

**MASTER OF SCIENCE IN ELECTRICAL AND COMPUTER  
ENGINEERING DEGREE  
PROPOSAL**

**PURDUE UNIVERSITY CALUMET  
SUMMARY**

## **1. Characteristics of the Program**

The objective is to establish a Master of Science in Electrical and Computer Engineering (MSECE) degree program at Purdue University Calumet (PUC). This will build on the existing Master of Science in Engineering (MSE) degree program in Interdisciplinary Engineering where the ECE designation will properly indicate what the students are specializing in at the graduate level.

### **a. Campuses offering Program**

To be offered by Purdue University Calumet, Hammond, Indiana on-campus.

### **b. Scope of Delivery**

The degree program will be offered in the Northwest Indiana region.

### **c. Mode of Delivery**

The program will primarily be offered on-campus in the traditional classroom format, although some courses may be offered in blended or distance formats to meet student needs.

### **d. Other Delivery Aspects**

Distance education courses offered by other Purdue campuses provide expanded course choices and flexibility for students. Students have the option to pursue internship.

### **e. Academic Unit Offering Program**

The program will be offered by the Department of Electrical and Computer Engineering in the College of Engineering, Mathematics and Science. Although the Master of Science degree in Electrical and Computer Engineering is offered on other Purdue campuses, those campuses do not serve the Northwest Indiana region. Purdue North Central, the closest Purdue campus, does not offer any engineering master's degree programs. No other institution offers this degree in the Northwest Indiana area.

## **2. Rationale for Program**

### **a. Institutional Rationale**

This degree is proposed to meet the growing need for a comprehensive and advanced Electrical and Computer Engineering (ECE) program required by the high technology employment in Northwest Indiana (NWI). The proposed degree program will establish a graduate program in ECE in NWI that nurtures discovery, synthesis and professional advancement for the students.

One of the missions of Purdue University Calumet is to "...selectively offer graduate education in areas of strong student interest and community need as well as faculty expertise" (Strategic plan 2013, p. 2-see Appendix F in full proposal for link). This proposal fits into the mission of the campus for quality graduate education. See full proposal for expanded discussion of the campus mission.

Additionally, Purdue University Calumet has developed several centers and institutes that promote engineering projects through faculty, graduate student, and visiting scientist and engineer participation. These centers, notably the Energy Center, the Center for Innovation through Visualization and Simulation (CIVS), and the Purdue Water Institute, promote research and development activities that include advancing technology in energy efficiency, reliability, utilization, and processes, virtual reality with simulation technologies, application of simulation and visualization technologies to business, healthcare, and industrial and community applications of water quality monitoring, analysis and

treatment. In addition, each of the centers also emphasizes student education and training by bringing together applied research by faculty, regional partnerships and student learning through internships. The Energy Center, for example, has employed 30 engineering graduate students in recent years, all of them specializing in Electrical and Computer Engineering.

Also, as part of the Northwest Indiana Computational Grid, the Rosen Center for Advanced Computing has established the Miner (now Peregrine1) Computer Cluster at Purdue University Calumet in December, 2009 to foster more local, cutting-edge research and application in high performance computing. This computer cluster is a high performance network of supercomputers and data storage facilities that partners Purdue University Calumet, Purdue University West Lafayette, Notre Dame University, and the U. S. Department of Energy at Argonne National Laboratory. These centers currently employ 15 Purdue Calumet graduate engineering students, most of whom are pursuing their thesis research for their MSE degrees with ECE specialization.

The Purdue Technology Center of Northwest Indiana, which opened in January, 2005 has been an impetus for many high technology companies with close ties to Purdue University Calumet. These companies offer internships and full time jobs to Purdue University Calumet graduates, with most offers going to engineering seniors, graduate students, and graduates. As these high-tech companies mature, and other start-up companies take up their place at the Purdue Technology Center, the need for engineering master's degree holders with focused areas of specializations will also grow. Samples of survey and support letters from companies that hire PUC engineering graduates are included in Appendix E.

