New Program Proposal Template

Program Title:

Bachelor of Science in Electrical Engineering

Are you proposing a program new to WSU or extending an existing program to a new site or medium?

☑ New to WSU ☐ Extending Existing Program

CIP Code (consult registrar):__14.1001__
(**C**lassification of **I**nstructional **P**rograms)

Department: School of Engineering and Computer Science (ENCS), WSU Vancouver

College: College of Engineering and Architecture

Departmental Contact:

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Campus of Origin: Vancouver

Starting Date: Fall 2008

Method of course delivery: (check all that apply)

☑ Classroom
- ❍ Pullman
- ◉ Vancouver
- ❍ Tri-Cities
- ❍ Spokane
- ❍ Spokane - ICN
- ❍ WSU Learning Centers at:

_____

☐ WHETS or Video-conferencing System
☐ On-line
☐ Videotape
☐ Flexible Enrollment (with e-mail)
☐ Correspondence (Paper only)
☐ Other (please describe) _____

I. Mission Statement

Washington State University

Vision
Washington State University offers a premier undergraduate experience, conducts and stimulates world-class graduate education, research, scholarship and art, and provides an exemplary working and learning environment that fosters engagement.

Mission
As a public, land grant and research institution of distinction, Washington State University enhances the intellectual, creative, and practical abilities of the individuals, institutions and communities that we serve by fostering learning and inquiry in all their forms.

A) Mission statement of School of ENCS

The mission of the School of ENCS is to provide high-quality education that prepares graduates for success in professional practice and advanced studies. The School provides this education through small-size undergraduate and graduate programs that allow close interaction between faculty and students. Additionally, the School's mission includes performance of applied as well as fundamental research through engagement with area industry and the pursuit of scholarly activities by its faculty.

College of Engineering and Architecture

To provide a comprehensive education to a diverse constituency in engineering and architecture that prepares students to contribute effectively to the profession and society, for advanced study, and for lifelong learning; to conduct research, integrated with education, in selected areas of excellence, within traditional disciplines and within interdisciplinary teams, technologically important and relevant to the region and nation; and to serve constituents through technology and design transfer partnerships and extended education programs.

WSU Vancouver

As a public, land grant and research institution of distinction, Washington State University enhances the intellectual, creative, and practical abilities of the individuals, institutions and communities it serves by fostering learning and inquiry in all forms.

Washington State University Vancouver is an engaged research university dedicated to offering premier undergraduate and graduate experiences and sees the educational endeavor as student-centered, relevant and purposeful. Faculty, students and community are partners in actively seeking connections within and across disciplines, and collaboratively engaging as lifelong learners in a technologically and culturally complex world.

B) Describe how this proposed program will complement or reflect these missions.

Questions to ask:

- Where are we? (as a department/college/campus)
- Where do we want to go (or to develop, or to be perceived)?
- How will the proposed program help us get there?

Access to higher education in SW Washington: Higher education in southwest Washington is less available than elsewhere in the state. The number of funded FTE per unit of population at the community colleges is lower than elsewhere in the state. Even more striking is the limited availability of access to baccalaureate and graduate degrees. As a result, the baccalaureate and graduate attainment rate of southwest Washington is behind that of the state as a whole[1].

Washington is behind the rest of the U.S. in providing access to baccalaureate and graduate degrees. At 48th in the country, it supports the advanced levels of higher education less than all but three states. Washington supports one seat in public four-year institutions per 66 members of the population (**1:66**). In southwest Washington that average is **1:468**, making it the least served region of the state.

The availability of higher education is not always the best measure of an educated work force. The baccalaureate and graduate attainment rates are better measures for employers seeking college graduates. In this measure southwest Washington also lags well behind the state and the region. In the Portland metropolitan area the baccalaureate attainment rate is **20.2%;** in Washington it is **18.4%**. In contrast, southwest Washington has achieved only a **12.9%** level of bachelor's degree educated residents. In Clark County it is somewhat higher at **14.5%**, but still significantly lower than the Portland metropolitan area and the state of Washington. The percentage of the population with graduate and professional degrees is **10%** in the Portland metropolitan area, **9.3%** in the state of Washington, **7.5%** in Clark County, and **6.8%** in the southwest Washington region.

