

**Bachelor of Science in Engineering  
to be offered by  
Indiana State University at Terre Haute**

**1. Characteristics of the Program**

- a. Campus(es) Offering Program:  
Indiana State University
- b. Scope of Delivery (Specific Sites or Statewide):  
Terre Haute, Indiana
- c. Mode of Delivery (Classroom, Blended, or Online):  
Classroom
- d. Other Delivery Aspects (Co-ops, Internships, Clinicals, Practica, etc.):  
Co-ops and Internships
- e. Academic Unit(s) Offering Program:  
Department of Applied Engineering and Technology Management in the College of Technology

**2. Rationale for the Program**

- a. Institutional Rationale (Alignment with Institutional Mission and Strengths)
  - *Why is the institution proposing this program?*

Our state, region, and nation have become much more dependent upon engineering professionals, particularly in the areas of manufacturing and aviation/aerospace. Simultaneously, a new breed of engineer is needed who will meet global challenges, expand disciplinary boundaries, and facilitate rapid technological innovation. Generalists are needed who possess not only technical fundamentals but also expertise in broad areas such as strong problem-solving skills, entrepreneurship, innovation, and collaboration. The state needs engineers who have had access to authentic, practice-based engineering experiences and are ready to meet the needs of industry. Perhaps this was best stated at the Aviation and Aerospace Symposium (14 April 2016) in Indianapolis by Freddie Sarhan, vice president of Praxair Surface Technologies, who said, “I think where we fall short is the jack-of-all-trades engineer. In a manufacturing environment, an engineer that has a toolbox and gets their hands dirty on the shop floor is critical to the success of the manufacturing industry.”

We are proposing a Bachelor of Science in Engineering (BSE) degree. The program will serve as a niche area for generalists, which would in turn serve those operations that, in many cases, have a small staff and need broadly trained, flexible employees. Also, given our current University demographics and recent growth, we expect to recruit, enroll, and graduate significant numbers of underrepresented students such as African Americans, Hispanics, and women, which would increase the diversity of graduates working in this field.

The BSE consists of a core set of classes. In addition students will select a concentration area in which to complete additional coursework for developing technical depth to complement the overall generalist nature of the degree. The three concentrations are: industrial

engineering, civil engineering, and mechanical engineering. The program overall will provide systems-level, interdisciplinary teamwork experiences plus project-management experience.

- *How is it consistent with the mission of the institution?*

The BSE is firmly rooted in the ISU mission, which states, “Indiana State is dedicated to teaching and the creation of knowledge while maintaining its longstanding commitment to inclusiveness, community and public service, and access to higher education. We integrate teaching, research, and creative activity in an engaging, challenging, and supportive learning environment to prepare productive citizens of the world.” (Indiana State University, 2016)

The mission of the BSE is to support human capital development for the twenty-first century in the engineering field, with an emphasis on community and public service. This specific mission will allow students to enter the workforce as leaders in the areas of engineering where they can apply their knowledge and skills to many areas of societal need, e.g., emerging technologies, manufacturing, autonomous systems, etc. This program will prepare students to join the workforce as entry-level professionals with the necessary knowledge and skills to be successful in today’s competitive environment.

The addition of general engineering is aligned with the University’s mission to help meet the workforce needs of the state through the preparation of career-ready graduates. If Indiana is to maintain its central roles in manufacturing and logistics, it needs more engineers who want careers in Indiana and a desire to work in operations as opposed to research and development.

- *How does this program fit into the institution’s strategic and/or academic plan?*

The University’s strategic plan, *There’s More to Blue*, has a central focus on preparing students for the workforce and meeting the workforce needs of Indiana. We are choosing to add degree programs in areas with strong demand for graduates and that pay above-average salaries. We are dedicated to the preparation of students for professional employment.

A primary goal of the ISU Strategic Plan is to “Advance Experiential Learning and Career Readiness” (Goal 2). A primary strategy associated with Goal 2 is to increase internships and co-ops. A number of small manufacturing organizations and businesses in the area/region have expressed a need for “engineering generalists.” Currently, active student chapters of the American Society of Mechanical Engineers (ASME) and the Society of Automotive Engineers (SAE International) provide numerous experiential learning opportunities. Student competitions such as the Shell Eco-marathon (a high-mileage competition), the American Society of Civil Engineers Concrete Canoe Competition, and the American Institute of Aeronautics and Astronautics Student Design/Build/Fly Competition also provide excellent experiential learning opportunities. These practical experiences are built into and central to the academic programming.

Many active student organizations such as Females in Technology (FiT), Team Sycamore Racing (TSR), and student chapters of National Society of Black Engineers (NSBE), and Society of Manufacturing (SME) as well as student competitions will provide robust opportunities to support engineering students in practicing their skills and interacting in a team environment.

ISU has a strategic focus on recruiting low-income and first generation students. The University also has a long history of attracting and promoting diversity, and its new strategic

plan includes a focus on increasing the diversity of graduates in business and STEM fields. Not only is there a tremendous need for engineers in the state of Indiana, but there is also a growing understanding that to meet this need we will need to increase the number of women and minorities in the field. The relatively small fraction of women and minority groups such as African Americans and Hispanics in the engineering profession has remained constant at about 13–15% over the last thirty years. Despite significant efforts by government, industry, and academia to increase the attractiveness of the engineering field to these groups, engineering programs are not attracting and retaining enough women and minorities. As the minority populations continue to grow through mid-century, the number of incoming students who are members of underrepresented groups will increase. ISU has developed effective strategies to attract a diverse student body and is helping those students succeed.

The most recent data from College Results Online of Education Trust<sup>1</sup> indicates that ISU has the highest percentage of underrepresented minorities of any public institution in the state, with 22.2%. By comparison, Indiana University–Bloomington has 8.5%; Purdue University–West Lafayette, 7.3%; and University of Southern Indiana, 5.6%. Over the last four years, the ISU College of Technology (COT) has increased our efforts to attract minorities and females. Presently, 23% of our students are females; 13%, African American; and 4%, Hispanic.

Through our student organizations and activities, we will continue to work to increase our recruitment and the success of underrepresented students. Last year, a student chapter of the NSBE was started with the purpose of increasing attraction to and success in STEM fields. This group works to help accomplish the mission of attracting and ensuring the successful graduation of its members. A primary purpose of the organization is to influence cultural change within its community by invigorating members' spirits and energizing their minds. The organization prepares its members to complete their STEM education, make a cultural impact in their communities, and gain the knowledge and skills to succeed professionally. Strategic dollars have been reallocated to make them successful.

The COT has also made significant headway in efforts to increase the number of female students. Bev Bitzegaio, Cheryl Roberson (an alum and Rolls Royce project engineering manager), and Mary McGuire (an alum and retired engineer) have worked hard to attract and ensure successful graduation of females. They have encouraged females to join the student organization Females in Technology (FiT), participate in Women & Hi Tech of Indianapolis networking events, attend a special event for college women on career development and mentoring, and interface with the FiT Advisory Council for mentoring and professional development. FiT students host an annual conference for about 150 high school females, FiT for the Future. FiT members also regularly present at a variety of events and locations around the state, including Passport to High Tech at Connor Prairie, the Women in Technology Workshop at Carmel High School, the Girl Scouts Slumber at the Speedway, the Terre Haute Children's Museum, and regional high schools seeking to develop their own FiT groups.

In addition, Mary McGuire has been working with female students attending Pike High School and Westfield High School in preparation to increase our student base. We will also work with the Center for Leadership Development in Indianapolis and University of Chicago Chapter Schools (Michael Lackenbach). COT has reallocated internal dollars to provide support and resources for these efforts.

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<sup>1</sup> Data from 2014 aggregated from <http://www.collegeresults.org/default.aspx>

- *How does this program build upon the strengths of the institution?*

ISU has a strong foundation in engineering technology, offering programs in architecture, automation, automotive, civil, computer, electrical, engineering technology management, manufacturing, mechanical, and packaging. Several faculty who are already steeped in the engineering technology realm have credentials, expertise, and a desire to extend their teaching into the engineering courses. Students in the ISU engineering degree program will benefit from the hands-on-education orientation of these highly qualified faculty.

In the past six years the College of Technology has doubled in student enrollment and developed six new academic programs. The driving force for these changes has been a focus on understanding the needs of the workforce within the state and developing academic programs that meet this need. This focus has been our mantra for this initiative as well. Workforce development statistics reveal the tremendous need for graduates of general engineering programs at the state, regional, and national levels. There is a growing necessity to reinvest in areas such as manufacturing, infrastructure, and aviation/aerospace.

Innovation requires leadership. Indiana State University has community engagement and the development of civic responsibility as a pillar of its strategic plan. This strategic initiative complements the traditional engineering curriculum and will help our graduates take leadership roles in their companies and their communities. The days when engineers lived isolated professional lives are in the past. Engineers must work with politicians, lawyers, and business executives to address our societal needs. Engineers must take leadership roles, not only on technical projects but also in society more generally. Engineers must help lead their communities, state, and federal governments, and help lead society to economic and workforce development.

#### b. State Rationale

This program will support state priorities by:

- giving students the opportunity to complete a degree that is highly valued in the marketplace with an innovative approach;
- providing a more diverse set of graduates to meet industry needs;
- creating a degree that presents varied opportunities for the student and fulfills multifaceted needs in business;
- establishing an extensive support system to ensure student success;
- offering a degree with a clear path to employment;
- providing a degree that builds upon existing infrastructure and minimizes the need for new resources;
- increasing the percentage of underrepresented populations in the engineering profession; and
- providing additional support to ensure student success in areas of the curriculum that are very demanding.

c. Evidence of Labor Market Need

i. National, State, or Regional Need

The proposed Bachelor of Science in Engineering will meet workforce needs at all three levels. However, the focus will be to meet the needs of the state of Indiana. College of Technology faculty members and administrators continue to elicit the advice of industry partners to maintain degree relevance. These partners hold executive/management positions in state government and private industry. The letters of support (see item vi. in this section and Appendix 5 below) document their need to draw from a diverse and wide pool of candidates, and retain such employees once hired. This degree will increase that pool and focus on recruiting students from Indiana who are more likely to be anchored in the state based on familial ties and their existing social support system in addition to many other reasons.

The collected data documents an unmet need at each level. This degree will prepare each student to fill a wide variety of engineering specialties. National, state, and regional needs can be reviewed in items iii. and iv. in this section (see below).

ii. Preparation for Graduate Programs or Other Benefits

Students who complete this degree will be qualified to pursue graduate education opportunities.

iii. Summary of Indiana DWD and/or U.S. Department of Labor Data

**State Data**

Recent data from the Indiana Department of Workforce Development (2012 to 2022) shows the following:

Mechanical Engineers (SOC Code 17-2141)

- Base employment of 9,781 jobs
- Growth of 652 jobs (6.67%)
- 65 annual growth openings
- Job Orders: 4,468
- Median Wage: \$71,580 per year

Civil Engineers (SOC Code 17-2051)

- Base employment of 2,779 jobs
- Growth of 408 jobs (14.68%)
- 41 annual growth openings
- Job Orders: 1,373
- Median Wage: \$71,470 per year

Industrial Engineers (SOC Code 17-2112)

- Base employment of 8,042 jobs
- Growth of 521 jobs (6.48%)
- 52 annual growth openings

- Job Orders: 2,707
- Median Wage: \$69,830 per year

### **National Data**

Recent data from the U.S. Bureau of Labor Statistics (2014 to 2024) shows the following:

#### *Mechanical Engineers*

The national job outlook for mechanical engineers is anticipated to grow by approximately 5% from the years 2014 to 2024, which is considered to be an average level of growth by the U.S. Bureau of Labor Statistics. This average growth will cause an increase of approximately 14,600 mechanical engineering jobs. Nationally, there were 277,500 total mechanical engineering positions reported in 2014. In May 2015, the median pay for mechanical engineers was \$83,590 per year, or \$40.19 per hour.

#### *Civil Engineers*

The national job outlook for civil engineers is expected to grow by approximately 8% from the years 2014 to 2024, with an increase of approximately 23,600 additional jobs. This increase is on target with other occupations and is due to aging infrastructures and the need to manage various civil engineering projects that occur both in government and the private sector. Nationally, there were 281,400 total civil engineering positions reported in 2014. In May 2015, the median pay for civil engineers was \$82,220 per year, or \$39.53 per hour.