With no other university providing graduate engineering programs in Northwest Indiana, offering focused master's degrees in Electrical and Computer Engineering at Purdue University Calumet will help reach the strategic goal for the campus and also fulfill the need for a technologically sophisticated workforce for the region.

## **b. State Rationale**

**Reaching Higher, Achieving More:** the proposed degree program aligns with the Commission's policy as stated in the Reaching Higher, Achieving More statement. By providing needed technical degrees to meet regional workforce needs, the proposed degree meets the goal of a workforce-aligned higher education system, and helps to increase higher education attainment.

**Regional Campus Policy** The proposed degree program fits within the Regional Campus Policy of the Commission for Higher Education, which provides, as to the missions of Indiana's Regional Campuses, that Regional Campuses may offer select masters programs to meet state and regional needs (Regional Campus Policy, 3). The proposed degree program fits within the Regional Campus policy, and meets the state Higher Education mission by providing advanced degrees to regional students to supply the workforce with STEM educated graduates.

## **c. Evidence of Labor Market Need:**

### **i. National, State or Regional Need**

The new name of the degree emphasizing the ECE concentration will create more employment opportunities and better admission prospects for doctoral degree programs for our engineering graduate students.

It will also meet the growing need for a comprehensive and advanced ECE program required by the high technology employment in Northwest Indiana (NWI).

The proposed MSECE degree program provides advanced degree opportunities that are needed to meet the growing high technology employment in Northwest Indiana and southern suburbs of Chicago. As stated in the Regional Campus Policy, the primary geographic responsibility for Purdue University Calumet is the Northwest Indiana/Great Chicago Area.

Many of the graduates of the PUC engineering program who prefer to stay and work in northwest Indiana are employed within commuting distances from the high technology companies in the Greater Chicago area. These graduates will benefit greatly from the availability of advanced ECE courses that will contribute to the graduates' professional growth and enhance their career advancement prospects. Northwest Indiana is experiencing engineering and technological growth in all aspects of design, testing, manufacturing, research and development. Additionally, with a significant majority of Purdue Calumet engineering graduates working in the greater Chicago area, which is referred to as the Silicon Prairie due to its high technology electronics and computer and information technology companies, there is a great demand for highly skilled and specialized electrical and computer engineers in the region. Furthermore, the local industries have been modernizing their facilities in response to globalization and international competition. As a result, companies such as BP Products North America, Whiting, IN, S\TEC Group, Hammond, IN, and Arcelor Mittal, Burns Harbor, IN, have expressed their need for specialized graduate engineers.

### **Market Demand**

From the growing enrollment in our MSE (IDE) program over the past 13 years and the preponderance of preference for the ECE specialization by the MSE degree students, we expect the demand for MSECE will continue to grow. Our proposed MSECE degree is designed to broaden a student's knowledge in several fields of electrical and computer engineering. Our needs study and The Bureau of Labor Statistics report referenced below indicate that the demand for students with a graduate degree in ECE will remain strong for a long time.

### **ii. Preparation for Graduate Programs or Other Benefits**

The proposed degree program will enhance the professional skills of ECE graduates employed in the electrical and computer engineering industry in the Northwest Indiana/Chicago region.

- The program will provide opportunities for faculty to be engaged in the state of the art technologies in electrical and computer engineering.
- The program will offer an enhanced set of dual level electives for undergraduate students in electrical and computer engineering.
- Students in a focused graduate program, with or without thesis option, can collaborate with faculty for increased research and scholarship activities.

The proposed degree program will provide a nationally recognized graduate program in Electrical and Computer Engineering (ECE) at Purdue University Calumet through a combination of theoretical and practical education that develops professional expertise of ECE graduates. The proposed program

focuses on the latest advances in Electrical and Computer Engineering that will enhance the opportunities for prospective doctoral degree students.

The proposed Master of Science degree in Electrical and Computer Engineering will also prepare students to work as professionals within the electrical and computer engineering industry.

