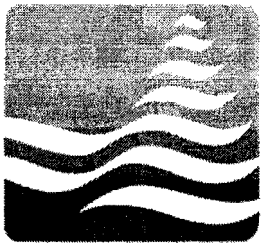

Northern Michigan University

Academic Program Review Self-Study Report

Department/Unit Name:	Engineering Technology
Dean Name:	Harvey Wallace
Department Head Name:	Michael Rudisill
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PART A: Departmental Information

I. History, Development, and Mission of the Department

Departmental Narrative:

The department originated in 1915 as the Manual Training Department and over the years the name changed to Industrial Arts and then Industrial Arts Education. Up until the 1970's era the department was entirely dedicated to producing "Industrial Arts" teachers for K-12. A graduate of the department from the late 1950's attending alumni reunion claimed that at that time the department was the largest in Education – which would have made it the largest department on campus at that time.

In the 1970's the department began to change focus due to the declining demand for Industrial Arts teachers, growing demand from traditional students and airbase personnel for technical degrees and started offering degrees that would prepare graduates for industry. In 1973 the department changed its name to Industry & Technology to reflect the changing focus and in 1991 split into two departments – the Industrial Technology Department & the Electronics Department to accommodate the growth in preparing students for industry and particularly technical graduates in the electronics area that was fueled in a large part by airbase personnel. It was in 1988 that the first engineering technology program was introduced – Electronic Engineering Technology (EET) which exist to this time.

When the airbase closed in 2003 (actually the effect was prior to that once the closure was announced and drawdown of base personnel started) the effect on departmental enrollments was dramatic. Initially it was actually positive as airbase personnel were positioning themselves to exit the service. But as the base personnel worked through the system and the lower local population caused departmental enrollments through 2007 to drop by over 60%. During this timeframe with advice from our industrial advisory council and trying to attract more enrollments the Mechanical Engineering Technology (MET) degree was introduced in 2000. And in 2001 due at least partially due to the lowered enrollments in both departments, the Industrial Technology Department and the Electronics Department were reintegrated into the Engineering Technology Department. In 2008 enrollments finally started to rebound and have continued to improve to the present.

In recent history since 2001 the department has continued to adapt to changing student and industry requirements. A certificate in CNC Technology was introduced in 2001 with support from Pioneer Surgical to provide skilled machinist for their programs. This was broadened in 2010 to include an associate degree in CNC technology (effectively replaced manufacturing technology) to match industry and student desires.

The architectural program (associate degree) was discontinued in 2006 due to low enrollments. And in 2010 the Industrial Technology (IT) degree was combined with the Technology and Applied Sciences (TAS) due to declining enrollments to provide a baccalaureate completion degree for students coming in with associate degrees (traditionally the TAS degree) and a degree with manufacturing management flavor (traditionally the IT degree).

The Secondary Education Industrial Technology major, which for the majority of the department's history was the only degree, after being suspended for a short period in the late 1990's has small enrollments but outstanding placements. And the EET and MET degrees which currently are the two defining degrees for the department received ABET (Accreditation Board for Engineering and Technology) accreditation in 2010 placing them with the elite programs in the country.

Departmental Data:

A. Faculty. List faculty and their credentials (degree) and area of specialty. Curriculum Vitae for each faculty member should be included in the appendix.

Faculty Name	Highest Degree	Current Rank	Area of Specialty	Primary Teaching Responsibility
Michael J. Cauley	EdD	Associate Professor	Engineering Design/CAD	Eng Design/CAD
John A. Gumaer	MS	Assistant Professor	Electrical Engineering	Electronics
Robert A. Marlor	PhD	Associate Professor	Civil Engineering	Structures/Materials
Michael W. Martin	MS	Assistant Professor	Mechanical Engineering	Mechanical Eng
Cale T. Polkinghorne	EdS	Instructor	Manufacturing/CNC	Machining/CNC
Michael D. Rudisill	MS	Associate Professor	Electrical Engineering	Electronics

Comments:

Due to the hands-on nature of the engineering technology program practical experience in engineering is valued very highly. Therefore the terminal degree is defined in the bylaws as:

The Engineering Technology department recognizes the EDD or PhD in an appropriate area of training, education, engineering or technology as the terminal degree. A Masters Degree plus registration in the State of Michigan as a Professional Engineer also meets the terminal degree requirement.