#### *Industrial Engineers*

A large change in the need for industrial engineering positions is not anticipated in the next ten years. Nationally, there were 241,100 industrial engineering positions reported in 2014. From 2014 to 2024, it is estimated that the job outlook will grow by 1%, which would add approximately 2,100 jobs. In May 2015, the median pay for industrial engineers was \$83,470 per year, or \$40.13 per hour.

It is well reported in the media that the infrastructure in Indiana and throughout the United States requires billions of dollars of improvements to maintain the system. The American Society of Civil Engineers 2013 report card for America's infrastructure estimated the need to invest \$3.6 trillion by 2020. The demand for engineers will follow the dollars that flow into these projects. This financial investment will place an increased demand for more engineers. The BSE will assist in meeting this demand.

#### iv. National, State, or Regional Studies

### **Regional Data**

Data collected to support this new program predicts steady employment for existing engineers as well as an increased need regionally. Projections provided by Region 7 of WorkOne anticipates growth over the next decade for civil engineers (12.5%), mechanical engineers (8.8%), and industrial engineers (10.6%). Indiana Workforce Development concurs with this prediction, showing growth for civil engineers (14.68%) and industrial engineers (6.48%).

Projected job-openings data from the Region 7 Workforce Development (Lisa Lee) for the time period ending 2022 shows: (1) Mechanical Engineers (SOC Code 17-2141), 271 employed, 10 average openings, and 100 jobs; (2) Civil Engineers (SOC Code 17-2051), 81 employed, 3 average openings, and 30 jobs; and (3) Industrial Engineers (SOC Code 17-2112), 260 employed, 9 average openings, and 90 jobs.

v. Surveys of Employers or Students and Analyses of Job Postings

According to the Indiana Department of Workforce Development, the job market is strong when considering job orders that were placed in the last 12 months. The data points to a healthy industry need for engineers, with civil engineers (SOC Code 17-2051) at 1,373, industrial engineers (SOC code 17-2112) at 2,707, and mechanical engineers (SOC code 17-2141) at 4,468.

vi. Letters of Support

Letters of support have been received from various industries, all expressing the need to diversify and increase the overall engineering candidacy pool. Additionally, support was given regarding seeking out underrepresented groups such as minorities and women. Others were excited about the opportunity to hire interns who could, after degree completion, become employees. See Appendix 5.

The proposal has received letters of support from the following:

- Tri Aerospace LLC, 1055 South Hunt St., Terre Haute, IN 47803
- IEA, 2647 Waterfront Parkway E. Dr., Indianapolis, IN 46214
- Garmong, 3050 Poplar St., Terre Haute, IN 47803
- Endress & Hauser, 2350 Endress Place, Greenwood, IN 46143
- FedEx, 3131 Democrat Rd., Suite C-119, Memphis, TN 38118
- Institute of Transportation Engineers—Indiana Section, [www.indianaite.org](http://www.indianaite.org)
- CH2M Hill, 200 W. Madison St., Suite 2000, Chicago, IL 60606
- Pillow Logistics, 4105 Vincennes Rd., Indianapolis, IN 46268
- Duke Energy, 301 Home Ave., Terre Haute, IN 47803
- Frontier, 8001 W. Jefferson Blvd., Fort Wayne, IN 46804
- State Representative Bob Heaton, Indiana House of Representatives District 46
- HURCO, One Technology Way, P.O. Box 68180, Indianapolis, IN 46268
- National Center for Complex Operations, 2902 N. Meridian Street Indianapolis, IN 46208
- Indiana Manufacturers Association, 101 W. Washington St., Suite 1050 E, Indianapolis, IN 46204
- State Senator Jon Ford, Indiana Senate District 38
- State Representative Clyde Kersey, Indiana House of Representatives District 43
- State Representative Alan Morrison, Indiana House of Representatives District 42
- ZF TRW Automotive Electronics, 902 South 2<sup>nd</sup> St., Marshall, IL 62441
- Thompson Distribution, 2225 N. College Avenue, Indianapolis, IN 46205

### **3. Cost of and Support for the Program**

#### a. Costs

##### i. Faculty and Staff

- A total of **6.0 FTE additional faculty** and **2.0 FTE additional staff** will be required to fully implement this program across the University.
- In the College of Technology, there are presently nine full-time, tenured or tenure-track faculty members who are qualified to teach engineering topics in the proposed engineering program. These faculty are fully deployed in teaching their respective areas in engineering technology. A reassignment of courses will allow the engineering program to begin without adding new faculty. As enrollment projections are met, new faculty will be added in accordance with the following:
  - Delivering the 17 total courses (50 total credits) annually of engineering topics, factoring in a cumulative 80% completion rate, will produce approximately 2,880 Student Credit Hours (SCH) (192 student FTE per year) for the department. With minimal additional capacity available, adding 4.0 FTE tenure-track faculty members over three years from the time of program approval will maintain the University target student-to-faculty ratio. Taking into consideration the initial rollouts of courses and the number of students expected, we will search for two tenure-track faculty members in the first year of approval and two additional tenure-track faculty members in the following year to begin teaching in the program's second and third year, respectively.
  - With enrollment growth, an administrative assistant and a student services professional would also be added.
  - For the three science courses, the current faculty are qualified and capable of absorbing the additional students through rearranging the course offerings within the department. No new science faculty are required.
  - For the five courses in Mathematics, there will be a need for 2.0 FTE additional faculty as the program grows to the expected intake of 60 incoming freshmen per year. With the current staffing and qualifications of Math faculty, the department will request one tenure-track faculty in the fall of the year the program is approved. As the program increases in number of majors, the department will require a second tenure-track faculty member. When operating at the expected intake of 60 freshmen per year, the Mathematics Department will be delivering approximately 1,100 SCH in direct support of the program.

##### ii. Facilities

The COT has robust engineering technology programs, with numerous laboratories already available. Because of our reputation, the COT has received in-kind gifts from industry partners such as Siemens (\$9.6 million) and Hurco (\$500K). These continuing donations and industry engagement activities allow our students to have great experiences that will help them be contributing members of the workforce.



- Minor remodeling of spaces is required to accommodate additional faculty and retool classrooms to accommodate required pedagogy.
  - Costs are currently estimated at under \$500,000 spread over the first three years of the program.
  - See Appendix 7: Facilities, Detail.
- iii. Other Capital Costs (e.g., Equipment)
- While significant equipment exists due to the existing engineering technology programs, it is expected that new and/or updated equipment in support of research and courses will be requested not only for the engineering program but also for existing engineering technology programs. As the laboratories and classrooms are utilized in multiple engineering and engineering technology programs, the usage of the equipment becomes inextricably intertwined.
  - A combination of additional or reallocated resources totaling \$750,000 is expected, with costs spread over the first four years of the program. The equipment will be utilized in other courses as well, thereby impacting 600-plus students on an annual basis.
  - See Appendix 8: Other Capital Costs, Detail.

b. Support

i. Nature of Support (New, Existing, or Reallocated)

Support for this program will come through reallocation of existing faculty lines, with the possibility of new faculty lines being added if program growth warrants such additions. Additional money/support from the state is not being requested.

No programs are being downsized or eliminated as a direct result of this program, but the University continuously evaluates the effectiveness, need, and affordability of all of its programs. No programs in the College of Technology have been eliminated in the past five years.

ii. Special Fees above Baseline Tuition

Course fees of \$30 per student are anticipated to replace consumables for new laboratory courses.

**4. Similar and Related Programs**

a. List of Programs and Degrees Conferred

i. Similar Programs at Other Institutions

<b>University</b>	<b>Degree Name</b>	<b>Delivery Mode</b>
University of Southern Indiana	BS in Engineering	Campus
Taylor University	BS in Engineering	Campus
Valparaiso University	BS in Engineering	Campus

The University of Southern Indiana (USI) is the only public university in the state of Indiana that offers a similar degree to our proposed BS in Engineering degree.

The proposed ISU program will create educational opportunities for underrepresented and at-risk students who may not be able to obtain an engineering degree through one of the existing universities in Indiana. ISU will implement multiple student-success supports for these at-risk students through university collaboration, mentoring, and curriculum design for differential equations and other higher-level STEM curriculum. It is ISU's goal to make these students successful not only while at ISU, but also in the growing job market.

ISU is unique from USI in many notable areas, such as with regard to the socioeconomic status of our students, as depicted in the following table.

	<b>Indiana State University</b>	University of Southern Indiana
Size (Undergrad FTE)	<b>9,510</b>	7,888
% Pell Recipients among Freshmen	<b>56.1%</b>	35.3%
% Underrepresented Minorities	<b>22.2%</b>	5.6%
Total Cost for In-State, On-Campus	<b>\$20,619</b>	\$19,568
Average Net Price after Grants	<b>\$11,525</b>	\$12,925
% of 21st Century Scholars	<b>16%</b>	8%

ii. Related Programs at the Proposing Institution

There are no engineering programs at ISU. However, there is a strong presence of engineering technology programs that will provide the necessary resources of laboratories and well-qualified faculty. These engineering technology programs will each be stronger because of the presence of the engineering program.

b. List of Similar Programs Outside Indiana

<b>University</b>	<b>Degree Name</b>	<b>Delivery Mode</b>
Olivet Nazarene University	BS in Engineering	Campus
University of Illinois at Urbana-Champaign	BS in General Engineering	Campus
Western Illinois University	BS in Engineering	Campus
Andrews University	BSE Engineering	Campus
Calvin College	BSE Engineering	Campus
Hope College	BS Engineering	Campus
Michigan Technological University	BS Engineering	Campus

c. Articulation of Associate/Baccalaureate Programs

The proposed engineering program articulates well with the Ivy Tech Community College AS in Pre-Engineering Generalist degree program. A virtually seamless transfer program will allow students to complete the two-year degree at Ivy Tech and finish the BS in Engineering program at ISU in 120 credit hours. The complete articulation agreement is included in Appendix 9 below.

**5. Quality and Other Aspects of the Program**

a. Credit Hours Required/Time To Completion

120 credit hours / 4 years

b. Program Competencies or Learning Outcomes

**Program Educational Objectives:** Graduates two to three years into their careers should have the foundation to:

1. Apply disciplinary reasoning, critical thinking, and hands-on skills to identify, analyze, and solve problems. (**Engineering**)
2. Communicate effectively in both oral and written form to articulate technical knowledge, ideas, and proposals. (**Communication**)
3. Consider professional, ethical, and social responsibility of engineering practices. (**Global Responsibility**)
4. Perform effectively, think independently, and work collaboratively in a team environment in a membership or leadership role. (**Management and/or Teamwork**)
5. Actively participate in professional development, including continuous self-improvement and lifelong learning. (**Lifelong Learning**)

**Student Outcomes:** Students at the time of graduation are prepared to demonstrate:

- 1.1 An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
- 1.2 An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
- 1.3 An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- 2.1 An ability to communicate effectively with a range of audiences.
- 3.1 An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- 4.1 An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
- 5.1 An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

**Student Competencies:** Students will be assessed on their abilities in the following areas:

**Mathematics and Advanced Engineering Mathematics**

- Analytic geometry and trigonometry
- Calculus
- Differential equations (e.g., homogeneous, nonhomogeneous, Laplace transforms)
- Numerical methods (e.g., algebraic equations, roots of equations, approximations, precision limits)
- Linear algebra (e.g., matrix operations)

**Probability and Statistics**

- Measures of central tendencies and dispersions (e.g., mean, mode, variance, standard deviation)
- Probability distributions (e.g., discrete, continuous, normal, binomial)
- Estimation (e.g., point, confidence intervals)
- Expected value (weighted average) in decision making
- Sample distributions and sizes
- Goodness of fit (e.g., correlation coefficient, least squares)

**Chemistry**

- Periodic table (e.g., nomenclature, metals and nonmetals, atomic structure of matter)
- Oxidation and reduction
- Acids and bases
- Equations (e.g., stoichiometry, equilibrium)
- Gas laws (e.g., Boyle's and Charles' Laws, molar volume)

**Instrumentation and Data Acquisition**

- Sensors (e.g., temperature, pressure, motion, pH, chemical constituents)
- Data acquisition (e.g., logging, sampling rate, sampling range, filtering, amplification, signal interface)
- Data processing (e.g., flow charts, loops, branches)