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

Projections indicate that the demand for jobs in high-tech industries will continue to increase and such businesses will have a growing need for employees with advanced degrees. The Bureau of Labor Statistics (BLS) reports in its March 29, 2012 Occupational Outlook Handbook an employment growth rate of six percent for Electrical Engineers (<http://www.bls.gov/ooh/architecture-and-engineering/electrical-and-electronics-engineers.htm>) and nine percent for Computer Engineers between 2010 and 2020 (<http://www.bls.gov/ooh/architecture-and-engineering/computer-hardware-engineers.htm#tab-6>).

Further, a report from Georgetown University Center for Education and Workforce forecasts lower unemployment rate and higher earnings for graduate electrical engineering degree holders compared with undergraduate degree holders (3.5 % versus 5.2 %) <sup>1</sup> (Appendix D). Consistent with the BLS report, many technology companies are now moving into the Northwest Indiana – South Chicago area, including several at the new Purdue Technology Center in Merrillville, Indiana.

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

With technological growth in all fields of Electrical and Computer Engineering, a master's degree is increasingly becoming a requirement for gainful employment. Based on long-term occupational projections, as stated above, Electrical and Computer Engineering jobs will continue to experience significant growth through 2018. Purdue University Calumet is situated in Economic Growth Region (EGR) 1 within Indiana and is adjacent to the Chicago-Naperville-Joliet, IL Metropolitan Statistical District. Most of our students live and work in these two regions.

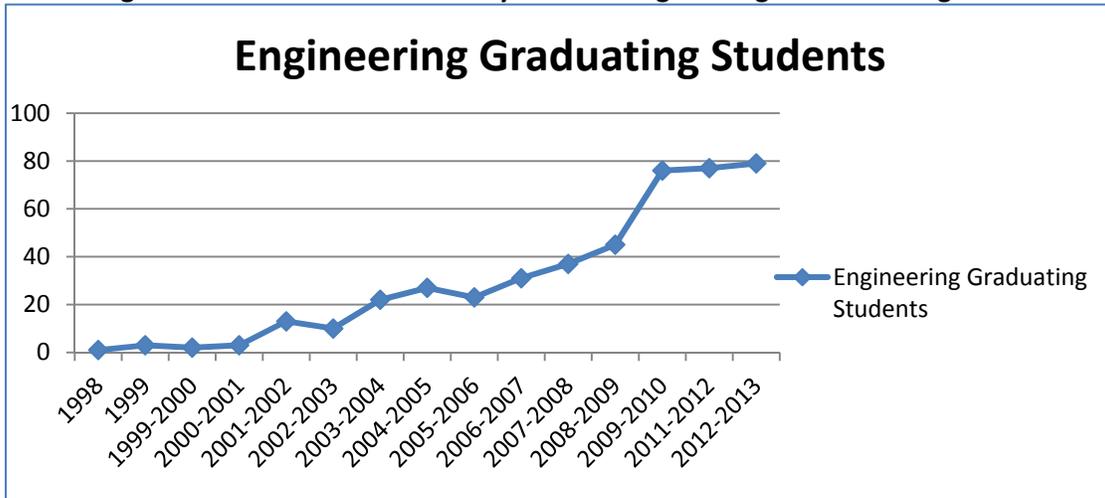
### **v. Surveys of Employers or Students and Analysis of Job Postings**

Over the past 11 years, the number of engineering graduate students has grown from approximately 30 to 170 with number of students graduating from the program shown in Fig. 1. Below. A large majority of these students have been interested in specialization in Electrical and Computer Engineering (or, Mechanical Engineering, see companion proposal) and, consequently, focused on taking courses and completing thesis work in ECE (or, ME) within the interdisciplinary field of study offered at PUC. Fig. 2 On the next page shows this preference of students who graduated with the MSE degree program, with ECE specialization based on their plans of study, at PUC over the same 13 year period. As the figure indicates, only a handful of graduates opted to study general engineering for their MSE (Interdisciplinary Engineering) degrees with no notation about their area of concentration.

