

Proposing Institution

South Carolina State University

Title of Proposed Program

Bachelor of Science in Industrial Engineering

Submission Date

September 15, 2014

Mr. Thomas J. Elzey, President

South Carolina State University

300 College Avenue

Orangeburg, South Carolina 29117

Contacts:

Dr. Kenneth, Lewis, Dean
College of Science, Mathematics, Engineering & Technology
803-536-8860; kewis31@scsu.edu

Dr. W. Franklin Evans, Interim Provost
803-536-7180; wevans1@scsu.edu

Program Modification Proposal

Classification

Program Title:	Bachelor of Science in Industrial Engineering
Concentrations, Options, and Tracks:	None
Academic Unit Involved:	Department of Industrial and Electrical Engineering Technology, College of Science, Mathematics, Engineering and Technology
Designation, Type, and Level of Degree:	Bachelor of Science in Industrial Engineering (BSIE), Four-year undergraduate
Proposed Date of Implementation:	Fall Semester, 2015
CIP Code:	150612
Site:	South Carolina State University, Orangeburg, SC
Program Designation:	Bachelor of Science
Program Qualifies for Supplemental Palmetto Fellows and Life Scholarship Awards:	Yes
Delivery Mode:	Traditional
Area of Certification	N/A

Institutional Approval

Department of Industrial and Electrical Engineering Technology:	February 19, 2014
Dean:	February 20, 2014
Educational Policies Council:	February 27, 2014
Faculty Senate:	March 12, 2014
Board of Trustees:	April 3, 2014
President:	April 3, 2014

Purpose

South Carolina State University (SCSU) requests approval of a Bachelor of Science in Industrial Engineering degree (BSIE). The objective of this program is to modify the existing ABET-accredited Industrial Engineering Technology (IET) program at South Carolina State University (SCSU) to Industrial Engineering (IE) and to offer a BSIE to students at SCSU.

According to the Institute of Industrial Engineers official definition, IE is concerned with the design, improvement, and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems. Industrial Engineers apply engineering design to creating and improving systems that deliver products or services. For instance, an Industrial Engineer may be involved in designing a new

production plant for a car manufacturer (a product), or in designing an effective emergency room for a hospital (a service). In designing these systems, an Industrial Engineer integrates equipment, materials, energy, information, and people together to meet business objectives, while insuring product/service quality and reliability, the safety and satisfaction of customers and employees, and the effective and productive use of resources.

The purposes of this proposed program are:

1. To provide students with enhanced opportunities to be licensed or to take professional exams
2. To provide students with a professional degree leading to employment after graduation
3. To address the persistent demand for IE graduates
4. To provide continuing education opportunities for locally employed engineers
5. To promote economic development in this region by retaining and expanding local industries
6. To foster improved relationships between industry partners and SCSU

Justification

To survive and prosper in today's global markets, companies must constantly improve the quality of their products and services, the productivity of their organizations, and how quickly they can respond to changing customer needs/wants. This is what industrial engineers do. Industrial Engineers have an incredibly diverse range of career options. Career opportunities can be found in traditional manufacturing, such as automotive and electronics manufacturing, and the aviation and ship-building industries; process industries such as chemical, steel, pharmaceuticals, and paper manufacturing; construction industries; and service-oriented industries such as financial institutions, hospitals and health care, transportation and logistics, government, and business systems consulting. As firms facing global competition seek new ways to improve productivity, they will increasingly turn to industrial engineers to achieve these improvements. SCSU implemented IET program in the fall of 1985 to take steps to remedy the lack of modern industrial engineers in the state. The IET program has been accredited by ABET/TEC since 1992 and SCSU is the only institution in the state that offers an accredited Bachelor of Science in Industrial Engineering Technology (BSIET) degree program. Demands placed on IE professions in industry have increased dramatically as manufacturing and the associated supply process have become increasingly complex.