**Ethics and Professional Practice**

- Codes of ethics
- NCEES *Model Law* and *Model Rules*
- Public protection issues (e.g., licensing boards)

**Safety, Health, and Environment**

- Industrial hygiene (e.g., carcinogens, toxicology, MSDS, lower exposure limits)
- Basic safety equipment (e.g., pressure relief valves, emergency shut-offs, fire prevention and control, personal protective equipment)
- Gas detection and monitoring (e.g., O<sub>2</sub>, CO, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>S, radon)
- Electrical safety

**Engineering Economics**

- Time value of money (e.g., present worth, annual worth, future worth, rate of return)
- Cost (e.g., incremental, average, sunk, estimating)
- Economic analyses (e.g., breakeven, benefit-cost, optimal economic life)
- Uncertainty (e.g., expected value and risk)
- Project selection (e.g., comparison of unequal life projects, lease/buy/make, depreciation, discounted cash flow)

**Statics**

- Resultants of force systems and vector analysis
- Concurrent force systems
- Force couple systems
- Equilibrium of rigid bodies
- Frames and trusses
- Area properties (e.g., centroids, moments of inertia, radius of gyration)
- Static friction

**Dynamics**

- Kinematics
- Linear motion (e.g., force, mass, acceleration)
- Angular motion (e.g., torque, inertia, acceleration)
- Mass moment of inertia
- Impulse and momentum (linear and angular)
- Work, energy, and power
- Dynamic friction
- Vibrations

**Strength of Materials**

- Stress types (e.g., normal, shear, bending, torsion)
- Combined stresses
- Stress and strain caused by axial loads, bending loads, torsion, or shear
- Shear and moment diagrams
- Analysis of beams, trusses, frames, and columns
- Deflection and deformations (e.g., axial, bending, torsion)
- Elastic and plastic deformation
- Failure theory and analysis (e.g., static/dynamic, creep, fatigue, fracture, buckling)

### **Materials Science**

- Physical, mechanical, chemical, and electrical properties of ferrous metals
- Physical, mechanical, chemical, and electrical properties of nonferrous metals
- Physical, mechanical, chemical, and electrical properties of engineered materials (e.g., polymers, concrete, composites)
- Corrosion mechanisms and control

### **Fluid Mechanics and Dynamics of Liquids**

- Fluid properties (e.g., Newtonian, non-Newtonian)
- Dimensionless numbers (e.g., Reynolds number, Froude number)
- Laminar and turbulent flow
- Fluid statics
- Energy, impulse, and momentum equations (e.g., Bernoulli equation)
- Pipe flow and friction losses (e.g., pipes, valves, fittings, Darcy-Weisbach equation, Hazen-Williams equation)
- Open-channel flow (e.g., Manning equation, drag)
- Fluid transport systems (e.g., series and parallel operations)
- Flow measurement
- Turbomachinery (e.g., pumps, turbines)

### **Fluid Mechanics and Dynamics of Gases**

- Fluid properties (e.g., ideal and non-ideal gases)
- Dimensionless numbers (e.g., Reynolds number, Mach number)
- Laminar and turbulent flow
- Fluid statics
- Energy, impulse, and momentum equations
- Duct and pipe flow and friction losses
- Fluid transport systems (e.g., series and parallel operations)
- Flow measurement
- Turbomachinery (e.g., fans, compressors, turbines)

### **Electricity, Power, and Magnetism**

- Electrical fundamentals (e.g., charge, current, voltage, resistance, power, energy)
- Current and voltage laws (Kirchhoff, Ohm)
- DC circuits
- Equivalent circuits (e.g., series, parallel, Norton's theorem)
- Capacitance and inductance
- AC circuits (e.g., real and imaginary components, complex numbers, power factor, reactance and impedance)
- Measuring devices (e.g., voltmeter, ammeter, wattmeter)

### **Heat, Mass, and Energy Transfer**

- Energy, heat, and work
- Thermodynamic laws (e.g., 1st law, 2nd law)
- Thermodynamic equilibrium
- Thermodynamic properties (e.g., entropy, enthalpy, heat capacity)
- Thermodynamic processes (e.g., isothermal, adiabatic, reversible, irreversible)
- Mixtures of nonreactive gases

- Heat transfer (e.g., conduction, convection, and radiation)
- Mass and energy balances
- Property and phase diagrams (e.g., T-s, P-h)
- Phase equilibrium and phase change
- Combustion and combustion products (e.g., CO, CO<sub>2</sub>, NO<sub>x</sub>, ash, particulates)
- Psychometrics (e.g., relative humidity, wet-bulb)

c. Assessment

Assessment will be developed to meet Engineering Accreditation Commission (EAC) requirements of Accreditation Board of Engineering and Technology (ABET).

***BS in Engineering Program—Process for evaluating Program Educational Objectives***

**Identifying Program Constituencies**

We identify the following stakeholders and clientele to be the constituencies with respect to the Engineering Program Educational Objectives:

- **Industrial Advisory Committee (IAC).** This selective and highly involved group of individuals expects to see the program yield quality graduates that meet current and future industry needs. An Industrial Advisory Committee is composed of program faculty, employers, and past graduates, and may include faculty from relevant two-year community colleges. This committee will be specifically formed for the BS in Engineering degree.
- **Faculty.** The faculty will fulfill their educational responsibility in leading the students in the learning process, periodically evaluating and adjusting, if necessary, the teaching pedagogy pertinent to achieving the educational objectives.
- **Alumni.** The alumni expect a continued high-quality educational program, as their careers and reputations are associated with the quality of their alma mater.
- **Employers of graduates.** This group expects to hire employees who are globally responsible, technically competent, productive, self-motivated learners, team members, and good communicators.

**Process**

The Engineering faculty, in concert with the department, college, and University faculty, have primary authority over the curriculum, student outcomes, and program educational objectives. The faculty must involve and seek input from the program constituencies to ensure the program maintains relevancy with the needs of the constituents.

Program Educational Objectives (PEOs) will receive input from the constituencies on a three-year cycle. The input will be documented and reviewed. The resulting faculty recommendations will be documented and implemented as appropriate.

- Faculty present PEOs to IAC in a three-year cycle for discussion, revision, adjustment, and approval.
- Feedback from IAC is assimilated into the PEOs.
- PEOs presented to graduates by means of electronic survey administered annually.

- Data collected annually, combined in a rolling three-year cycle, analyzed and acted upon by faculty, and presented to IAC along with existing PEOs for discussion, revision, adjustment, and approval (complete cycle).

### **2016 Review Cycle**

1. Faculty action: 2015
  - a. The current list of five PEOs were created during the calendar year 2014 and approved by the AETM Department faculty in December 2014. Previous minutes of advisory committees were consulted during this process.
2. Input from constituencies: 2016
  - a. The AETM Department entire advisory committee reviewed, discussed, and gave input to the list of PEOs.
3. Action: 2017
  - a. Form a specific Industrial Advisory Committee
  - b. Provide feedback to IAC regarding program development
  - c. Collect information and feedback from IAC
4. Follow-up status: 2018
  - a. Provide detailed results of action plan
  - b. Establish annual data collection
  - c. Review in next cycle

### **2019 Review Cycle**

1. Faculty action:
  - a. Analyze previous-cycle data, actions, results, and status
  - b. Use analysis to review program educational objectives
2. Input from constituencies:
  - a. The Industrial Advisory Committee will review and discuss the relevancy of the program educational objectives.
  - b. Survey alumni, if any exist (program would be just two years old)
  - c. Collect data annually
3. Action:
  - a. Analyze data and develop action plan
  - b. Provide feedback to IAC
  - c. Implement plans
4. Follow-up status:
  - a. Provide detailed results of action plan
  - b. Continue annual data collection
  - c. Merge collected data with results for review in next cycle



**B.S. in Engineering**  
**Assessment Plan: Fall 2020/Spring 2021**

**Student Learning Outcome 1.1**

Upon graduation, the student will have an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

Applies to Program Educational Objective 1.

Within three to five years from graduation, the graduate will be able to demonstrate technical proficiency by applying disciplinary reasoning and critical thinking to identify, analyze, and solve problems in the design, manufacture, and maintenance of major subsystems and technologies (Engineering).

Measures:

Measure 1: The practice exam for the Fundamentals of Engineering Other Disciplines exam

Measure 2: A senior survey will be administered that will address this student outcome.

Details/Description: The data will be collected in ENGR 409. The entire FE exam is pertinent to this outcome, so the entire exam results will be analyzed. The senior exit exam will be administered in ENGR 409. Data specifically addressing this competency will be analyzed.

Target:

Since the exam selected corresponds to the curriculum, the target is initially set at passing the exam. The target for the senior exit survey will be established upon an analysis of the results.

Data Collection Time: Spring 2021

Responsible Individual(s): The program coordinator, department chair, and faculty teaching ENGR 409 will be responsible for the process of this outcome.

Analyze and Review Findings: (Fall 2021) Include the data collected, minutes of the review, and discussion points of Industrial Advisory Committee; previous cycles of the process should be included and become an ongoing part of the process.

Create and Implement Action Plan: (Spring 2022) Give a detailed action plan with a timeline.

Follow-up with Latest Status: (Spring 2023) Give details regarding follow-up.

Review Cycle Begins Again: Fall 2023

**Student Learning Outcome 1.2**

Upon graduation, the student will have an ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

Applies to Program Educational Objective 1.

Within three to five years from graduation, the graduate will be able to demonstrate technical proficiency by applying disciplinary reasoning and critical thinking to identify, analyze, and solve problems in the design, manufacture, and maintenance of major subsystems and technologies (Engineering).

Measures:

Measure 1: The practice exam for the Fundamentals of Engineering Other Disciplines exam

Measure 2: A senior survey will be administered that will address this student outcome.

Details/Description: The data will be collected in ENGR 409. The entire FE exam is pertinent to this outcome, so the entire exam results will be analyzed. The senior exit exam will be administered in ENGR 409. Data specifically addressing this competency will be analyzed.

Target:

Since the exam selected corresponds to the curriculum, the target is initially set at passing the exam. The target for the senior exit survey will be established upon an analysis of the results.

Data Collection Time: Spring 2021

Responsible Individual(s): The program coordinator, department chair, and faculty teaching ENGR 409 will be responsible for the process of this outcome.

Analyze and Review Findings: (Fall 2021) Include the data collected, minutes of the review, and discussion points of Industrial Advisory Committee; previous cycles of the process should be included and become an ongoing part of the process.

Create and Implement Action Plan: (Spring 2022) Give a detailed action plan with a timeline.

Follow-up with Latest Status: (Spring 2023) Give details regarding follow-up.

Review Cycle Begins Again: Fall 2023

### **Student Learning Outcome 1.3**

Upon graduation, the student will have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Applies to Program Educational Objective 1.

Within three to five years from graduation, the graduate will be able to demonstrate technical proficiency by applying disciplinary reasoning and critical thinking to identify, analyze, and solve problems in the design, manufacture, and maintenance of major subsystems and technologies (Engineering).

Measures:

Measure 1: The practice exam for the Fundamentals of Engineering Other Disciplines exam

Measure 2: A senior survey will be administered that will address this student outcome.

Details/Description: The data will be collected in ENGR 409. The entire FE exam is pertinent to this outcome so the entire exam results will be analyzed. The senior exit exam will be administered in ENGR 409. Data specifically addressing this competency will be analyzed.

Target:

Since the exam selected corresponds to the curriculum, the target is initially set at passing the exam. The target for the senior exit survey will be established upon an analysis of the results.

Data Collection Time: Spring 2021

Responsible Individual(s): The program coordinator, department chair, and faculty teaching ENGR 409 will be responsible for the process of this outcome.

Analyze and Review Findings: (Fall 2021) Include the data collected, minutes of the review, and discussion points of Industrial Advisory Committee; previous cycles of the process should be included and become an ongoing part of the process.