---

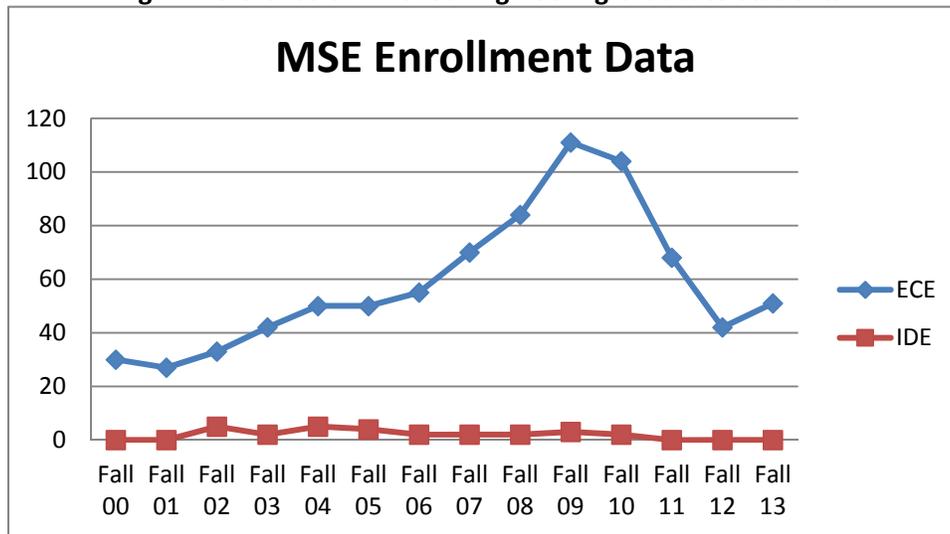
<sup>1</sup> Anthony P. Carnevale, Ban Cheah and Jeff Strohl, "Hard Times: College Majors, Unemployment and Earnings: Not All College Degrees are Created Equal," from the Georgetown University Center on Education and the Workforce, <http://cew.georgetown.edu/unemployment/> released January 4, 2012.

**Fig.1 Growth of Purdue University Calumet Engineering Graduate Program \***



\*Fall 2000 to Fall 2013 based on 'live' data

**Fig 2. Preference of Enrolled Engineering Graduate Students\***



\*Focused in Completing Coursework and Thesis Options in ECE over IDE from Fall 2000 to Fall 2013, Based on 'live' data

These charts are obtained from 'live' data based on Plan of Study information and the interest area of the students' enrollment. Data showing headcounts and FTE for the ECE concentration generated by the Office of Institutional Research are shown in section 6, table 2. (One of the possible reasons attributed

to the decline in graduate enrollment is the lack of MSECE degree, which was cited by some students planning to pursue a Ph.D. degree after graduating with a BSECE degree from Purdue University Calumet. With more and more U.S. universities attracting students from China, for example, it is to our advantage to stay competitive with the MSECE degree offering at Purdue University Calumet). In response to globalization and international competition, the local industries have modernized their facilities, which require specialized graduate engineers. The need for focused graduate degrees has also been advocated by the Engineering Advisory Board members (30 members representing 22 companies) and the leaders of local industries. Eighty percent of the respondents to the survey voiced their support for specialized MSECE and, for Mechanical Engineering, MSME degree programs at Purdue University, Calumet.

See full proposal for an extended discussion of the student and employer surveys undertaken by the program in support of this proposal.

Based on the workforce forecasts and employer and alumni surveys (see Appendix E in the full proposal for examples), we strongly believe that the proposed MSECE degree program will attract many ECE graduates from the Northwest Indiana region and the surrounding southern suburbs of the Chicago area.

**vi. Letters of support** See Appendix E in the full proposal for Letters of support and Sample surveys. Both Students and area employers have indicated interest in the proposed program. Some samples are attached to this overview.

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

#### **a. Costs**

With the current ECE faculty running the MSE degree program, no additional resources are requested for the foreseeable future. See Table 1 at the end of this document, and in the full proposal.