Gumaer, Marlor, Martin and Rudisill are all registered Professional Engineers, Dr. Cauley is the most senior faculty member on campus and Mr. Polkinghorne has finished all of the coursework for his doctorate and expects to have his degree within 18-24 months. Overall it is a very experienced faculty group

B. Enrollments and Service Role of Department.

Year	SCH	FTETF	SCH/FTETF	Majors	Total Majors	Majors/ FTETF	% Service
Fall 2006	1,812	7.76	233.5	189	197	24.4	28.8%
Fall 2007	1,610	8.09	199.0	178	189	22.0	34.4%
Fall 2008	1,937	8.17	237.1	193	202	23.6	34.4%
Fall 2009	2,093	8.44	248.0	243	284	28.8	31.7%
Fall 2010	2,176	9.65	225.5	225	260	23.3	30.4%

Student credit hours and majors have slowly increased over the last five years and we are working to continue that trend. Enrollments had a surge in 2009 due the economy and did fall back slightly in 2010 although holding about the 2008 level and are up again in 2011 according to preliminary numbers.

FTETF spiked slightly in 2010 mainly due to a new position funded by the DOE grant we received that year. We are hopeful that enrollments can be grown in that program to justify continuing the position when the grant ends (2013). The grant also probably slight effected SCH/FTETF as it required smaller lab sections in that program which would impact that statistic.

Percentage Service has hovered around 30% and we would expect that to remain in that area barring drastic changes in university curriculum.

C. Facilities and Equipment

Lab space in the Jacobetti Center has shrunk in the past several years with the leasing of space (previously departmental lab space) to Northern Initiatives and the renting of departmental lab space to local labor unions (Electrician's Local) for training. At the same time the department's needs have not diminished but have grown.

In this same time period the department has added a Alternative Energies Lab, added a power technician program which requires a great deal of lab space, greatly expanded the SAE student Baja club and expanded the senior projects scope for both EET and MET students. We have been fortunate to obtain much needed new equipment through internal and external grants and CERP but we are almost literally now at the point where any new equipment will require removing something from the existing labs.

There is no dedicated space for senior projects (a critical part of the curriculum), SAE club and the dedicated space for the alternative energies lab is situated on the mezzanine above the HVAC lab causing conflicts there. There is absolutely no dedicated space for faculty research or projects which has to be limiting.

The equipment available for faculty use is certainly adequate but the space problem has become critical. The Scholarly Resource Assessment goes into more depth of the problems and is attached.

D. Revenue and Other Resources Generated

1. Grants (internal and external):

Title of Grant	Source of Funding	Value of Grant	Faculty Member(s) Involved
Hybrid BAJA – Second-Generation Vehicle	Faculty Grants	$5,000	Rudisill
Workforce Training for the Electric Power Sector	Department of Energy	$673,462	Rudisill
Renewable Energy Laptop Computer Station at NMU	Wisconsin Energy	$1,000	Martin
Renewable energy powered laptop computers at NMU	Wildcat Innovation Fund	$4,970	Gumaer, Martin
Breaking down classroom walls: Fostering improved communication and relations between engineers and tradesmen through a joint semester project	COPS	$1,240	Martin, Polkinghorne

2. Other sources of revenue:

The department has received and continues to receive a great deal equipment and materials donation.

UPPCO and ATC have donated large amounts of equipment including the resources to move the equipment in support of the power technician program. In addition UPPCO has pledged $30,000 (over three years) of support to the program as a cash contribution.

Pioneer Surgical and Superior Extrusion (just to mention the two largest contributors) have donated a great deal of equipment and materials in support of our machining and CNC programs. In addition Pioneer Surgical supports the CNC Certificate by supplying instructors and scholarships for students in the program.