One of the reasons for these lower educational attainment rates was the lack of available alternatives to acquire a bachelor's or graduate degree. Up until Fall 2006, the only way to access programs at WSU Vancouver was through the 2+2 option where students had to complete the lower division at another institution which was often a local community college. After authorization from the Legislature in April 2005, WSU Vancouver became a four-year institution and admitted its first freshmen class in Fall 2006. Now the citizens of SW Washington can either choose the 2+2 option or the 4-year option at WSU Vancouver. This recent important development will undoubtedly have a significant future impact in the degree attainment rates in SW Washington. However, the campus has a limited array of degree programs. The proposed Electrical Engineering program will expand the offerings.

Response to community needs: Development of technology-based sectors of the economy is very important to the state of Washington. In turn these industries depend on higher education and especially the availability of local degree programs and research partners. While larger companies can import much of their highly educated talent from other states or countries, smaller and younger companies are especially dependent upon a strong in-state education system because they cannot afford the recruitment efforts to import talent and are especially sensitive to frequent turnovers. In addition, these smaller and younger companies are dependent upon the synergy that can occur when partnering with local educational and research institutions. Success of smaller and younger companies is critical to the overall growth of the technology industries and the economy.

In Clark County and southwest Washington there are over 340 technology firms employing in excess of 8,400 workers. The semiconductor industry, with its epicenter in Clark County is a $9.3 billion industry that has created 36,000 high paying jobs. The high-tech industry employs electrical engineers yet there is no local program in electrical engineering depriving the citizens of SW Washington of an opportunity to be trained for high paying jobs and the employers of drawing from a local talent pool. Given the fact that

[1] US Census 2000 Clark, Cowlitz, Pacific, Wahkiakum, Klickitat, Skamania counties.

Clark County is the fastest growing county in the state, it is anticipated that the number of technology firms demanding electrical engineering graduates will continue to increase.

The community of southwest Washington is extremely concerned about the "brain drain" demonstrated by the fact that the most often contemplated alternatives for current high school students are higher education opportunities in Oregon and outside the state of Washington. Community and university leaders along with local industries and related groups have come together and initiated a proposal to the state for a new electrical engineering program at WSU Vancouver. This effort is endorsed by several elements in the southwest Washington economic community including the Greater Vancouver Chamber of Commerce and Identity Clark County (Columbia River Economic Development Council, CREDC) as part of their shared business priorities, the High Tech Council, the WSU Vancouver Advisory Council, the WSU Vancouver Engineering Industry Advisory Board as well as legislators from southwest Washington.

Electrical Engineering is a well-established and acknowledged degree and is sought after by the industry in the area, especially the high tech industry. The wide recognition and employment opportunities create demand among the place-bound students for an electrical engineering program in SW Washington. However, such a program does not exist. The place-bound students face the decision of having to go out of state to Oregon for their degree. The proposed degree will fulfill the mission of WSU Vancouver to engage in the community to provide access to higher education for place-bound students. It will also help the ENCS and the College fulfill their mission of providing high-quality education to prepare graduates for success in a field relevant to the region and nation.

II. Program Description

Questions to ask:

- What is the nature and focus of this program?
- Is it interdisciplinary in nature? If so, what are the fields of study involved, and how will multiple units work together in delivering the program? *(Document support from all units involved.)*
- Within what discipline(s) does it fall? What distinguishes it from other similar disciplines or from other branches of the same field?
- Is it a broad, general program or will it focus on one specialization? Does it offer more than one option?

The School of Engineering and Computer Science (ENCS) at WSU Vancouver offers mechanical engineering and computer science degree programs at the BS and MS levels. The new electrical engineering program will be added to the ENCS. It will be accredited separately from the Pullman and Tri-Cities programs. The program will be an on-campus, primarily day program. It will be offered in regular scheduled hours during the Fall and Spring semesters.

The program will offer option areas defined by specific technical electives. The options will include digital systems, electronics devices and materials, and networks and communication systems. These option areas will serve the needs of the semiconductor and other industries in the area.

The curriculum was designed to assure that adequately prepared students can finish it in 4 years. Furthermore, students transferring at the junior level from community colleges can graduate in two years. The lower division courses fit the state-wide articulation agreements already in place.

III. State Need and Student Demand for the Program

National and state trends

After the boom of the 1990s, the U.S. economy suffered a number of serious setbacks. Although the economy has had difficulty shaking off a stubborn slowdown, recent statistical data suggest that we are now poised for a more sustained recovery. GDP is expected to grow during the next decade, while productivity remains strong and inflation remains stable[2]. Business spending on high-tech and computer-related equipment is anticipated to lead the rapid growth. On the government side, a projected increase in defense, medical, aerospace spending are expected. These are areas where electrical engineers play a major role.