There is a shortage of engineers nationally and in South Carolina. South Carolina State University, with its deep roots in the African-American community, is certain to attract and nurture to graduation young people who would otherwise not have considered a career in engineering. It is highly probable that the university will attract federal and foundation support not available to other universities in the state of South Carolina. The national Bureau of Labor Statistics projects 10,100 new jobs between 2012-2022 and a job growth rate of about 5% nationally. It also projects that the number of Industrial Engineers is expected to grow by 6 percent between 2010 to 2020. This is higher than the average for all engineering disciplines. The growth rate and demand for Industrial Engineers in South Carolina is higher because of the influx of new industries such as Boeing, Amazon, and BMW. New Industries are demanding a diverse work force. Experience has shown that industry prefers engineering graduates. In fact, some industries will not hire engineering technology graduates at all, especially in South

Carolina. Nonetheless, the demand for IET graduates from SCSU remains high even during the current economic downturn, and over the past three years over 80% of IET graduates had either accepted a job offer or have been admitted to a graduate program at the time of graduation. Several companies, who hired IET graduates of SCSU, have been demanding qualified IE graduates based upon the quality of performance of our graduates. For example, the Boeing Company in North Charleston, which has already recruited four IET graduates (two with M.S. degree) and presented seminars in the Spring semester of 2012-13 and in the Fall semester of 2013-2014 at SCSU, expressed their interest in recruiting IE graduates from SCSU rather than IET graduates. In addition, employed IET graduates consistently asked to change the IET program to an IE program.

The existing IET faculty is comprised of two Ph.Ds. in the IE discipline and one MS degree holder in IE with extensive industrial experience. The area coordinator was designated as a Governor's Distinguished Professor several years ago. Over the last two years the faculty has published twelve (12) articles in conference proceedings and professional journals. In addition, the faculty currently has four (4) active federal grants. This faculty has demonstrated that it already produces IET graduates who are equal to IE graduates. Our recent IET graduates who have attended graduate programs have earned M.S. degrees from various prominent institutions such as Virginia Polytechnic Institutes and State University, Clemson University, and Florida International University. This is a clear demonstration of the fact that our IET graduates can compete successfully in graduate IE programs anywhere. The proposed program will be able to satisfy the need for industrial engineers demanded by local business and industry.

In South Carolina, the state law will change in 2020 to prohibit Engineering Technology graduates from becoming licensed as Professional Engineers (PE). It implies that any Engineering Technology major who graduates with a B.S. degree after 2012 cannot ever become licensed as a PE in this state with just that degree. The educational requirements for being allowed to qualify to take the professional engineering licensing exam in the state of South Carolina will exclude engineering technology graduates as of 2020. This change in policy will greatly disenfranchise IET graduates who are often equally qualified and deserving of being able to earn a professional engineering license as their IE graduate counterparts. The IET program at SCSU has a history of producing high quality engineering professionals who are a credit to their organizations and to the engineering profession. It is imperative that the modification of the existing IET Program at SCSU to an IE program be allowed so that future high quality engineering professionals who are graduates will have a fair opportunity to attain professional licensure.

The mission of the College of Science, Mathematics, Engineering and Technology (CSMET) is to "produce scientists, mathematicians, engineers and engineering technologists..." and the mission of SCSU encompasses the following benefits for successful students: "... prepares highly skilled, competent, economically and socially aware graduates to meet life's challenges and demands that enable them to work and live productively in a dynamic, global society." The proposed program is aligned to the missions of the University and CSMET in its goals to produce engineers and meet the needs of local business and industry.

The proposed program does not duplicate any of the existing programs currently offered by the university. The curriculum for the proposed IE program shares a common foundation with mathematics, chemistry, physics, and common engineering subjects.

Enrollment

The proposed modification is expected to create an increase in enrollment. South Carolina State University’s internal data strongly shows that the university will experience increased enrollment in engineering disciplines as shown in the existing Nuclear Engineering program at SCSU. The alignment of academic training with current and predicted market demands in the areas related to this discipline (such as: logistics management, supply chain management, manufacturing processes, product/process efficiency, product layout, facilities layout, etc.) will attract many high performing students that are interested in pursuing careers in science and mathematics. This increase in enrollment should be visible in both the number of in-state students who are present in this program as well the number of out-of-state students. This is due to the regional and national nature of market demands for an increased number of trained industrial engineers to fill modern and predicted workforce needs.

