
Large Format Printer - $5,000
Additional Equipment/materials to be identified - $50,000

13. LIBRARY RESOURCES

a) Current Holdings:

Library Resources for New Program Proposal: B.S. in Industrial Process Engineering

The Gregg-Graniteville Library occupies a recently renovated two-story 40,000 square foot building situated on the main university quadrangle. The Gregg-Graniteville Library is an official depository for Federal and South Carolina documents. The library is open 78 hours per week with variations during exam periods, inter-sessions, summer terms, and holidays.

a) qualitative and quantitative assessment of current holdings in view of the program being proposed.

The Gregg-Graniteville Library collection currently contains:

Print Volumes (Books/Serials): 211,251	E-Books: 62,626
Microform Units: 79,896	AV Units: 4,088
Databases (including PASCAL and DISCUS): 252	E-Journals: 29,776

Our current monograph holdings (print and electronic) in areas related to Engineering, subdivided by subject include:

Technology (General) -- (Library of Congress Call# Subclass T): 724 volumes
Engineering (General) (Library of Congress Call# Subclass TA): 1119 volumes
Hydraulic Engineering (Library of Congress Call# Subclass TC): 48 volumes
Environmental Technology (Library of Congress Call# Subclass TD): 451 volumes
Highway Engineering (Library of Congress Call# Subclass TE): 13 volumes
Railroad Engineering (Library of Congress Call# Subclass TF): 16 volumes
Bridge Engineering (Library of Congress Call# Subclass TG): 17 volumes
Building Construction (Library of Congress Call# Subclass TH): 84 volumes
Mechanical Engineering (Library of Congress Call# Subclass TJ): 624 volumes
Electrical Engineering (Library of Congress Call# Subclass TK): 2029 volumes
Motor Vehicles (Library of Congress Call# Subclass TL): 348 volumes
Mining Engineering (Library of Congress Call# Subclass TN): 112 volumes
Chemical Technology (Library of Congress Call# Subclass TP): 332 volumes
Total monographs (print and electronic) holdings: 5917 volumes

A qualitative examination of the titles in the USCA collection was conducted comparing our current holdings with those in *Resources for College Libraries (RCL)*. RCL is a collaboration between *Choice*, a publishing division of the Association for College and Research Libraries (ACRL) and Bowker, a leading publisher in bibliographic authority. The RCL is the premier core list for academic libraries. *RCL* is a highly selective core list of close to 60,000 titles across subject areas representing essential texts for academic libraries, particularly for those of small liberal arts colleges. When the USCA library holdings were compared with the titles in *Resources for College Libraries*, the results in the relevant areas were as follows:

LC Classification	Total # of Volumes Owned	% of Core Titles Owned (Resources for College Libraries)
(T1-995)Technology (General)	724	9%
(TA1-2040)Engineering (General). Civil engineering (General)	1119	5%
(TC1-978)Hydraulic engineering	48	0%
(TC1501-1800)Ocean engineering	0	0%
(TD1-1066)Environmental technology. Sanitary engineering	451	12%
(TE1-450)Highway engineering. Roads and pavements	13	0%
(TF1-1620)Railroad engineering and operation	16	0%
(TG1-470)Bridge engineering	17	25%
(TH1-9745)Building construction	84	2%
(TJ1-1570)Mechanical engineering and machinery	624	5%
(TK)Electrical Engineering	2029	6%
(TL) Motor Vehicles	348	5%
(TN) Mining Engineering	112	12%
(TP) Chemical Technology	332	10%

The majority of the Engineering related collection (58%) was published between 2000 and 2010. 12% of the collection was published since 2010.Qualitatively, our current monographs collection is strongest in the areas of Sanitary Engineering, Bridge Engineering and Mining Engineering. Quantitatively our holdings are strongest in General/Civil Engineering and Electrical Engineering, Our current monographs collection needs to be strengthened to include more current and quality titles particularly in the areas of Mechanical and Electrical Engineering. This would require an estimated $5,000 additional funds per year.