Create and Implement Action Plan: (Spring 2022) Give a detailed action plan with a timeline.  
Follow-up with Latest Status: (Spring 2023) Give details regarding follow-up.  
Review Cycle Begins Again: Fall 2023

d. Licensure and Certification

*Graduates of this program will be prepared to earn the following:*

- *State License:*

Professional Engineer (PE)

- *National Professional Certifications (including the bodies issuing the certification):*

National Society of Professional Engineers–Professional Engineer

e. Placement of Graduates

Members of the Industrial Advisory Board of the Applied Engineering Technology Management Department have stated that they would be interested in hiring graduates of this program to fill their needs in mechanical, civil, and industrial engineering. Additionally, data supplied by the Indiana Department of Workforce Development also supports the need for graduates with this general engineering degree who can be molded to address a variety of engineering specialties.

Students who complete the program will be qualified to continue their education by pursuing graduate degrees in the field of technology, education, or business as well as in many other disciplines.

f. Accreditation

Accreditation Board for Engineering and Technology – (ABET) Engineering Accreditation Commission – (EAC)

ABET is the premier accreditation body for engineering programs. It will be sought to validate the quality of the program and to maintain the strength of the program once established. Additionally, prospective students use this accreditation as a determinant when they evaluate engineering programs. Having this accreditation will increase the competitive advantage of graduates in the marketplace.

**6. Projected Headcount and FTE Enrollments and Degrees Conferred**

- *Report headcount and FTE enrollment and degrees conferred data in a manner consistent with the Commission’s Student Information System.*

Institution/Location: Indiana State University at Terre Haute  
 Program: BS in Engineering

	Year 1 FY2018	Year 2 FYI2019	Year 3 FY2020	Year 4 FY2021	Year 5 FY2022
Enrollment Projections (Headcount)					
Full-Time	25	59	106	148	176
Part-Time	0	0	0	0	0
Total	25	59	106	148	176
Enrollment Projections (FTE)					
Full-Time	25	59	106	148	176
Part-Time	0	0	0	0	0
Total	25	59	106	148	176
Degrees Conferred Projections	0	0	0	20	32

CHE Code: 1807  
 Campus Code: 01  
 County: 84  
 Degree Level: Baccalaureate  
 CIP Code: Federal - 14.0101 State - 14.0101

*Appendix 1: Institutional Rationale, Detail (This appendix should contain links to the institution's strategic and/or academic plan or the plans themselves.)*

*Indiana State University Strategic Plan – There's More To Blue*

*Appendix 2: Summary of Indiana DWD and/or U.S. Department of Labor Data, Detail (This appendix should contain the detailed tables, upon which the summary of the labor market demand is based.)*

**Indiana Department of Workforce Development Projection for the Year 2022**

<b>Title</b>	<b>Base Employment</b>	<b>Projection Employment</b>	<b>Numeric Change</b>	<b>% Change</b>	<b>2014 Median Wage</b>
Mechanical Engineers	9,781	10,433	652	6.67%	\$52,060
Civil Engineers	2,779	3,187	408	14.68%	\$71,470
Industrial Engineers	8,042	8,563	521	6.48%	\$69,830

**Job Orders / Applicants (12 months)**

**INTERNAL JOB ORDERS** (only available to an individual who is already employed by the company)

<b>Title</b>	<b>Job Orders</b>	<b>Open Positions</b>	<b>Avg. Hourly Wage</b>
Mechanical Engineers	374	646	\$28.33
Civil Engineers	162	176	\$23.03
Industrial Engineers	389	454	\$23.56

**EXTERNAL JOB ORDERS**

(open to internal and external candidates)

<b>Title</b>	<b>Job Orders</b>
Mechanical Engineers	4,094
Civil Engineers	1,211
Industrial Engineers	2,318

**APPLICANTS**

<b>Title</b>	<b>Avg. Hourly Wage</b>	<b>Number of Applicants</b>
Mechanical Engineers	\$26.97	431
Civil Engineers	\$23.26	77
Industrial Engineers	\$19.68	164

*Appendix 3: National, State, or Regional Studies, Detail (This appendix should contain links to the studies cited or the studies themselves.)*

<http://www.workonewest.com/>

<https://www.in.gov/dwd/>

**Indiana Department of Workforce Development Data for Region 7 (2016)**

(Clay, Parke, Putnam, Sullivan, Vermillion, and Vigo Counties)

<b>Title</b>	<b>10-year Growth</b>	<b>Avg. Annual Openings</b>	<b>Jobs to Fill by 2022</b>	<b>Openings–New Jobs</b>	<b>Openings–Replacement Jobs</b>
Mechanical Engineers	8.80%	10	100	2	8
Civil Engineers	12.50%	3	30	1	2
Industrial Engineers	10.60%	9	90	2	7

*Appendix 4: Surveys of Employers or Students and Analyses of Job Postings, Detail (This appendix should contain links to the surveys or analyses cited, or the documents themselves.)*

**Indiana Department of Workforce Development Engineering Job Orders / Applicants (12 months)**

**INTERNAL JOB ORDERS** (only available to an individual who is already employed by the company)

<b>SOC Title</b>	<b>Job Orders<sup>1</sup></b>	<b>Open Positions</b>	<b>Avg. Hourly Wage</b>
Aerospace Engineers	30	66	\$32.18
Agricultural Engineers	4	4	NULL
Biomedical Engineers	50	64	\$33.24
Chemical Engineers	25	29	\$31.22
Civil Engineers	162	176	\$23.03
Computer Hardware Engineers	10	15	\$12.24
Electrical Engineers	195	256	\$29.23
Electronics Engineers, Except Computer	85	158	\$33.13
Environmental Engineers	25	1,023	\$22.77
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	204	217	\$11.37
Industrial Engineers	389	454	\$23.56
Materials Engineers	39	43	\$30.68
Mechanical Engineers	374	646	\$28.33
Mining and Geological Engineers, Including Mining Safety Engineers	2	2	\$23.57
Nuclear Engineers	2	2	\$19.23
Petroleum Engineers	2	2	\$35.06
Engineers, All Other	2,080	3,374	\$19.52

<sup>1</sup> Job orders (JO) can have multiple positions embedded within one JO. For example, under Aerospace Engineers, there are 30 JOs and then there are 66 open positions, or individual employees, needed.



**EXTERNAL JOB ORDERS** (open to internal and external candidates)

<b>SOC Title</b>	<b>Job Orders</b>
Aerospace Engineers	145
Biomedical Engineers	72
Chemical Engineers	278
Civil Engineers	1,211
Computer Hardware Engineers	144
Electrical Engineers	2659
Electronics Engineers, Except Computer	373
Environmental Engineers	265
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	407
Industrial Engineers	2,318
Marine Engineers and Naval Architects	63
Materials Engineers	246
Mechanical Engineers	4,094
Mining and Geological Engineers, Including Mining Safety Engineers	30
Petroleum Engineers	71
Engineers, All Other	6,135

**APPLICANTS**

<b>Title</b>	<b>Avg. Hourly Wage</b>	<b>Number of Applicants</b>
Aerospace Engineers	\$27.05	59
Agricultural Engineers	\$12.78	19
Biomedical Engineers	\$24.91	48
Chemical Engineers	\$30.32	57
Civil Engineers	\$23.26	77
Computer Hardware Engineers	\$17.33	101
Electrical Engineers	\$28.65	233
Electronics Engineers, Except Computer	\$24.27	42
Environmental Engineers	\$22.60	39
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	\$22.50	108
Industrial Engineers	\$19.68	164
Marine Engineers and Naval Architects	\$14.42	5
Materials Engineers	\$22.06	42
Mechanical Engineers	\$26.97	431
Mining and Geological Engineers, Including Mining Safety Engineers	\$30.42	12
Nuclear Engineers	\$31.25	1
Petroleum Engineers	\$15.11	7
Engineers, All Other	\$26.68	702

## Engineering Job Orders / Applicants (6 months)

**INTERNAL JOB ORDERS** (only available to an individual who is already employed by the company)

<b>SOC Title</b>	<b>Job Orders<sup>1</sup></b>	<b>Open Positions</b>	<b>Avg. Hourly Wage</b>
Aerospace Engineers	22	50	\$32.18
Agricultural Engineers	4	4	NULL
Biomedical Engineers	8	9	\$34.73
Chemical Engineers	11	11	\$34.13
Civil Engineers	106	107	\$20.75
Computer Hardware Engineers	4	9	\$9.00
Electrical Engineers	116	163	\$32.31
Electronics Engineers, Except Computer	56	77	\$32.69
Environmental Engineers	10	10	\$27.86
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	129	140	\$16.14
Industrial Engineers	247	276	\$28.34
Materials Engineers	21	21	\$37.97
Mechanical Engineers	189	303	\$30.01
Mining and Geological Engineers, Including Mining Safety Engineers	2	2	\$23.57
Nuclear Engineers	2	2	\$19.23
Engineers, All Other	1,285	2,342	\$22.41

<sup>1</sup> Job orders (JO) can have multiple positions embedded within one JO. For example, under Aerospace Engineers, there are 22 JOs and then there are 50 open positions, or individual employees, needed.

**EXTERNAL JOB ORDERS** (open to internal and external candidates)

<b>SOC Title</b>	<b>Job Orders</b>
Aerospace Engineers	62
Biomedical Engineers	40
Chemical Engineers	132
Civil Engineers	655
Computer Hardware Engineers	73
Electrical Engineers	1,307
Electronics Engineers, Except Computer	183
Environmental Engineers	139
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	193
Industrial Engineers	1,091
Marine Engineers and Naval Architects	13
Materials Engineers	86
Mechanical Engineers	1,769
Mining and Geological Engineers, Including Mining Safety Engineers	14
Petroleum Engineers	45
Engineers, All Other	2,849

**APPLICANTS**

<b>Title</b>	<b>Avg. Hourly Wage</b>	<b>Number of Applicants</b>
Aerospace Engineers	\$27.11	24
Agricultural Engineers	\$12.38	10
Biomedical Engineers	\$25.68	20
Chemical Engineers	\$30.13	35
Civil Engineers	\$25.45	31
Computer Hardware Engineers	\$19.28	52
Electrical Engineers	\$30.02	99
Electronics Engineers, Except Computer	\$20.07	30
Environmental Engineers	\$21.50	19
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	\$20.52	51
Industrial Engineers	\$19.74	97
Marine Engineers and Naval Architects	NULL	1
Materials Engineers	\$21.75	19
Mechanical Engineers	\$27.60	240
Mining and Geological Engineers, Including Mining Safety Engineers	\$33.67	7
Nuclear Engineers	\$31.25	1
Petroleum Engineers	\$13.58	3
Engineers, All Other	\$27.44	378

*Appendix 5: Letters of Support, Detail (This appendix should contain the letters of support for the program.)*



1055 South Hunt St  
Terre Haute Int'l Airport  
Terre Haute, Indiana 47803

Phone: 812-872-2400  
Fax: 812-877-3330

Website: [www.TriAerospace.com](http://www.TriAerospace.com)



Conformance to  
Aerospace Quality Systems-  
AS9100

November 29, 2016

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English:

I am excited about the possibility of Indiana State University offering engineering degrees.

As the former General Manager of Tri-Industries and the former owner and President/CEO of Tri Aerospace, LLC I have observed graduates from many universities with engineering and technical degrees. I have always appreciated the "hands on" capabilities of the Indiana State University graduates and have hired many of them.

The addition of a Bachelor's degree in engineering to the potential employee will increase the starting salary as well as give them a head start on their productivity.

As the aerospace companies in the Midwest develop and expand, Indiana State University engineering graduates can fill a strong need for practical engineers.

If I can be of help in the development of this program, please contact me.

Best regards;

A handwritten signature in black ink that reads "Robert R. Brown". The signature is fluid and cursive.

Robert R. Brown



2647 Waterfront Parkway East Drive  
Suite 100  
Indianapolis, IN 46214

Tel (800) 688 3775  
[www.iea.net](http://www.iea.net)

February 2, 2016

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English,

It is my pleasure to write a letter in support of The College of Technology at Indiana State University to commence an engineering program, accredited by both the Indiana Commission of Higher Education and the Accreditation Board of Engineering and Technology.

Infrastructure and Energy Alternatives (IEA) is a leading engineering, procurement and construction (EPC) contractor and is one of the largest clean energy construction firms working throughout North America. In order to be innovative leaders in our specialized industry, we are constantly seeking new talent to join our ranks. IEA has a long-standing commitment of hiring interns and new graduates from engineering programs across the Country. Most recently this initiative has taken on new life as we begin to develop our "grow from within" program...taking new engineering grads and mentoring them to be our future project management leaders.