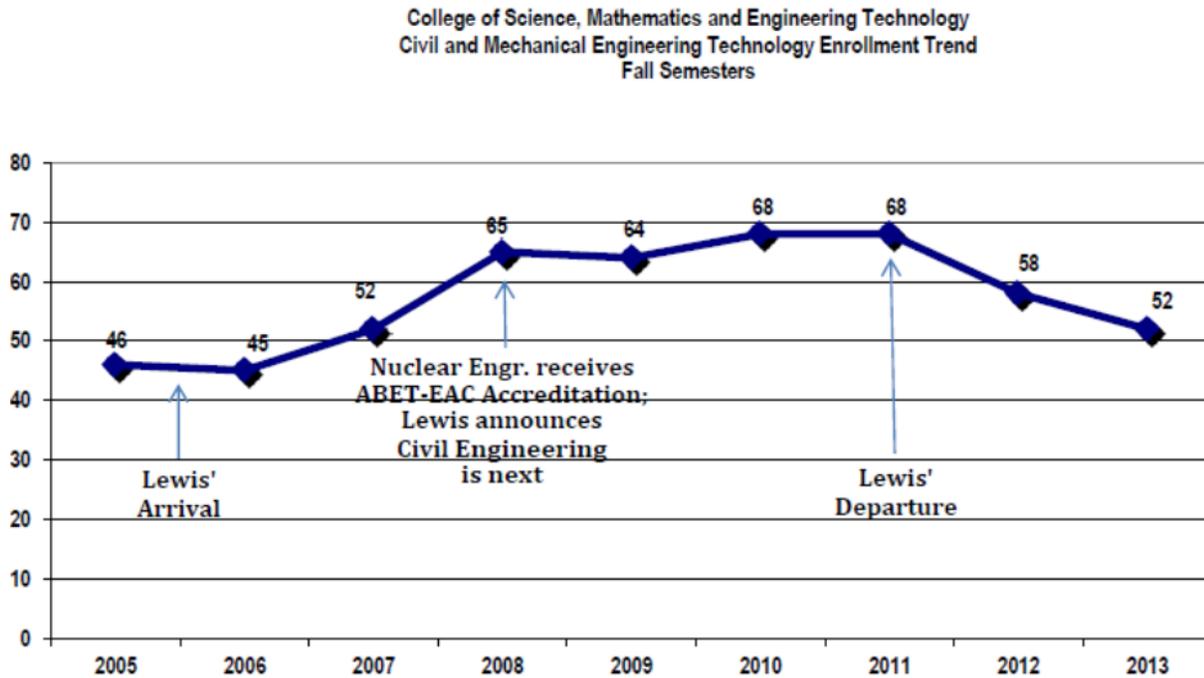
b)

Year	Estimated New Enrollment					
	Fall		Spring		Summer	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2015-16	6	96	10	160	0	0
2016-17	16	256	20	320	0	0
2017-18	30	480	32	512	0	0
2018-19	38	608	40	640	0	0
2019-20	40	640	42	672	0	0

The table below shows how the Nuclear Engineering Program at SCSU increased its enrollment between 2008 and 2012 even as the overall university’s enrollment decreased during that time.

Year	SC State Fall Enrollment	Nuclear Enrollment
2008	4888	30
2009	4538	36
2010	4362	49
2011	4326	53
2012	3807	55
2013	3461	55

The diagram below shows the increase in enrollment for the Civil Engineering Technology after an announcement was made that there was a plan to offer Civil Engineering at SCSU.



Both the Nuclear and Civil Engineering enrollment examples indicate a clear student demand and interest in engineering at this university. The implementation of the Industrial Engineering program at SCSU should create the same trend in enrollment increases.

Curriculum

- a) Below is the IE curriculum. The curriculum is designed to meet the existing EAC of ABET criteria for the Industrial Engineering program. Four new courses (which are represented in the curriculum) have been developed specifically for the program and are described in section b.