### **4. Similar and Related Programs**

#### **a. List of Programs and Degrees Conferred**

A 'Master of Science in Electrical and Computer Engineering (MSECE)' is the degree to be awarded to all students who successfully complete the program. The student's diploma will read "Master of Science in Electrical and Computer Engineering, Purdue University, Awarded at Hammond in the State of Indiana (date)."

#### **i. Similar Programs at Other Institutions**

No public institution offers an MSECE degree program to serve the residents of northwestern Indiana. The closest public institution that offers a master's degree program in ECE is Purdue University, West Lafayette, which is over 95 miles from Hammond. The University of Notre Dame, at a distance of 72 miles from Hammond, is the closest private institution in Indiana that, along with several universities in the Chicago area, offer equivalent graduate degrees in ECE. The proposed master's program in ECE will be the first one based in northwest Indiana to serve students in Purdue University Calumet's geographic area.

Additionally, with the availability of dormitories at PUC, the proposed program can attract quality students from outside of Northwest Indiana.

## **ii. Related Programs at the Proposing Institution**

The related program at Purdue University Calumet is the Interdisciplinary Engineering program (MS in Engineering) or MSE. It is anticipated that most of the current students in the MSE program with a concentration in ECE will move to the MSECE program. The other proposed related program is the proposed MS in Mechanical Engineering (MSME), also proposed to be offered at PUC.

## **b. List of Similar Programs Outside Indiana**

The University of Illinois at Chicago, Illinois, is the nearest public institution offering a graduate program in Electrical and Computer Engineering. However, due to the distance and the high cost of out-of-state tuition, students from Northwest Indiana have been reluctant to attend any of the above (out of state or private) institutions to obtain a graduate degree.

## **c. Articulation of Associate/Baccalaureate Programs**

Since this is a graduate degree, there are currently no articulations contemplated.

## **d. Collaboration with Similar or Related Programs on Other Campuses**

We do not anticipate the need for any collaborative arrangements with other parties. The possibility of enrolled students taking online courses offered at other Purdue campuses is being explored, to enhance the course options available to students.

Some of the courses (e.g., ECE 57400: Software Engineering Methodology) in the proposed program may be taken by students enrolled in the Master of Science in Computer Science degree program. Similarly, courses such as CS 50300: Operating Systems, may be taken by students in the proposed MSECE degree program.

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

### **a. Credit Hours Required/Time to Completion**

The proposed degree program requires a total of 30 credit hours to be completed with thesis or non-thesis option. To earn the Master of Science in Electrical and Computer Engineering (MSECE) degree, students must complete 30 credit hours, with an aggregate minimum grade point average of 3.0 for the courses listed in the Plan of Study. Sample plans of study are listed in Appendix A in full proposal for the thesis and non-thesis options. The degree can be completed in 2 years of full-time study.

## **6. Projected Headcount and FTE Enrollment and Degrees Conferred**

Projected growth for the ECE Department graduate student enrollment is from the current level of 57 (full-time equivalent) to about 85 in five years.

Purdue University, Calumet has been experiencing a decent growth in engineering graduate student enrollment in the last 13 years (Figs. 1 and 2 in section 2.c.v).

**Table 2**  
**Data for Question # 6**  
**Projected Headcount and FTE Enrollment and Degrees Conferred**

	<b>Year #1</b> <b>FY 2014</b>	<b>Year # 2</b> <b>FY2015</b>	<b>Year # 3</b> <b>FY 2016</b>	<b>Year # 4</b> <b>FY 2017</b>	<b>Year # 5</b> <b>FY 2018</b>
Enrollment Projections (Headcount)	<u>60</u>	<u>65</u>	<u>70</u>	<u>76</u>	<u>82</u>
Enrollment Projections (FTE)	<u>36.0</u>	<u>39.0</u>	<u>42.0</u>	<u>46.0</u>	<u>50.0</u>
Degree Completions Projection	<u>37</u>	<u>40</u>	<u>43</u>	<u>47</u>	<u>52</u>