An engineering program in our back yard (Terre Haute) allows IEA to tap into local talent, offering internship opportunities, and ultimately hiring graduates who have proven success by way of an ISU Engineering degree. Additionally, as the renewable energy industry continues to be sustained and supported across the United States, IEA would welcome the chance to provide input into the ISU Engineering curriculum, giving students an expert view of our industry with real life class room learnings.

In conclusion, myself, our Executive Leadership Team and Human Resources leaders fully support ISU receiving accreditation to offer an engineering curriculum and would welcome the opportunity to assist in developing the content of that program. In the future, we would further welcome the chance to have a presence on Campus of meeting with students, offering them career advancement assistance and ultimately hiring ISU talent.

Sincerely,

JP Roehm  
President





February 2, 2016

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English:

Thank you for sharing your exciting plans to start an engineering program at Indiana State University.

As you know, Garmong Construction Company has had tremendous success hiring graduates of ISU's Construction Management program and we are confident that we would experience similar results from an engineering program under your leadership.

Garmong Construction is a professional construction management and general contractor with annual revenues approaching \$100 million, and our project management staff is equally divided between professionals with construction management and engineering degrees.

Our business' limiting factor is the ability to recruit well educated staff members, so we are both excited and confident that ISU may soon be producing graduate engineers.

Sincerely,

Brian Kooistra  
Chief Operating Officer

C.H. Garmong and Son, Inc.  
*Since 1923*  
3050 Poplar Street  
Terre Haute, IN 47803  
(812) 234-3714



Endress+Hauser, Inc. Greenwood, Indiana USA

December 20, 2016

Provost Michael Licari  
Vice President of Academic Affairs  
Indiana State University  
Terre Haute, IN 47809

Dear Provost Licari

I write today in support of the University's recent board of trustees' decision to create and implement an engineering degree program (BSE) at ISU.

As a native Hoosier, and 30+ year employee at Endress+Hauser, I can attest that (1) Indiana State has always turned out exemplary engineering technology graduates and (2) that the industries in which we work need them, and degreed engineers, to fill a technical talent shortage that all experts agree will affect us until at least the year 2030.

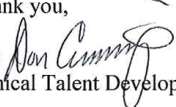
Endress+Hauser is in the field of process automation. That is, we support the process industries that are so vital to modern society, by providing real time process manufacturing measurements for end products such as foods, medicines, fuels, construction materials, chemicals, and clean water.

Our global corporation (family-owned and Swiss-based) has its US headquarters right here in Greenwood, IN – a location that arose from a chance meeting in the 1970s between our late founder (G.A. Endress) and then-Lieutenant Governor, Robert Orr – when Endress+Hauser sought to open its doors in the United States at a location near to both good transportation and a higher education system that could supply our needs.

Fast forward to today and Endress+Hauser's large corporate campus south of Indianapolis is comprised of six E+H divisions with half a million square feet under roof – including three manufacturing plants and a sales/service/engineering division. Amongst all those are dozens of different roles for degreed engineers – in production and testing, in design, in field work, and in managing a variety of business units. But filling each year's requirements for talent is increasingly more difficult. However, to facilitate our doing so more readily as openings occur, in 2014 we implemented a Rotational Development program (of which I am the program manager) which, in itself, requires up to 9 new engineers per year.

To the extent our Rotational program mitigates some of our talent challenges, we have not yet been successful at assembling a diverse cast of young engineers. We see ISU as a means to helping us solve that problem with its clear intent to provide engineering education for under-served populations. And this, coupled with our successful experiences with hiring past ISU COT grads, is why we offer our support for the new BSE program(s).

Regards and thank you,

Don Cummings   
Manager, Technical Talent Development

cc: Dean Robert English

Endress+Hauser, Inc.  
2350 Endress Place  
Greenwood, IN 46143  
Phone: 317-535-7138  
Sales: 888-ENDRESS  
Service: 800-642-8737  
Fax: 317-535-8498

**Jim L. Bowman**  
Senior Vice President

Flight Operations  
3131 Democrat Road  
Suite C-119  
Memphis, TN 38118

Telephone 901.224.5515  
Mobile 901.828.6158  
Fax 901.457.6577  
jim.bowman@fedex.com



July 28, 2016

Provost Mike Licari  
Vice President of Academic Affairs  
Indiana State University  
Terre Haute, IN 47809

Dear Provost Licari,

In response to your questions about FedEx and engineering graduates and Indiana State starting a program, I offer the following:

1. We hire engineers from many schools across the country. The competition is keen for those with the skills we desire coupled with a significant demand from other companies and government entities. It's been our experience that the demand for high quality engineers most years exceeds supply.
2. FedEx Express is an operating company of FedEx Corporation. Air Operations is division of FedEx Express. We hire approximately 10 engineers per year in Air Operations. It's important to note that with our demographics (50% of Air Operations employees are 55+) we expect that number to continue to grow. Other FedEx operating companies also hire engineers.
3. A good BSE with practical knowledge and technical skill is highly valuable to our organization. The sooner they can lead projects and work independently the better for our company.
4. Our engineers primarily work on aircraft modification programs and aftermarket modifications to our new aircraft to fit the cargo mission.
5. FedEx is very interested in a BSE with an autonomous systems background. Again, the ability to acclimate to a new position and be productive in a relatively short period of time would be very valuable for our company. The applications that we believe may have potential include:
  - a. Drones for small package remote delivery outside the optimum and cost beneficial range of a delivery truck; however, we would need those personnel to work on also developing a customer experience angle.

1

- b. We see a need for drones in disaster relief and emergency medical supply delivery with longer range, in the 50-100 mile round trip arena and would most likely be fuel driven.
- c. We see a need for drones for aircraft external structural inspections (i.e., hail damage, checks, etc.) that can be remote or tethered and operated inside/outside a hangar on the airport ramp areas.

FedEx Express is fully aware of the shortage of BSE qualified individuals in the United States. We are interested in supporting accredited programs that are training those individuals. However, it is important to note that the ability of these individuals to produce results within a short time span of hire is almost as important as the degree itself.

Please let me know if you have further questions or require more information.

Thanks,



James Bowman, Director of Operations  
Senior Vice President, Flight Operations

Cc: Dean English ISU



## Institute of Transportation Engineers Indiana Section

[www.indianaite.org](http://www.indianaite.org)

GARY MROCZKA – PRESIDENT  
ED COX – VICE-PRESIDENT  
RICHARD ZIELINSKI – TREASURER

LAURA SLUSHER – SECRETARY  
LAUREN HURST – DIRECTOR  
JEFF HILL – PAST-PRESIDENT

January 2, 2017

Dr. Michael R. Williamson  
Assistant Professor of Civil Engineering  
Indiana State University  
200 North Seventh Street  
Terre Haute, Indiana, 47809-1902

Dear Dr. Williamson:

On the behalf of our Board of Directors representing more than 250 transportation professionals across Indiana, the Indiana Section of the Institute of Transportation Engineers offers our support to the Indiana State University to establish an Accredited Bachelor of Science in Engineering Program, focused on Civil Engineering.

At both the national and state levels, the renewed focus on infrastructure investment has taken center stage. The Civil Engineering Community needs to be ready to meet the professional talent and resource needs of this challenge. With a significant increase in funding, there is a huge risk of a labor deficit for professionals in transportation design and construction management. Graduates of this program will help fill this void and allow them to apply to test for the two State of Indiana professional engineering license exams.

We appreciate your leadership and efforts to date with ISU program. The Board of Directors wishes you and your students continued success.

Sincerely,

Jeff Hill, PE, PTOE  
2017 Past-President  
ITE Indiana Section  
City Engineer  
City of Fishers Indiana  
(317) 595-3160

Gary Mrocza, P.E.  
2017 President  
ITE Indiana Section  
Senior Project Manager  
AECOM  
(317) 532-5485

CH2M Hill Inc.  
200 West Madison Street Suite 2000  
Chicago, IL, 60606  
Tel: 312-873-9768  
Fax: 312-873-9801  
Email: jiguang.zhao@ch2m.com

January 3<sup>rd</sup>, 2017

**Re: Bachelor of Science in Engineering program at Indiana State University**

To whom it may be concerned,

I am writing this letter to show my support for Indiana State University's creation of a new Engineering Degree. In detail I would like to express my support for the creation of a new Bachelor of Science in Engineering (BSE) with a focus of Civil Engineering at Indiana State University (ISU).

As a practicing engineer for 10 years and a fellow of the Institute of Transportation Engineers (ITE) for 5 years I have seen a need for more Civil Engineers. With the new administration's goal to rebuild the interface transportation systems for the country, I would expect more career opportunity for students in Civil Engineering.

I am quite familiar with the current Civil Engineering Technology program at ISU. Under the leadership of Dr. Williamson, solid progress has been made towards the goal to be an ABET-accredited civil engineering program. I feel it is ready to take the next step and become a full Engineering program that will increase students knowledge in the field of Engineering and allow them to take the Professional Engineering Exam. There is currently a lack of students graduating with Engineering degrees and I feel a BSE program at ISU would fill a much needed gap by attracting more students to the field of engineering. Please feel free to let me know if more information is needed for your consideration.



Jiguang Zhao, Ph. D., P. E. FITE



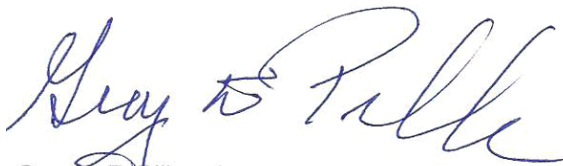
As an executive with Xerox Corporation, Executive Assistant for Indiana Governor Bob Orr, founder of the Pillow Express Delivery in Indiana, United Courier in Cincinnati, and owner of the largest minority-owned delivery and courier service in Indiana, it is an honor to provide my support for the College of Technology's initiative to develop a Bachelor's of Science program in Engineering. The COT program will have three concentrations in the areas of Mechanical Engineering, Industrial Engineering, and Civil Engineering. Individuals with this type of degree will be able to fill positions in these three vital areas.

From a workforce development perspective, there is a meaningful need for more engineers particularly in these areas. According to workforce development statistics, there is a projected need for a 6.8% increase in mechanical engineers and a 6.6% increase for industrial engineers for the next 10 years. The state of Indiana's growth opportunity is contingent upon advancements in agriculture, manufacturing, aviation, and the aerospace industry. There is a growing demand for engineers within the state of Indiana. The aviation and aerospace industry, specifically, will need more engineers.

The program will have a strategic focus on attracting minorities. In this case that would be African Americans, Hispanics, and females. Not only is there a tremendous need for engineers in the state of Indiana, there is a moral obligation to improve the number of minorities in this field. The relatively small fraction of women and minority groups such as African American and Hispanic in the engineering profession has remained constant at about 13-15% over the last thirty years. This situation exists despite significant efforts by government, industry, and academia to increase the attractiveness of the engineering field. Engineering programs are not attracting and retaining enough women and minorities. As the minority groups continue to grow through mid-century, the number of incoming students who are members of under-represented groups will increase. Great racial diversity of entrants into engineering programs will occur, and most of these students will be first generation students with relatively pre-college exposure to engineering. ISU has developed effective strategies to attract a more diverse student body. Indiana State University is known for having a high number of African Americans who are first generation students.

The College of Technology has committed to the advancement of Unmanned Systems in the state of Indiana, and this engineering degree program will focus on specialized applications in this areas. Many of the partners in Unmanned Systems are interested in engineers who have been involved in Unmanned Systems. The field of Unmanned Systems is a burgeoning market and industry that crosses all sectors. Unmanned Systems are going to be prevalent in agriculture, utility companies, first responders, manufacturing warehousing, transportation, and national security. Developing engineering within this specialized market will help move the state of Indiana forward as a leader in this niche market. Industry leaders always identify Workforce Development as a critical need.

We need ISU to offer an engineering program to prepare and grow a workforce that can fill the need that is now being created. I encourage you to continue to move forward to establish an engineering program that will ultimately be beneficial to the state and the citizens of Indiana. This field is growing at a rapid pace, and unmanned system technologies are becoming ubiquitous in every facet of technology and non-technology business. The College of Technology has been instrumental in this field and wants to continue to grow in expertise in this area. Multiple companies in the agriculture, transportation, technology, warehousing, defense, entertainment, communication, and service markets are being built around unmanned systems technology. ISU will be counted in the handful of universities worldwide that offer an unmanned system degree and this integrated with an engineering program will be a magnet for both the College of Technology as well as for related, supporting degree programs at the university such as the Scott College of Business programs and computer science.