Current databases or e-journal packages with Engineering-related materials currently accessible to USCA students include:

ACS Web (American Chemical Society)
Science Direct
SpringerLink
Wiley Online Library
SciFinder Scholar
MathSciNet
Web of Knowledge

Our electronic databases are not currently adequate for the proposed degree. To adequately support the degree and its emphasis on Mechanical Engineering, subscriptions to the following resources are strongly recommended:

Compendex (via Elsevier's Engineering Village platform) = $28,904
INSPEC (via Elsevier's Engineering Village platform) = $7,735
Standards and Engineering Digital Library (SEDL) (from the American Society for Testing and Materials (ASTM) = $16,200
American Society of Mechanical Engineers (ASME) Journal Package = $8,511

Should the degree continue to expand to include more of a focus on Electrical Engineering, the following resource should also be adopted:
Institute of Electrical and Electronics Engineers (IEEE) Digital Library

The prices quoted here are for 2014. Database costs generally rise 3-6% annually.

Current journal holdings
The library currently subscribes directly to four serial subscriptions in the area of Engineering including:

Chemical Engineering | *Civil Engineering*
IEEE Spectrum | *Mechanical Engineering*

In addition to these titles, USCA faculty and students have access to approximately 1,428 other serial titles relevant to Engineering through our full-text databases and consortial journal packages.

b) New Acquisitions

	1st year	2nd year	3rd year	4th year	5th year	Total
Monograph purchases	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$25,000**
Database subscriptions	**$61,350**	**$61,350**	**$61,350**	**$61,350**	**$61,350**	**$306,750**
TOTAL	**$66,350**	**$66,350**	**$66,350**	**$66,350**	**$66,350**	**$331,750**

c) PASCAL:
USCA maintains a formal written agreement with all universities and colleges in South Carolina, the Partnership Among South Carolina Academic Libraries (PASCAL http://pascalsc.org/), which supports both consortial purchasing of databases and statewide borrowing of materials. PASCAL Delivers provides for reciprocal library borrowing among private and public colleges/universities throughout the state. It is supported by a statewide courier service which makes book deliveries to campuses five days a week. The majority of our databases relevant for the proposed degree are not impacted by PASCAL.

Additional services
Using ILLIAD, a web-based Interlibrary Loan system, librarians fill requests for articles or documents that are scanned and transmitted via Ariel software. USC Aiken belongs to the KUDZU Consortium of southeastern libraries, providing delivery of items not available within the state to faculty and students within a few days.

The library maintains an active program of research assistance and instruction. The library faculty support classroom instruction in the disciplines and offer both general and course-specific library instruction. Instruction sessions are tailored to the needs of the course and the specific requirements of individual faculty members with the stated purpose of enabling all members of the college community to achieve information literacy in preparation for lifelong learning in a changing and global society.

14. **ACCREDITATION, APPROVAL, LICENSURE, OR CERTIFICATION**

a) Accreditation:

USC Aiken will seek accreditation from ABET the Accrediting Board for Engineering and Technology. According to the ABET web-site (http://www.abet.org/accreditation-timeline/) it takes approximately 18 months to complete the accreditation process. The process can be initiated once the first students graduate from the program. Under the proposed timeline, the first students could graduate in spring 2017. According to the ABET guidelines the accreditation process includes the following:

a. Readiness Review (one year before on-site visit)
b. Request for Evaluation (nine months prior to visit)
c. Self Study Report (six months prior to visit)
d. On-site visit
e. Draft statement provided by ABET (two to three months after visit)
f. Institutional response to draft statement (three to four months after visit)
g. Institution receives accreditation notification (August)

b) Licensure:

According to the National Society of Professional Engineers web site (http://www.nspe.org/resources/licensure/what-pe), to become a licensed engineer a person must:

☐ Earn a four-year degree in engineering from an accredited engineering program
☐ Pass the Fundamentals of Engineering (FE) exam
☐ Complete four years of progressive engineering experience under a PE
☐ Pass the Principles and Practice of Engineering (PE) exam

The first graduates of USC Aiken's engineering program will be eligible to take the engineering exam in 2021.

c) Teacher Preparation – Not applicable.

15. **ARTICULATION**

a) Associate-level to Baccalaureate:

Not applicable. USC Aiken does not offer an associates degree.

b) Entry from two-year institutions:

USC Aiken has developed the program so that the students in the pre-engineering program at Aiken Technical College can transfer into the program without losing any credit. A formal memorandum of understanding between USC Aiken and ATC is included in the appendix. Because Aiken Technical College is within the technical college system of South Carolina, those courses that are accepted via the articulation agreement with Aiken Technical College, will also be accepted from other technical colleges within the South Carolina Technical College System.

c) Terminal degree:

This degree is not a terminal degree.

d) MOUs:
USC Aiken has signed a MOU with Aiken Technical College. Students in ATC's pre-engineering program will be able to transfer into USC Aiken's engineering program without losing any credit.