## Appendix

### Sample Surveys and Letters of Support

Sample Survey Returned from an Engineering Company that hires PUC Engineering Graduates



**Charles J. Tilleman, P.E.**  
Site Engineering Authority



BP Products North America Inc.  
Whiting Refinery  
2815 Indianapolis Boulevard  
Whiting, Indiana 46394

February 3, 2011

Chenn Q. Zhou, Ph.D.  
Professor and Head of Mechanical Engineering Department  
Director of Center for Innovation through Visualization and Simulation (CIVS)  
Purdue University Calumet  
2200 169th Street  
Hammond, IN 46323

Dear Professor Zhou:

BP Whiting is proud to have 28 Purdue University - Calumet engineering graduates, including 5 with MS Engineering degrees, in our employ. We fully support your effort towards offering Master's degrees with focus and emphasis on ECE and ME. With more than 200 engineering graduates employed at Whiting, a local university offering discipline specific graduate degrees could be seen as desirable for advancing their engineering knowledge and career.

Best of luck in your efforts and please feel free to contact me if there is anything further that I can do to help you.

A handwritten signature in black ink that reads 'Charles J. Tilleman'.

Charles J. Tilleman

**Engineering Graduate programs  
PURDUE UNIVERSITY CALUMET**

Company Name: S\TEC Group Inc. (Superior Engineering ,LLC)

Address: 2345 167<sup>th</sup> St.; Hammond, Indiana ; 46323 \_\_\_\_\_

Telephone Number: 219 844 7030 \_\_\_\_\_

Email Address: rhunter@supereng.com \_\_\_\_\_

Your Name: Ronald Hunter \_\_\_\_\_

1. How many technical employees does your company have? **Approx 160** \_\_\_\_\_
2. How many employees have an engineering degree at the following levels? Estimate BS  
**40** MS **10** Ph.D. **0**
3. For those with a BS degree, how many are working toward a general MS degree in engineering? **Currently none**
4. How many of your employees might be interested in a separate MS degree in ECE or ME at Purdue Calumet, if available? Estimate 10 \_\_\_\_\_
5. Would the existence of a separate MS degree in ECE or ME at Purdue Calumet make it easier for you to hire MS holders?  
Strongly yes **X** Yes \_\_\_\_\_ No \_\_\_\_\_ Don't Know \_\_\_\_\_
6. Would Purdue Calumet offering a separate Master of Science degree in ECE and ME benefit your company? **I believe it would**  
Strongly yes **X** Yes \_\_\_\_\_ No \_\_\_\_\_ Don't Know \_\_\_\_\_
7. How many engineers with a graduate degree do you foresee to hire in the next five years? **8?**

Engineering Graduate programs  
PURDUE UNIVERSITY CALUMET

Company Name: ARCELORMITTAL BURNS HARBOR  
Address: 250 W. US HIGHWAY 12  
Telephone Number: 219 787 3081  
Email Address: dale.heinz@arcelormittal.com  
Your Name: DALE E. HEINZ

1. How many technical employees does your company have? ~ 100
2. How many employees have an engineering degree at the following levels?  
BS 75 MS 10 Ph.D. 2
3. For those with a BS degree, how many are working toward a general MS degree in engineering?  
NO ONE CURRENTLY.
4. How many of your employees might be interested in a separate MS degree in ECE or ME at Purdue Calumet, if available? SEVERAL
5. Would the existence of a separate MS degree in ECE or ME at Purdue Calumet make it easier for you to hire MS holders?  
Strongly yes \_\_\_\_\_ Yes  No \_\_\_\_\_ Don't Know \_\_\_\_\_
6. Would Purdue Calumet offering a separate Master of Science degree in ECE and ME benefit your company?  
Strongly yes \_\_\_\_\_ Yes  No \_\_\_\_\_ Don't Know \_\_\_\_\_
7. How many engineers with a graduate degree do you foresee to hire in the next five years? 25  
(ESTIMATED 5/YEAR)