George E. Pillow Jr.  
President/CEO  
[317-415-4000](tel:317-415-4000) | o  
[317-415-4009](tel:317-415-4009) | f  
[www.pillowlogistics.com](http://www.pillowlogistics.com)



**"25 Years of Transportation Excellence"**

Certified Minority Business Enterprise, State of Indiana  
Certified Minority Business Enterprise, City of Indianapolis  
Certified Minority Business Enterprise, City of Chicago  
National Minority Supplier Development Council, State of Indiana  
SBA 8a Certified





**Rick Burger**  
Govt & Community Relations Manager  
Indiana Community Relations &  
Economic Development

**Duke Energy**  
301 Home Ave.  
Terre Haute, IN 47803

o: 812.231.6796  
c: 812.230.0403  
f: 812.231.6709  
richard.burger@duke-energy.com

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

January 6, 2017

Dear Dr. English:

Congratulations on your initiative of developing new engineering programs in the College of Technology at Indiana State University. Duke Energy would like to formally support your efforts in developing high quality Bachelor of Science in Engineering degree programs.

At Duke Energy, we are always in need of quality engineers and Indiana State University has done a great job of providing them through the Engineering Technology department. Many of those students have advanced well within our company in our generation and distribution side. We see Indiana State University as a good feeder system for our future engineers.

The establishment of this program will meet the needs of Hoosier students and help meet the needs of engineering and manufacturing firms in the central region and throughout our State.

We are excited about supporting your initiative and we welcome the opportunity to help with curriculum development if you need input from industry.

Sincerely,

Rick Burger  
Community Relations Manager  
Indiana Community Relations & Economic Development  
Phone: (812)231-6796

January 9, 2017

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English,

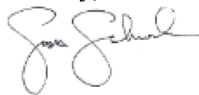
Pursuant to your request regarding the struggles hiring qualified and diverse talent for Frontier Communications in the engineering department I am happy to divulge relevant information to assist. I hope this information is valuable to you in your pursuit in the creation of the Bachelor of Science in Engineering degree at Indiana State University.

Frontier has an engineering force of over 10,000 personnel throughout the nation with many variations of disciplines needed. I personally am responsible for the engineering organization in seven states which include Indiana, Michigan, Wisconsin, Tennessee, Mississippi, Alabama, and Georgia. My organization consists of 330 full time employees, 35 contract engineers, and the use of countless engineering firms to support the work load and demands of our company. Through retirements, promotions, and terminations I was able to fill 26 engineering positions in 2016 in my region alone. Many of these positions remained open for more than 60 days looking for qualified candidates to apply, due to candidates not having a Bachelor's degree in engineering.

Engineering in Frontier has multifaceted disciplines that all require general engineering principles such as problem solving, technical expertise, ability to collaborate design among each discipline, and be innovative in developing low cost solutions. The telecommunications industry had a long history of standard practices without proper innovation in the engineering department. With the advent of deregulation and competition cost saving innovation is now a requirement to meet customers' expectations.

I am pleased to hear about the initiative towards this new degree program at Indiana State University. I'm certain that Frontier could have a direct benefit from this program in building qualified candidates for our engineering needs.

Sincerely,



Scott Schroeder  
Vice President Regional Engineering



**STATE OF INDIANA**  
**HOUSE OF REPRESENTATIVES**  
THIRD FLOOR STATE HOUSE  
INDIANAPOLIS, INDIANA 46204

Bob Heaton  
200 W. Washington St.  
Indianapolis, IN 46204  
Statehouse: 1-800-382-9841  
Website: [www.in.gov/H46](http://www.in.gov/H46)  
Email: [H46@in.gov](mailto:H46@in.gov)

COMMITTEES:  
Financial Institutions, Vice Chair  
Natural Resources  
Insurance

January 12, 2017

Dr. Robert English  
Dean – College of Technology  
Indiana State University  
Terre Haute, IN 47809

Dear Dr. English:

I hope this letter finds you well. As Representative of Indiana House District 46 and a proud alumnus of Indiana State University, I was pleased to learn of Indiana State University's bold initiative to propose to the Indiana Commission of Higher Education the offering of a Bachelor of Science Degree in Engineering (BSE) through the College of Technology. Congratulations on this effort!

Having been a long-time businessman plugged into our region, it is clear to me that our state and nation are becoming more dependent upon a cutting edge workforce in the STEM-related fields of employment. An example of this need includes engineering professionals, particularly in the areas of manufacturing and aviation/aerospace. These are sectors that are so important in Indiana and particularly Western Indiana, the region I have the pleasure to represent at the Indiana State House.

The College of Technology is a well-respected partner to business and industry. It has a terrific reputation, and I believe it is poised for even greater things. A BSE program is the right next step for the College and for Indiana State.

This program will be a win for our state and our citizens, and I am proud to offer my support.

Sincerely,

A handwritten signature in black ink, appearing to read "Bob Heaton".

Bob Heaton  
State Representative  
District 46

BH: am



**Hurco Companies, Inc.**  
One Technology Way  
P.O. Box 68180  
Indianapolis, IN 46268-0180 USA  
800.634.2416

June 7, 2016

Dr. Robert E. English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English,

Congratulations on your initiative of developing new engineering programs in the College of Technology at Indiana State University. The engineering team at Hurco Companies would like to formally support your efforts in developing high quality Bachelor of Science in Engineering degree program.

Hurco employs over 50 engineers at our global headquarters located in Indianapolis, IN. These engineers are the back bone of our business and they play key roles in new design, development, improvement, and support of Hurco's Computer Numerical Control (CNC) machines tools, controls, and software products for the global marketplace. While the majority of our engineers are in the software and electrical disciplines, our mechanical engineering department would be a good fit for graduates of your program who graduate with a concentration in mechanical engineering. Our projected hiring needs for the mechanical group are estimated to be five to seven engineers over the next five years.

During our last hiring process, we spent almost two months looking for the right candidate and there were only 13 applicants we felt were qualified. It would be a great opportunity for Hurco to be able to turn to ISU as a source for highly trained mechanical engineers who are carrying on school's reputation of developing dedicated and well-trained students with a strong work ethic. Moreover, high school students from around the Indiana will have another choice for their engineering education. As an Indiana company, we understand the importance of retaining these students and future workers in the state to help grow our economy.

We are excited about supporting your initiative and we welcome the opportunity to help with curriculum development if you need input from industry.

Sincerely,

David Plank  
Manager, Hurco North America



December 1, 2016

Dr. Robert English  
Dean, College of Technology  
Indiana State University  
101 North Sixth Street  
Terre Haute, IN 47809

Dear Dr. English,

This letter is written in support of Indiana State University's proposed Bachelor of Science in Engineering degree. The degree will serve to increase the depth of the engineering candidacy pool, which will serve in fulfilling an ongoing need to fill key positions within Indiana state government agencies.

The National Center for Complex Operations (NCCO) directs and supports national security and homeland defense related activities throughout the state of Indiana, as well as, the Midwest region. Many of our projects, in the planning and execution stages, require the expertise of engineers whose disciplines are many and whose skills are precise. The NCCO also serves as a resource for U.S. government agencies and defense industrial base partners that are searching for qualified candidates to fill strategic positions and contribute to programs of great national importance.

Again, congratulations on the development of the new engineering program within the College of Technology. The NCCO would like to recognize your efforts and offer our support and assistance in regards to this new degree program.

Sincerely,

A handwritten signature in black ink, appearing to read "Mathew J. Konkler", is written over a horizontal line.

Mathew J. Konkler  
Director, Corporate Outreach



## Indiana Manufacturers Association, Inc.

101 West Washington St., Suite 1050 East • Indianapolis, IN 46204  
317-632-2474 • 800-462-7762 • Fax: 317-231-2320 • www.imaweb.com

January 10, 2017

Dr. Robert English  
Dean – College of Technology  
Indiana State University  
Terre Haute, IN 47809

Dear Dean English:

I am writing to offer my appreciation to Indiana State University, after learning of the University's initiative to propose a Bachelor of Science Degree in Engineering (BSE) through the College of Technology. I want to commend you for your work in this area.

For a long time, it has been clear to the business community that our state and nation are becoming more dependent upon a cutting edge workforce in the STEM-related fields of employment. Engineering professionals are needed in this state right now, and that need is only going to grow. I believe that ISU is wisely focusing its efforts on meeting the needs of employers in the manufacturing and aviation/aerospace areas.

As I follow the work of the College of Technology, I know you have a respected reputation, and the BSE program will help fuel Indiana's workforce for the 21st Century.

I am proud to offer my support.

Sincerely,

A handwritten signature in black ink, appearing to read 'B. Burton', written in a cursive style.

Brian Burton  
President & CEO



## State of Indiana

## Senate

Senator Jon Ford  
State House  
200 W. Washington Street  
Indianapolis, Indiana 46204-2785  
Telephone: (317) 234-9443  
Telephone: (800) 382-9467  
E-mail: s38@iga.in.gov

Committees:  
Family & Children Services  
Homeland Security & Transportation  
Public Policy  
Veterans Affairs & The Military

January 18, 2017

Dr. Robert English  
Dean – College of Technology  
Indiana State University  
Terre Haute, IN 47809

Dear Dean English:

I am pleased to offer my support for Indiana State University's College of Technology proposal to innovatively address workforce needs in the State of Indiana through its proposed Bachelor of Science Degree in Engineering (BSE).

In my work as a State Senator, business leader, and private citizen, I have long appreciated Indiana State University's College of Technology. The College has a respected history of engagement with employers around the state and enjoys a strong reputation of graduating students with hands on experience who are ready to hit the ground running in employment in STEM-related fields.

As employers in our state must increasingly engage and compete in a global economy, the need for emphasis on the skills developed by a BSE program has never been higher. Indiana State is already well positioned to address the critical Hoosier workforce needs for the global market, and I believe that the BSE proposal will strengthen the return on investment for the State of Indiana by enhancing our state human capital and attract investment and jobs.

This is the future, and I am proud to enthusiastically support this initiative.

Sincerely,

A handwritten signature in blue ink, appearing to read "Jon Ford".

Jon Ford  
State Senator, District 38



**STATE OF INDIANA**  
**HOUSE OF REPRESENTATIVES**  
THIRD FLOOR STATE HOUSE  
INDIANAPOLIS, INDIANA 46204

CLYDE KERSEY  
1463 BAY BREEZE COURT  
TERRE HAUTE, IN 47803

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COMMITTEES:  
WAYS AND MEANS  
STATUTORY COMMITTEE ON ETHICS, R.M.M.  
EDUCATION  
EMPLOYMENT, LABOR, & PENSIONS

January 12, 2017

Dr. Robert English  
Dean-College of Technology  
Indiana State University  
Terre Haute, IN 47809

Dear Dean English:

I am writing to commend Indiana State University and the ISU College of Technology for your proposed Bachelor of Science Degree in Engineering (BSE). As Representative of Indiana House District 43 and an Indiana State alum, I am proud of my alma mater for thinking boldly and trying to address shortages in STEM-related fields.

As a former teacher, I appreciate and understand the importance of STEM-programs of study and have long worried that our state is not producing enough engineers. We need engineers who will be ahead of the curve of rapid technological innovation and those who possess technical fundamentals, strong problem-solving skills, entrepreneurship, innovation, and collaboration. The state needs engineers who have access to authentic, practice-based engineering experiences and are ready to meet the needs of industry. The College of Technology is a well-respected partner to business and industry and you have my enthusiastic support for the proposed BSE.

Keep up your great work!

Sincerely,

A handwritten signature in black ink that reads "Clyde Kersey".

Clyde Kersey  
State Representative  
District 43





**STATE OF INDIANA**  
**HOUSE OF REPRESENTATIVES**  
THIRD FLOOR STATE HOUSE  
INDIANAPOLIS, INDIANA 46204

Alan Morrison  
State Representative  
200 West Washington Street  
Indianapolis, Indiana 46204  
(317) 234-2993  
[www.in.gov/H42](http://www.in.gov/H42)  
[h42@in.gov](mailto:h42@in.gov)

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Vice Chair: Agriculture and Rural Development  
Natural Resources  
Utilities and Energy

January 12, 2017

Dr. Robert English  
Dean – College of Technology  
Indiana State University  
Terre Haute, IN 47809

Dear Dean English:

As an Indiana State Representative serving six counties in the western region of the state and proud ISU alum, I am pleased to offer my support for Indiana State University's College of Technology proposal to address workforce needs in Indiana through its proposed Bachelor of Science Degree in Engineering (BSE).