The department also earns revenue occasionally by utilizing our resources in support of local entrepreneurs and industry. For example over the summer of 2011 we support a local entrepreneur by providing engineering support and prototype production for ski bindings which he is developing.

E. Departmental Costs

1. What is your annual departmental budget?

   $671,548 (base) | $785,540 (revised – CERP) {fy2011}

2. What are your instructional costs per student credit hour, i.e. $ spent on instruction/# of student credit hours?

   $671,548 / 4608 = $145.74 (base) | $785,540 / 4608 = $170.47 (revised – CERP) {fy2011}

3. What are the other major expenditures in your department other than instruction, i.e. non instructional costs (equipment, travel, library, software, etc.)?

   The largest cost for the department is the operation of the labs to support the curriculum. Even though we get donations to support these labs there are still large costs involved in maintaining equipment, obtaining supplies that we can't get donated and consumables. In the last fiscal year we had $25,000 in just lab supply expenses (base budget for discretionary spending is $27,500). This was elevated somewhat due to new equipment that was brought online but in any year the labs eat up almost our entire entire discretionary (non-personnel) budget.

4. Have you done anything to increase efficiency or contain costs in your department? Describe.

   As the lab supplies are the largest part of our budget (outside of personnel costs of course) that is where we focus our efforts to contain costs. The largest part of this is the solicitation of materials to support the labs from Superior Extrusion and other local companies. This saves the department thousands of dollars a year and allows students a much better educational experience as we don't have to severely limit materials for class projects.

   Another opportunity that we just implemented within the last year was to buy used carbide machine tooling from Pioneer Surgical at scrap material prices. Most of this tooling while worn for Pioneer's

production is fine for students in our labs. When we wear the tooling out we can sell it at scrap prices effectively providing us with tooling at no cost. This promises to save us thousands a year as tooling for the machine shop is a large unavoidable expense.

PART B: Individual Majors within the Department

Name of Major:	Electronics Engineering Technology
Self-study Contact Name:	Michael D. Rudisill
Self-study Contact Email:	mrudisil@nmu.edu
Self-study Contact Phone:	906.227.2190

II. History, Development and Recent Changes of the Major

As mentioned in the departmental history this degree was first offered in 1988. It was an outgrowth of what was then the Secondary Education Industrial Technology program with an electrical emphasis. This is a somewhat standard curriculum nationwide with various emphases depending on regional needs. Our program has an industrial emphasis graduating students prepared to work in manufacturing or related industry.

The last major revision to the major was in 1997 however course content is constantly updated with current technology. Curriculum and course content is reviewed on a regular basis by the departmental advisory council made up of industry representatives.

Graduates are tracked by the department with a survey shortly after graduation and periodic surveys to track them through their careers. Graduates routinely provide assistance with placement of new graduates and interns as well as donation of materials in support of the program. The program received ABET accreditation in 2010 which documented its content and delivery as meeting the highest national standards.

III. Demand for the Major

The demand for graduates from the Electronics Engineering Technology program has been excellent for the last five years even through the economic downturn. There is not much demand locally although some graduates have gotten employment at Cliffs Natural Resources. While the Fox Valley area of Wisconsin with its manufacturing base has historically been the largest employer of our graduates we currently see more graduates finding employment nationwide.

The Department of Labor forecasts the demand for Electrical Engineers will remain constant through 2018. What we see in our placements is that we could easily place twice as many graduates as we have available.

IV. Quality of the Inputs and Resources for this Major

A. Faculty Teaching in this Major (Credentials and Productivity)

Both full-time faculty (includes the department head) teaching in the curriculum hold Master's Degrees in Electrical Engineering and are licensed Professional Engineers in the state of Michigan. (Master's Degree and registration as a Professional Engineer satisfies the terminal degree in the department.)

Both are active in professional organizations with 4 papers (2/2) and 3 grants (1 external) between them in the last 5 years. All this professional development directly supports the curriculum and student learning.

There is currently an open position to support the electrical programs for which there is a search underway.