Additionally, for the past 25 years, USC Aiken has offered a two-year pre-engineering program where students could transfer to USC Columbia's engineering program. Students will still be able to transfer to USC Columbia after successfully completing the first two years of this program.

e) Explanation:
USC Aiken will continue to offer the pre-engineering program for those students wanting to transfer to USC Columbia. USC Aiken has a MOU with Aiken Technical College for students in their engineering program to transfer into our program.

f) Articulation with the South Carolina Transfer and Articulation Center
Within 18 months of the implementation of a new academic program, articulation information regarding the program will be posted to the online South Carolina Transfer and Articulation Center as required by CHE.

16. ESTIMATED COSTS AND SOURCES OF FINANCING

a) Estimated Costs and Financing

Table D – Estimated Costs and Sources of Financing by Year

ESTIMATED COSTS BY YEAR					
CATEGORY	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Program Administration	45,720	47,090	48,500	49,960	51,460
Faculty Salaries	407,250	544,560	560,470	577,470	594,830
Part-Time Faculty Salaries	15,000	15,480	15,960	16,440	16,920
Graduate Assistants	-	-	-	-	-
Clerical/Support Personnel	14,980	15,430	15,890	16,370	16,860
Supplies and Materials	100,000	125,630	128,770	131,990	135,290
Library Resources	66,350	68,010	69,710	71,450	73,230
Equipment	345,000	51,250	52,530	53,840	55,190
Facilities	50,000	50,000	-	-	-
Other (Identify)	-	-	-	-	-
TOTALS	**1,044,300**	**917,450**	**891,830**	**917,520**	**943,780**
SOURCES OF FINANCING BY YEAR					
Tuition Funding	765,720	897,400	928,000	958,600	990,220
Program-Specific Fees	27,750	35,850	35,850	35,850	35,850
State Funding*	-	-	-	-	-
Reallocation of Existing Funds**					
Federal Funding	-	-	-	-	-
Other Funding (Specify)***	250,830				
TOTALS	**1,044,300**	**933,250**	**963,850**	**994,450**	**1,026,070**
FUND BALANCE IMPACT	**-**	**15,800**	**72,020**	**76,930**	**82,290**

***Private sources

b) Assumptions

- We expect to maintain approximately 100 students in the program. To be conservative, we are assuming all students will be paying in-state tuition.
- Uses current tuition rate of $9018/year and 3% increase each year of program.
- Establishes a $100 majors fee for freshman/sophomores.
- Establishes a $300 majors fee for juniors/seniors
- Establishes a $10/credit hour lab fee for 100/200 level engineering courses
- Establishes a $25/credit hour lab fee for 300/400 level engineering courses

c) Special State Appropriations

USC Aiken does not plan to request additional state appropriations.

d) Institutional Funding and Other Sources

Funding for the program is from three sources; reallocation of current general revenue, tuition generated from engineering majors, and private sources of funding. Since USC Aiken already has a pre-engineering program, classroom and lab space already exists to support the program. The addition of two new faculty members will be accomplished by reallocating funds to convert a current instructor slot in mathematics to a tenure track engineering slot. The second new faculty member will be funded through reallocation of existing funds. These are reflected in the budget table.

To date USC Aiken has raised over $400,000 (URS and Savannah River Remediation) in support of the program to help purchase lab equipment and materials to support the upper level courses. Additionally USC Aiken has a pledge for $250,000 for an endowed chair. Once the program is approved, USC Aiken believes it will be able to raise significant additional funding to support the program.

$400,000 – pledged and partially paid from URS and Savannah River Remediation
$50,000 minimum annually – Savannah River Nuclear Solutions Engineering Scholarships
$72,000 - XXX Engineering Program Endowment Fund
$250,000 planned gift -XXX Engineering Endowed Professorship
$1,000 annually – Society for Mechanical Engineers
$25,000 – XXX Engineering Scholarship Endowment
$20,000 – XXX Engineering Scholarship Endowment
$10,000 – BAE Engineering Scholarship Endowment

XXX = local citizens who have committed to these Endowments.

In addition, local business/industries have indicated they are willing to offer lab space if needed in the future.

17. **PROGRAMS FOR TEACHERS AND OTHER SCHOOL PROFESSIONALS**

Not applicable to this proposal.