To put it frankly, we need more graduates in STEM-related fields and Indiana State University's College of Technology has a great history of graduating students in these fields. As a legislator and concerned citizen, I pay close attention to state and national data on projected workforce needs. The projected need for engineers in our state will not be met without programs such as the ISU-proposed BSE program of study. If our state is to continue to be the "crossroads of America" and indeed the world while now competing in a global economy, we need a workforce fueled by cutting edge universities offering cutting edge programs. The proposed BSE program is one such example.

I am proud to support this initiative and look forward to approval by our state Commission for Higher Education.

Sincerely,

Alan Morrison  
State Representative  
House District 42



Active & Passive  
Safety Technology  
Automotive Electronics

ZF TRW · Marshall IL

Department    Quality  
From            Michelle Robinson  
Phone          217-826-1830  
Fax             217-826-1831  
E-mail         michelle.e.robinson@zf.com

Indiana State University College of Technology  
Dr. Robert E. English  
101 North Sixth Street  
Terre Haute IN 47809

Date            2016-12-08

Re: Proposed Bachelor of Science in Engineering Program

Dear Dr. English

The news of the proposed Bachelor of Science in Engineering program is very exciting. Please accept my support of this plan for the College of Technology.

ZF TRW is a primary developer and producer of active and passive safety systems and serves all major vehicle manufacturers worldwide with an established footprint that includes facilities in more than 20 countries. It maintains 22 technical centers and 13 test tracks in vital markets around the world. At the Marshall Illinois facility, we employ nearly 1000 associates in a town of only 3600 people. Approximately 80 engineers support our manufacturing processes. Many of these are graduates of Indiana State who came here as new graduates and started as interns. ZF TRW provided a place for all of us to learn and grow based on the solid foundation we received at ISU. There is a constant need for those with exposure to mechanical, electrical, quality, and process engineering. A program such as you have proposed would provide new options to ZF TRW as we continue to grow.

As one of only two female engineers in Marshall I am particularly excited to hear that ISU will aggressively seek young women interested in engineering. While women and minorities make up approximately 15% of the engineering workforce across the U.S., this number is much lower in this area of Indiana and Illinois. ISU has placed an emphasis on attracting good students from these under-served groups and I see this as another positive of this proposal.

ZF TRW will be excited to see the opportunities that this degree program will provide for your students and for the technical manufacturing jobs of the Wabash Valley. We look forward to attending future job fairs and welcoming your students to our family.

Yours sincerely,

Michelle E. Robinson, Senior Quality Engineer  
ZF TRW Automotive Electronics

ZF TRW  
Automotive Electronics  
902 South Second Street  
Marshall IL



2225 N. College Ave.  
Indianapolis, Indiana 46205

Phone: 317 923-2581  
Fax: 317 923-4819

February 2, 2017

Provost Michael Licari  
Vice President of Academic Affairs  
Indiana State University  
Terre Haute, IN 47809

Dear Provost Licari,

I am writing this letter in support of the proposed Bachelor of Science in Engineering (BSE) degree at Indiana State University (ISU). The College of Technology has a number of strong programs with diverse candidates in Engineering Technology, and the addition of the BSE will allow the college to continue to build upon many years of quality and successful programs and take their curriculum to the next natural level. If approved by the Indiana Commission of Higher Education, the program will fulfill a distinct niche market in the state of Indiana, and aid many businesses in the state to hire candidates that retain skills that are transferrable across engineering disciplines. As manufacturing organizations develop and expand, this type of program can fill a compelling need for the practical engineer. The practical engineer has a special place in industry, and in our area of manufacturing, consulting and distribution, individuals with these skills will help us bridge the engineering content gap that often times occurs with our varied customer base. Indiana and the Nation need more technical trained talent that can hit the ground running, adding value from the first month on the job!

Data and personal testimony both support the need for increasing the educational opportunities and diversity for engineers. In addition to my personal challenges in hiring engineers who are able to understand multiple engineering disciplines, I have heard from many colleagues about their struggles to hire qualified professionals to fill key positions within their organizations. The generalist aspect of this degree will help alleviate some of the struggles many experience in hiring and retaining an engineering workforce, and allow us to take our businesses to new levels. The creation of this degree is crucial in meeting the continuing and growing workforce needs of Indiana and offer opportunity to its citizens to secure stable high paying professional engineering positions. It is with great confidence that I support ISU's pursuit of this degree.

I own and operate 4-businesses, all with engineering staffs-including, distribution; engineering design, energy management and process improvement; manufacturing and fabrication. I also serve on the board and a shareholder in an advanced manufacturing business. There are 50 degreed engineers among the 235 employees of the 5-companies.

Sincerely,

A handwritten signature in black ink, appearing to read "John Thompson". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

John Thompson, CEO  
Thompson Distribution Inc.  
2225 N. College Avenue  
Indianapolis, IN 46205

*Appendix 6: Faculty and Staff, Detail (This appendix should contain a list of faculty with appointments to teach in the program and a brief description of new faculty positions yet to be filled.)*

The following table contains current faculty members that have qualifications to teach engineering topics in the proposed engineering program. Their current teaching assignments or commitments are for teaching in the existing engineering technology programs. It is anticipated that up to four new tenure-track engineering faculty will be hired to complement the existing qualified engineering faculty and two new tenure-track Math faculty will be systematically incorporated to coincide with enrollments in the programs.

<b>College</b>	<b>Department</b>	<b>Area of Appointment</b>	<b>Name</b>	<b>Title/Rank</b>	<b>Tenure Status</b>	<b>Degree</b>
Technology	Applied Engineering Technology Management	Industrial & Mechanical	Affan Badar	Professor	Tenured	PhD
Technology	Applied Engineering Technology Management	Civil	Michael Williamson	Assistant Professor	Tenure Track	PhD
Technology	Applied Engineering Technology Management	Mechanical & Automotive	Phil Cochrane	Professor	Tenured	DBA
Technology	Applied Engineering Technology Management	Mechanical	Kristina Lawyer	Assistant Professor	Tenure Track	PhD
Technology	Built Environment	Industrial	Farman Moayed	Associate Professor	Tenured	PhD
Technology	Applied Engineering Technology Management	Mechanical	Mehran Shahhosseini	Associate Professor	Tenured	PhD
Technology	Applied Engineering Technology Management	Chairperson & Automotive	Randell Peters	Professor	Tenured	PhD
Technology	Applied Engineering Technology Management	Quality	Michael Hayden	Professor	Tenured	PhD
Technology	Applied Engineering Technology Management	Civil	Ahmed Mohamed	Assistant Professor	Tenure Track	PhD
Technology	Applied Engineering Technology Management	Engineering	<i>Expected need</i>		Tenure Track	
Technology	Applied Engineering Technology Management	Engineering	<i>Expected need</i>		Tenure Track	
Technology	Applied Engineering Technology Management	Engineering	<i>Expected need</i>		Tenure Track	
Technology	Applied Engineering Technology Management	Engineering	<i>Expected need</i>		Tenure Track	

<b>College (cont.)</b>	<b>Department</b>	<b>Area of Appointment</b>	<b>Name</b>	<b>Title/Rank</b>	<b>Tenure Status</b>	<b>Degree</b>
Arts and Sciences	Mathematics and Computer Science		Robert Johnson	Associate Professor	Tenured	PhD
Arts and Sciences	Mathematics and Computer Science		Nora Hopkins	Associate Professor	Tenured	PhD
Arts and Sciences	Mathematics and Computer Science		Charles Roberts	Professor	Tenured	PhD
Arts and Sciences	Mathematics and Computer Science		Nandini Bhowmick	Instructor	No Track	PhD
Arts and Sciences	Mathematics and Computer Science		Joan Dreher	Instructor	No Track	PhD
Arts and Sciences	Mathematics and Computer Science		Xiaofen Zhang	Assistant Professor	Tenure Track	PhD
Arts and Sciences	Chemistry and Physics		Valentina French	Associate Professor	Tenured	PhD
Arts and Sciences	Chemistry and Physics		Michelle Baltz-Knorr	Instructor	No Track	MS
Arts and Sciences	Chemistry and Physics		Eric Glendening	Chair/Professor	Tenured	PhD
Arts and Sciences	Chemistry and Physics		Adrienne Gilbert	Instructor	No Track	PhD
Arts and Sciences	Chemistry and Physics		Laurence Rosenhein	Associate Professor	Tenured	PhD
Arts and Sciences	Chemistry and Physics		Stephen Wolf	Professor	Tenured	PhD
Arts and Sciences	Chemistry and Physics		John Moody	Instructor	No Track	PhD

*Appendix 7: Facilities, Detail (This appendix should contain additional information on major impacts on facilities caused by this program.)*

<b>Overview of Needed Facility-Modification Project</b>	<b>Estimated Costs</b>	<b>Timeline</b>
Remodel TC 201 to accommodate two administrative assistants. This includes furniture.	\$25,000	2017 summer
Remodel TC 202 and adjoining hallway into five 120- to 150-sq.-ft., separate, secure office spaces. This includes furniture.	\$225,000	2018 summer
Remodel TC 215 space for three separate and secure 120- to 150-sq.-ft. faculty office spaces, including an open entry into the TC 201 office complex. This includes all fixtures and furniture.	\$125,000	2018 summer
Install media-presentation capability in TC 113 to allow for greater usage of classroom by AETM courses and more flexibility for engineering program. This includes an 8-ft.-wide motorized screen, speakers, microphone, ceiling-mounted projector, teaching podium with camera, etc.	\$50,000	2018 summer
Reconfigure bays in the TA 127 laboratory to accommodate chassis dynamometer research and instrumentation laboratory. This includes installation of a 22- to 24-ft. by 14-ft. bay door.	\$75,000	2019 summer
<b>Total</b>	<b>\$500,000</b>	

*Appendix 8: Other Capital Costs, Detail (This appendix should contain additional information on other capital costs associated with the program.)*

Since ISU has a strong presence in engineering technology, there exists a significant inventory of readily available and appropriate equipment for the new BS in Engineering degree program. We have been working toward creating a new simulation laboratory for multiple courses, including some of the proposed courses in the engineering program.

<b>Overview of Equipment Project</b>	<b>Estimated Costs</b>	<b>Timeline</b>
Upgrade all existing laboratories for use by Engineering and Engineering Technology students	\$294,000	2018 summer
Reconfigure room TC 212 as a 40-seat laboratory. High-end computing power with instructor controls is at the center of this proposal. With twin monitors at each station, one monitor can be controlled by the instructor and the other by the student for an interactive experience second to none. With a robust suite of CAD and hydraulics/electronics simulation software, this lab will be capable of supporting many courses within the engineering degree program. This includes all modifications, computers, furniture, chairs, and other ancillary costs. This modification needs to occur right away for both the engineering and engineering technology programs.	\$300,000	2017 summer
For the Civil Engineering concentration, a traffic signal simulator and cabinet are needed for the traffic engineering courses.	\$11,000	2017 summer
For the Civil Engineering concentration structural courses, there is a need for a suite of ASTM-standard concrete-testing equipment.	\$25,000	2017 summer
Complete final purchase of the HURCO horizontal lathe, which is currently on consignment.	\$60,000	2018 summer
Related to research in Civil Engineering, we are writing an NSF MRI program proposal for a transportation research driving simulator. The highly competitive grant program also requires a 30% match (listed in Estimated Costs) by the institution and is focused solely on the instrumentation.	\$60,000	2019 summer
<b>Total</b>	<b>\$750,000</b>	



*Appendix 9: Articulation of Associate/Baccalaureate Programs, Detail (This appendix should contain the actual articulation agreements relevant to the proposed program.)*

For the Pre-Engineering program at Ivy Tech, there are 2 options, the TSAP Mechanical Engineering Concentration and the Generalist Concentration. Transfer has been determined for students who might complete either program.