B. Credentials of Students Enrolled in this Major

1. First Time - Full Time New Freshmen

Year	# students	Avg ACT	HS GPA	% meeting all admission criteria	% w/composite ACT 24+
Fall 2006	2				
Fall 2007	2				
Fall 2008	4				
Fall 2009	10	23.4	2.87	90%	50%
Fall 2010	5				
Fall 2011	4				

Students directly entering the baccalaureate program are generally fairly well prepared as indicated by the one year data is shown for (we are unable to show data for years with less than six students). Most students who graduate from this program enter as Associate degree candidates which is the reason for the very low numbers. (We advise students to declare as Associate Degree candidates unless there are reasons for them to have to declare for the baccalaureate program.)

2. New Transfer Students

Year	#students	Avg Transfer Hours	Transfer GPA
Fall 2006	1		
Fall 2007	2		
Fall 2008	2		
Fall 2009	5		
Fall 2010	3		
Fall 2011	1		

Numbers for transfers into the program are also very low as shown (again we are prevented from showing data for years with less than six students). While there quite a bit of variation the average number of transfer hours over the six years shown was 48.7 and the average transfer GPA was 2.73.

3. Facilities & Equipment

There are two major labs that directly support the electrical program (it is not possible to differentiate between the associate and baccalaureate degrees). An electronics lab which is adequately supplied with test equipment (power supplies, meters, oscilloscope, etc) and components. There is also an industrial electrical lab that contains industrial grade electrical equipment (motors, transformers, controllers, etc). Additionally there are two other general purpose labs that are used for advanced and specialized electrical classes. The labs are generally in good condition however the industrial electrical lab will require some modernization within the next five years.

V. Quality of Major

A. Curriculum

The curriculum of all the programs in the department is monitored by the department's Advisory Committee made up of representative of industries that employ our graduates. This committee meets once a year and reviews each of the majors on a periodic basis. In addition each member is asked at each meeting about industry developments or trends that should be added to our curriculum.

The program also is required to cover all the ABET learning objectives in order to maintain our accreditation. A copy of our last self-study is included in the appendix to demonstrate the breadth of the assessment.

B. Learning Outcomes Assessment

The primary outcomes assessment tracked at the university level is job placement. We view placements as the primary reason students enroll in the curriculum and therefore should be primary measure of the success of the program. For the last 5 years 15 of the 19 graduates are known to have had employment in their field within six months of graduation. We were unable to track the other four graduates but assume that if they could not find employment they would have contacted us.

The second assessment tracked is that the graduates will have at the minimum a basic level of technical knowledge. This has been assessed for the last three years using a nationally normed test. Three of the four graduates taking the exam in the last year scored better than 50% (the national average).

Last for the last year we looked at presentation abilities of our graduates as this is a recognized weak area for engineering graduates nationally. This was assessed during senior project presentations and all the graduates were scored by the audience (faculty, advisory council members and students) as satisfactory.

We also track a large number of specific objectives in support of our ABET accreditation. These can be viewed in the attached self-study.

C. Job Placement and Graduate School Acceptance

Graduates from the Electronic Engineering Technology program from NMU or any similar program nationally do not enter graduate school but enter the workforce.

Job placements as discussed above have been excellent out of the program. We are not aware of any graduates from the last five years that are not employed. As we advise all of our graduates to contact us if they are looking for work due to our large pool of industry contacts we are confident that all are employed.

VI. Size, Scope, and Productivity of the Major

Data: (Tables and Charts)