South Carolina State University Industrial Engineering Program (Total Credits: 129)			
Freshman Year - First Semester		Freshman Year -Second Semester	
Course	Credit	Course	Credit
E 150 English Composition & Comm.	3	E 151 English Composition & Comm.	3
M 153 Calculus I	3	M 163 Calculus II	3
ENGR 150 Mech. Drawing & Basic CAD	3	S 250 Public Speaking	3
ENGR 170 Intro. to Eng. Technology	3	C 150 General Chemistry I	3
PSY 250/SOC 250	3	C 151 General Chemistry I Lab	1
UNIV 101 Intro. to Univ. Comm.	2	H 250/H 251 World History	3
Total	17	Total	16
Sophomore Year - First Semester		Sophomore Year -Second Semester	
Course	Credit	Course	Credit
M 237 Calculus III	3	C 152 General Chemistry II	3
P 254 General Physics I w/Calculus	3	C 153 General Chemistry II Lab	1
P 251 General Physics I Lab	1	P 255 General Physics II w/Calculus	3
ARTS 250/MU 250	3	P 253 General Physics II Lab	1
E 250/E 251 World Literature	3	IE 201 System Design	3
ETS 250 African American History	3	IE 252 Industrial Statistics I	3
ENGR 212 Statics	3	ENGR 213 Strength of Materials	3
Total	19	Total	17
Junior Year - First Semester		Junior Year - Second Semester	
Course	Credit	Course	Credit
EE 230 Circuit Analysis	3	IE 355 Simulation Modeling	3
IE 368 Professional Practice in IE	1	IE 353 Intro. To Mfg. Systems Eng.	3
ENGR 255 Engineering Economic Analysis	3	IE 357 Industrial Operations Research I	3
ENGR 310 Engineering Computing	3	IE 356 Plant Layout and Material Handling	3
IE 352 Industrial Statistics II	3	EE 233 Circuits Laboratory	1
IE 354 Motion and Time Study	3	M 403 Differential Equations	3
Total	16	Total	16
Senior Year - First Semester		Senior Year - Second Semester	
Course	Credit	Course	Credit
IE 440 Decision Support System in IE	3	IE 460 Technical Project	3
IE 452 Statistical Quality Control	3	MGT 316 Database Management Systems	3
IE 458 Human Factors Engineering	3	ENGR 313 Dynamics	3
IE 454 Industrial Operations Research II	3	IE 456 Production and Inventory Control	3
IE 457 Facility Location	3		
IE 459 Technical Project Proposal	1		
Total	16	Total	12

b) List of new courses to be added to the existing BSJET curriculum for modification into a BSIE program curriculum:

The courses listed in this section will be added to the existing courses within the current BSJET program at SCSU in order to modify the current program curriculum into the BSIE program curriculum at SCSU. These courses have been created and approved by the university.

1. IE 368 Professional Practice in Industrial Engineering {1 credit}

Description: This course is conducted as a seminar to orient students to issues of professional practice as an industrial engineer, through a discussion of design cases, industrial problems, and professional situations, led by South Carolina State University faculty and staff, and by practicing professionals.

2. IE 201 System Design I {3 credits}

Description: This course is an introduction to the design of industrial engineering systems. Emphasis is placed on design methodologies in the context of a design process including the user or stakeholder needs identification, the design specification development, the design concept generation, evaluation and selection, design development, the prototype development and refinement, and the product delivery to the customers. A series of projects are used to apply the knowledge to real life cases.

3. IE 457 Facilities Location {3 credits}

Description: This course is designed to teach students techniques used in finding a location for a new manufacturing facility. Topics discussed are transportation, work force, tax base, educational facilities, real estate availability, recreation and others. Upon completion of the course the student should be able to use the above techniques to select a suitable location for a new facility.

4. IE 440 Decision Support Systems {3 credits}

Description: This course is an application of decision support systems arising in Industrial Engineering (IE). Emphasis is placed on the study of the design of design of decision support systems for production and service systems based on operations research models. It includes methods of decision-making and problem solving, use of spreadsheet with VBA applications, databases, and integrated VBA development environments to implement decision support systems.