**Ivy Tech: AS in Pre-Engineering Mechanical Engineering TSAP Concentration With STGEC  
to  
Indiana State University: BS in Engineering**

**GENERAL EDUCATION (FOUNDATIONAL STUDIES) COURSES**

Foundational Studies Category	Credits
Junior Composition	3
Upper Division Integrative Elective	6
General Education Credits	9

**MAJOR REQUIRED COURSES AT ISU**

Required BS in Engineering Courses	Credits
SFTY 341 or MATH 241	3
MFG 225 Material Testing	3
ENGR 303 Fluid Mechanics	3
TMGT 361 Quality Systems and Tools	3
MET 405 Economic Analysis for Engineering & Technology	3
ENGR 406 Strength of Materials	3
ENGR 409 Senior Project	3
Concentration Course	3
Concentration Course	3
Concentration Course	3
Concentration Course	3
Credits for Major	33

**GRADUATION REQUIREMENTS**

ISU Graduation Requirements	GPA/Credit Hours
Cumulative GPA	2.0
ISU Residency Credits	30 (9 upper level)
Upper Level (300-499) Credits	45
Total Credits for Degree	120

**TSAP DEGREE MAP for REMAINING 60 HOURS**

Fall 1	Credits	Spring 3	Credits
<b>MATH 241 or SFTY 341</b>	3	ENGR 303, Fluid Mechanics	3
<b>Concentration #1</b>	3	Elective	3
<b>TMGT 361, Quality Systems and Tools</b>	3	Concentration #2	3
<b>FS-JRCOMP</b>	3	MFG 225, Introduction to Materials, Processes, and Testing	3
<b>Elective</b>	3	Elective	3
Total	<b>15</b>	Total	<b>15</b>
Fall 4	Credits	Spring 4	Credits
<b>ENGR 305, Dynamics</b>	3	ENGR 409, Senior Project	3
<b>ENGR 406, Strength of Materials</b>	3	MET 405, Economic Analysis for Engineering and Technology	3
<b>Concentration #3</b>	3	Concentration #4	3
<b>FS-UDIE</b>	3	FS-UDIE	3
<b>Elective</b>	3	Elective	3
Total	<b>15</b>	Total	<b>15</b>
		<b>Total Credits</b>	<b>60</b>

**Ivy Tech: AS in Pre-Engineering Generalist With STGEC  
to  
Indiana State University: BS in Engineering**

**GENERAL EDUCATION (FOUNDATIONAL STUDIES) COURSES**

ISU Foundational Studies Category	ISU Course	Credits	IVY Tech Course*	Credits
			IVYT 1XX	1
Freshman Composition	Waived		STGEC	
Junior Composition	Refer to Catalog <sup>¶</sup>	3		
Communication	Waived		STGEC	
Quantitative Literacy or Mathematics	Waived		STGEC	
Non-native Language	Waived		STGEC	
Health/Wellness	Waived		STGEC	
Science w/Lab	Waived		STGEC	
Social & Behavioral Sciences			STGEC	
Literary Studies	Waived		STGEC	
Fine & Performing Arts			STGEC	
Historical Studies	Waived		STGEC	
Global Perspectives & Cultural Diversity	Waived		STGEC	
Ethics & Social Responsibility	Waived		STGEC	
Upper Division Integrative Elective	Refer to Catalog	6		
<b>General Education Credits</b>		<b>9</b>		<b>30</b>

\*A grade of C or higher is required for all transfer courses.

<sup>¶</sup>ENG 105 (Composition II) or equivalent is a prerequisite to Junior Composition

## MAJOR REQUIRED COURSES

Required BS in Engineering Courses	Course to be completed as ISU	Credits	Ivy Tech Course*	Credits
MATH 131			MATH 211	4
MATH 132			MATH 212	4
MATH 231			MATH 261	4
MATH 327			MATH 264	3
SFTY 341 or MATH 241	SFTY 341 or MATH 241	3		
PHYS 115/115L			PHYS 220	5
PHYS 116/116L			PHYS 221	5
CHEM 105/105L			CHEM 105	5
MET 103	MET 103	3		
MET 130			ENGR 196	3
ECT 165			ENGR 251	4
MFG 225	MFG 225	3		
ENGR 241			ENGR 197	3
ENGR 301			ENGR 200	3
ENGR 302			ENGR 260	3
ENGR 303	ENGR 303	3		
ENGR 305	ENGR 305	3		
			ENGR 279	1
TMGT 361	TMGT 361	3		
MET 405	MET 405	3		
ENGR 406	ENGR 406	3		
ENGR 409	ENGR 409	3		
Concentration Course	Concentration Course	3		
Concentration Course	Concentration Course	3		
Concentration Course	Concentration Course	3		
Concentration Course	Concentration Course	3		
	Free Electives	12		
<b>Credits for Major</b>		<b>48</b>		<b>47</b>

\*A grade of C or higher is required for all transfer courses.

## CREDIT HOUR DISTRIBUTION

Credits Needed	Credit Hours
AS Degree	60
Program-specific Credits from Ivy Tech	47
Credits To Be Completed at ISU	60

## GRADUATION REQUIREMENTS

ISU Graduation Requirements	GPA/Credit Hours
Cumulative GPA	2.0
ISU Residency Credits	30 (9 upper level)
Upper Level (300–499) Credits	45
Total Credits for Degree	120

Disclaimer: Unless specified per the agreement, 100- to 200-level transfer courses are not typically accepted as meeting 300- to 400-level major requirements. Please refer to the ISU Catalog for more specific details concerning graduation requirements. Changes to the curricula at either institution may result in changes to the student's degree plan.

*Appendix 10: Credit Hours Required/Time To Completion, Detail (This appendix should contain the semester-by-semester, course-level detail on the program curriculum, including how long it will take to complete the program, assuming full-time study.)*

**BS IN ENGINEERING: SAMPLE EIGHT-SEMESTER DEGREE MAP FOR PROPERLY PREPARED STUDENTS**  
 (assumes engineering-ready student with scores of SAT 530 V/600 M or ACT 25, and Maple TA 21)

Fall 1	Credits	Success Marker	Spring 1	Credits	Success Marker
MET 103, Introduction to Technical Graphics with CAD	3		MFG 225, Introduction to Materials, Processes, and Testing	3	
MET 130, Introduction to Engineering and Technology	2		ECT 165, D.C. Circuits and Design	3	
MATH 131, Calculus I	4		MATH 132, Calculus II	4	
ENG 107, Rhetoric and Writing	3		CHEM 105, General Chemistry I	3	
FS-COMM	3		CHEM 105L, General Chemistry I Laboratory	1	
			Free elective	1	
<b>Total</b>	<b>15</b>		<b>Total</b>	<b>15</b>	
Fall 2	Credits	Success Marker	Spring 2	Credits	Success Marker
MATH 231, Calculus III	4		MATH 327, Advanced Engineering Mathematics	3	
PHYS 115, University Physics I	4		PHYS 116, University Physics II	4	
PHYS 115L, General Physics I Laboratory	1		PHYS 116L, University Physics II Laboratory	1	
ENGR 241, Data Acquisition and Instrumentation	3		ENGR 301, Thermodynamics	3	
FS-HW	3		FS-FPA	3	
			Free elective	1	
<b>Total</b>	<b>15</b>		<b>Total</b>	<b>15</b>	

**BS IN ENGINEERING: SAMPLE EIGHT-SEMESTER DEGREE MAP FOR PROPERLY PREPARED STUDENTS**  
 (continued)

Fall 3	Credits	Success Marker	Spring 3	Credits	Success Marker
ENGR 302, Statics	3		MATH 241 or SFTY 341	3	
Concentration #1	3		ENGR 303, Fluid Mechanics	3	
TMGT 361, Quality Systems and Tools	3		Concentration #2	3	
FS-JRCOMP	3		FS-LS	3	
FS-SBS	3		FS-HS	3	
<b>Total</b>	<b>15</b>		<b>Total</b>	<b>15</b>	
Fall 4	Credits	Success Marker	Spring 4	Credits	Success Marker
ENGR 305, Dynamics	3		ENGR 409, Senior Project	3	
ENGR 406, Strength of Materials	3		MET 405, Economic Analysis for Engineering and Technology	3	
Concentration #3	3		Concentration #4	3	
FS-ESR	3		FS-UDIE	3	
FS-GPCD	3		FS-UDIE	3	
<b>Total</b>	<b>15</b>		<b>Total</b>	<b>15</b>	

**Total Credits      120**

## ENGINEERING MAJOR REQUIRED CREDITS

Required Math and Science Courses (32 Credits)				Prerequisites
MATH	131	4	Calculus I	A grade of C or better in MATH 112 and 115 or appropriate placement examination score.
MATH	132	4	Calculus II	A grade of C or better in MATH 131.
MATH	231	4	Calculus III	A grade of C or better in MATH 132.
MATH	333	3	Differential Equations	A grade of C or better in MATH 231.
SFTY	341	3	Applied Probability and Statistics for Engineering and Technology	Math 115 or MET 215 or equivalent.
-or-				
MATH	241	3	Principles of Statistics	Appropriate placement exam score or MATH 035 or equivalent.
PHYS	115	4	University Physics I	Successful completion of or concurrent enrollment in PHYS 115L and MATH 131.
PHYS	115L	1	University Physics I Lab	Successful completion of or concurrent enrollment in PHYS 115.
PHYS	116	4	University Physics II	PHYS 115; successful completion of or concurrent enrollment in PHYS 116L and MATH 132.
PHYS	116L	1	University Physics II Lab	Concurrent enrollment in PHYS 116.
CHEM	105	3	General Chemistry I	SATM 510, ACTM 21, Maple TA score of 12, MATH 099, MATH 112, MATH 115, or MATH 131. Successful completion of or concurrent enrollment in CHEM 105L.
CHEM	105L	1	General Chemistry I Lab	Co-requisite concurrent enrollment in 105 or consent of instructor or chairperson.
<b>32</b>				
Required Engineering Core Courses (38 Credits)				Prerequisites
MET	103	3	Introduction to Technical Graphics w/CAD	
MET	130	2	Introduction to Engineering and Technology	
ECT	165	3	D.C. Circuits and Design	
MFG	225	3	Introduction to Materials, Processes, and Testing	
ENGR	241	3	Data Acquisition and Instrumentation	MATH 131
ENGR	301	3	Thermodynamics	MATH 131 and PHYS 115
ENGR	302	3	Statics	MATH 131 and PHYS 115
ENGR	303	3	Fluid Mechanics	MATH 131 and PHYS 115
ENGR	305	3	Dynamics	ENGR 302, MATH 333
TMGT	361	3	Quality Systems and Tools	Foundational Studies: Quantitative Literacy
MET	405	3	Economic Analysis for Engineering and Technology	MET 215 or MATH 115 or higher or appropriate placement score and Junior standing
ENGR	406	3	Strength of Materials	ENGR 302
ENGR	409	3	Senior Project	Senior standing
<b>38</b>				

**ENGINEERING MAJOR REQUIRED CREDITS** *(continued)*

<b>Required Concentration Area Courses—</b>		<b>Prerequisites</b>
<b>Civil Engineering Concentration (12 Credits)</b>		
CVET	410 3 Structural Analysis Concrete Design	
CVET	411 3 Waste Water System Design	
CVET	426 3 Traffic Engineering	
ENGR	441 3 Hydrology for Engineering	(MATH 129 or MATH 131) and (ENGR 303 or MET 329)
<b>12</b>		
<b>Industrial Engineering Concentration (12 Credits)</b>		<b>Prerequisites</b>
ENGR	460 3 Operations Research	MATH 231
ENGR	461 3 Work Measurement	MATH 131
ENGR	462 3 Reliability Engineering and Maintainability	SFTY 341, ENGR 340, and Junior standing
TMGT	471 3 Production Planning and Control I	
<b>12</b>		
<b>Mechanical Engineering Concentration (12 Credits)</b>		<b>Prerequisites</b>
ENGR	401 3 Heat Transfer	ENGR 301
ENGR	402 3 Finite Element Analysis	ENGR 305
MET	404 3 Engineering Design & Management	Junior standing
ENGR	408 3 Machinery Dynamics	ENGR 305
<b>12</b>		
<b>82 Major Required Credits</b> (70 Math, science, and core credits, plus 12 concentration credits)		