1. Enrollment as 1st and 2nd majors over the past six years

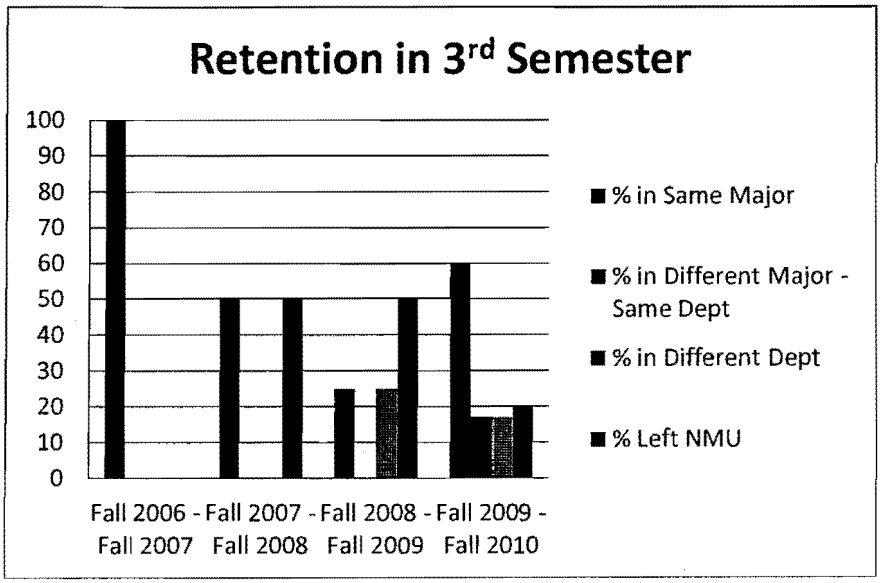
Numbers for the program are small but many that end up graduating start in associate degree programs and enter the major after graduating with the associate degree. The overall trend is up with a spike around 2009 due to the economy with many returning to the workforce with jobs available. For all of our programs a problem (from our perspective not the student's) is that many times using the knowledge they gained from the program to this point student leave for employment opportunities.

	2006	2007	2008	2009	2010	2011
# students	24	18	24	38	41	34

2. Retention (1st to 3rd semester) over the past five years

Due to the small number of incoming freshmen this metric is erratic in the least. Looking overall however of the 18 entries only 5 left the university which is probably better than the university average.

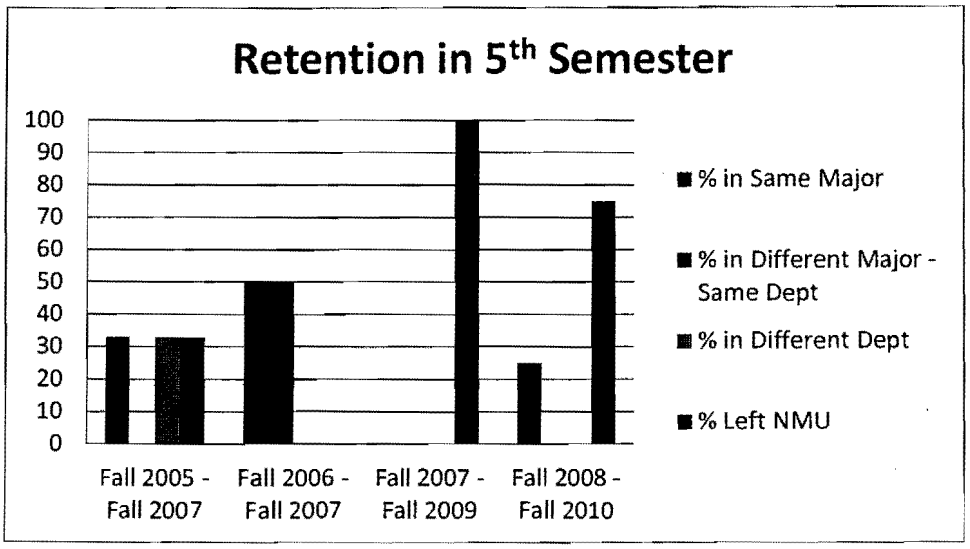
	# Enrolled to start	Retention in 3rd semester				
		# in Same Major	% in Same Major	% in Different Major Same Dept	% in Different Dept	% Left NMU
Fall 2006→ Fall 2007	2	2	100%	0%	0%	0%
Fall 2007→ Fall 2008	**2**	**1**	**50%**	**0%**	**0%**	**50%**
Fall 2008→ Fall 2009	4	1	25%	0%	25%	50%
Fall 2009→ fall 2010	10	6	60%	17%	17%	20%



3. Retention (1st to 5th semester) over the past four years

Again small numbers make this very erratic. Over the four years listed however just under 50% were still at the university. By the time students make it to the fifth semester they are employable with the skills they have acquired and several took such opportunities.