Faculty

The existing faculty of the current IET program at SCSU will be used to implement the program modification for the IE program. There will be no required additional costs in terms of faculty in order to create the new BSIE program at SCSU.

Physical Plant

- a) The existing plant infrastructure of the current IET program at SCSU will be used to implement the proposed program modification. There will be no required additional costs in terms of buildings or other plant infrastructure in order to complete this modification. The new Engineering and Computer Science Complex at SCSU, as well as the other existing buildings at this University, contain all of the necessary classroom and lab space for housing the proposed modification.
- b) There will not be any additional physical plant requirements resulting from this proposed modification.

Equipment

There are not any major equipment items that will need to be purchased in order to perform the proposed modification. The equipment being used by the current program is appropriate and necessary to be applied to the modified program.

Library Resources

- a) The library has the ability to support the IET program. The close proximity between the existing IET program and the modified program with the proposed changes, will allow for the library to continue to support the necessary library related activities. There should be no diminishing effects to the overall ability of the library to function as a vital support tool for academics due to the implementation of the proposed modifications.
- b) There should not be any required independent acquisitions needed annually for at least the first five years for the modified program. The library's existing books, journals, and electronic databases should be able to fulfill the requirements for this program. Therefore the estimated costs are nonexistent.
- c) PASCAL is one of the tools that are currently available for use for the IET program. The availability and use of PASCAL will continue with the implementations of the proposed modifications.

Accreditation, Approval, Licensure, or Certification

The current program has been and is currently accredited by the Technology Accreditation Commission (TAC) of ABET. After the modification is implemented, the accrediting body will switch from TAC of ABET to the Engineering Accreditation Commission (EAC) of ABET. ABET accreditation will be pursued. The BSIE program is expected to be EAC of ABET accredited within four years of CHE approval.

Estimated Costs and Source of Financing

The existing faculty, staff, and infrastructure of the current IET program at SCSU will be used to implement the new IE program. There will be no required additional costs in terms of faculty, buildings, or other resources in order to create the new BSIE program at SCSU.

ESTIMATED COSTS BY YEAR						
CATEGORY	1st	2nd	3rd	4th	5th	TOTALS
Program Administration ¹	18,264	18,629	19,002	19,382	19,770	95,047
Faculty Salaries ²	164,761	168,056	171,417	174,846	178,343	857,423
Graduate Assistants	0	0	0	0	0	0
Clerical/Support Personnel	6,000	6,000	6,000	6,000	6,000	30,000
Supplies and Materials	2,000	2,000	2,000	2,000	2,000	15,000
Library Resources	0	0	0	0	0	0
Equipment	0	0	0	0	0	0
Facilities	0	0	0	0	0	0
Other (Identify)	0	0	0	0	0	0
TOTALS	191,025	194,686	198,419	202,228	206,112	992,469

SOURCES OF FINANCING BY YEAR						
Tuition Funding ³	58,320	131,220	225,990	284,310	298,890	998,730
Program-Specific Fees	0	0	0	0	0	0
State Funding*	0	0	0	0	0	0
Reallocation of Existing Funds**	191,025	194,686	198,419	202,228	206,112	992,469
Federal Funding ⁴	405,371	405,371	0		0	810,742
Other Funding (Adjunct faculty salary, etc.)	0	0	0	0	0	0
TOTALS	654,716	731,277	424,409	486,538	505,002	2,801,941

¹This figure includes 25% release time for the Academic Program Coordinator (APC) of the Industrial Engineering Program. A salary increase of 2% is assumed in subsequent years.

²These are salaries of the faculty of the existing Industrial Engineering Technology program and are paid from E&G budget. This includes 75% of the salary of the APC. The faculty salary raise is assumed to be 2% in each subsequent years.

³The tuition is calculated at the rate of \$3,645 per student per semester.

⁴The Industrial Engineering Technology faculty members have several pending grants amounting about \$2M that are not included here.