	# Enrolled to start	Retention in 5th semester				
		# In Same Major	% In Same Major	% In Different Major-Same Dept	% In Different Dept	% Left NMU
Fall 2005→ Fall 2007	3	1	33%	0%	33%	33%
Fall 2006→ Fall 2008	2	1	50%	50%	0%	0%
Fall 2007→ Fall 2009	2	0	0%	0%	0%	100%
Fall 2008→ fall 2010	4	1	25%	0%	0%	75%



4. Degree Completions

Completions per major are higher than is probably normal due to the large number of graduates that start out in associate programs. This is also somewhat distorted as 2006 was a low point in enrollment and we were graduating larger classes from previous years while in taking fewer students. Now we are seeing the reverse as we have taken in larger numbers in the last several years and graduating from previous smaller classes.

Year	# of Graduates	% of Graduates (#Graduates/#majors)
2006	10	42%
2007	6	33%
2008	5	21%
2009	7	18%
2010	5	12%
2011	5	15%

VII. Revenue and Other Resources Generated by this Major

There are no specific revenues generated by this major.

VIII. Costs and Other Expenses Associated with the Major

A. Estimate the instructional costs (faculty) for this major or courses specific for this major.

There is really no way to estimate the instructional cost for this specific major within the department due to faculty teaching courses that serve several baccalaureate programs within the department as well as associate level programs (which may or may not matriculate into this program) and service courses. The best estimate would be the departmental average shown in the departmental section of approximately $170 per SCH.

B. Are there non instructional costs (equipment, travel, library, software, etc.) specific for this major? Summarize, including approximate costs.

There is a relatively small cost for software funded through the LTF however again this is almost impossible to separate out by major as the software packages are used across several majors baccalaureate and associate degree programs. The two programs primarily used by this major are Labview and Multisim which run approximately $20,000 per year for license and upkeep.

IX. Impact of the Major and Aspirations for the Future

A. Importance of major to university and community

While there are not some of the obvious ties to the community from this program that others have there are nonetheless many important relationships that are solidified by this program. For example although the department's relationship with Cliff's Natural Resources is primarily associated with the Industrial Electrical concentration of the Electrical Technology degree (associate level program), the baccalaureate program provides continuing education opportunities for these graduates and higher level technicians available to support that industry.

Another important project that benefited the local community grew out of a senior project undertaken by two majors in Engineering Technology (one EET and one MET). The city of Marquette recently received a grant for and installed a current flow meter at Picnic Rocks to monitor rip currents and warn swimmers in an area that has claimed multiple lives. All of the engineering for that project including several presentations to sell the idea to the city were done by Craig Wiseman and Scott McLain as their senior project.

Challenges, Opportunities and Plans for Improvement

1. Challenges and threats, and areas for improvement and opportunities.

The primary short term challenge is to grow enrollment in both the baccalaureate and associate electrical programs. To have a healthy program the goal is to have 100 - 120 students in the electrical program counting both baccalaureate and associate students.

The current enrollment is 82 students so this is a 25-50% increase. The threat here is that associate degree students (those who initially come to NMU intending to just attain an associate degree and enter the workforce – even though many of them stay for the baccalaureate degree) are almost entirely local students – very few students leave "home" to attain an associate degree. It is well documented that the demographics is going to cause the pool of "local" students to continue to shrink.

We will need to increase our efforts to attract students from downstate, northern Illinois, northern Wisconsin, Minnesota and other areas to meet this goal (or even maintain current enrollments). Currently a majority of baccalaureate students are from outside the local area so we can attract these students – we just need to find ways to attract more.

2. Goals, objectives, timelines/benchmarks that address these challenges.

The first goal is a successful search for an additional faculty member. It is very difficult to find qualified adjuncts in the electrical program in the Marquette area and therefore operating with an open position causes overloads and extra work for existing faculty members limited the time they can devote to attracting new students.

If we can successfully hire a new faculty member the goal would be to reach a 20-25% increase in enrollment within two years. That is probably an ambitious goal but depending on the economy and other outside factors should be attainable.