The Bureau of Labor Statistics estimates 11.8% growth in demand for electrical engineers by 2014. The growth projection for computer hardware engineers (a subfield in electrical engineering) is expected to be about 10.1% by 2014[3].

[2] Su, Betty W., "The U.S. economy to 2012: Signs of growth", Monthly Labor Review, Bureau of Labor Statistics, February 2004.
[3] Bureau of Labor Statistics, http://www.bls.gov/ , 2007.

Electrical engineering is one of the high-tech fields in demand in Washington[4]. The context of the economic growth expectations at the national level is reflected in the state of Washington. The state data is based on 10 year projections for the period of 2004-2014. In 2004 there were an estimated 3,390 electrical engineers employed in the state. As of April 2007 there were 173 statewide openings. Between 2004 and 2014 an average annual long-term growth rate of 1.4% is estimated. For SW Washington the growth rate is 1.73%. Electrical engineers also work as electronics engineers. In this category, there were 183 statewide openings as of April 2007. The long term growth rate is projected as 1.3%. In both electrical and electronics categories a total of 356 openings were available. In SW Washington the annual average growth rate is projected to be 3.5%.

Southwest Washington is home to Washington's Silicon Forest, a concentration of high technology industries in the Vancouver/ Portland metropolitan area. The Washington semiconductor industry emerged as a significant economic cluster during the 1990s. The region joined San Jose, Austin, and Phoenix as national concentrations of technology based industries. SW Washington's technology cluster is unique in the nation in that it did not evolve in proximity or collaboration with a major research university. Absent a university, regional technology stalwarts such as Tektronix and Intel served as surrogate centers of innovation, workforce training and sources of entrepreneurial start-ups. While this model of growth and economic development has been successful for SW Washington, longer term there are challenges.

The absence of a robust research university limits emerging and small firms' ability to partner on research initiatives or draw on university based talent to support growth. To overcome this gap, a number of regional firms rely on distant labs and collaborators in Seattle, Oregon, etc. to conduct research on new products and manufacturing methods. This inefficient arrangement does not support the long term needs of the region. A major challenge facing the regional cluster is the lack of local graduates in electrical engineering. The foundation for an innovation economy is human talent. Competition for this scarce resource is fierce. Local technology companies desire the ability to recruit interns and full time employees from the region. They believe enhanced local production of Bachelors and advanced degrees at Washington State University Vancouver will heighten their ability to recruit and retain talent.

To address these challenges, Columbia River Economic Development Council (CREDC), Clark County High Technology Council, SW Washington Workforce Development Council and Washington Technology Center jointly proposed an "Innovation Zone" plan to Governor Gregoire in 2006. The proposed electrical engineering program at WSU Vancouver is closely articulated within this economic development plan. Furthermore, the plan calls for establishing a center for semiconductor research, development and innovation. The center will include the development of a research park at WSU Vancouver and a satellite of WTC Microfabrication Laboratory at WSU Vancouver[5].

Student demand

The electrical engineering (EE) degree is well known and is sought after by many industries in the area but is not available for the place-bound students in SW Washington.

There is demand and a breadth of employment opportunities for graduates. A marketing study conducted by a group of WSU Vancouver MBA students was administered in 2002 to develop a marketing plan for the WSU Vancouver Engineering program[6]. A total of 299 responses, including 223 high school students, 39

[4] Workforce Explorer, Washington, http://www.workforceexplorer.com , 2007.
[5] Bart Phillips, President, CREDC, "Promoting innovation in the technology cluster of SW Washington", 2006.
[6] Marketing plan for manufacturing engineering program, WSU Vancouver, April 2002.

Clark College and Lower Columbia College students and 37 industry paraprofessionals from four area businesses, were compiled and analyzed. Survey respondents were asked to indicate the degree they were targeting. On a scale of 1 to 6 mechanical engineering scored highest in all three groups (high school sample: 4.62, community college sample: 5.19, paraprofessional sample: 4.21) followed by electrical engineering as the second choice for degrees (high school sample: 3.82, community college sample: 4.96, paraprofessional sample: 3.86).

The market for WSU Vancouver programs is regional. WSU Vancouver target radius includes Washington counties with an approximate two-hour commute and Oregon counties specifically named in the border bill. These are Lewis, Wahkiakum, Cowlitz, Skamania, Clark, Columbia, Clatsop, Washington, Multnomah and Clackamas counties. Existing programs in the market area of WSU Vancouver are at Portland State University (PSU) and University of Portland (UP) with approximately 175 and 75 students, respectively.

Our target market contains (1) high schools; (2) community colleges; and (3) local paraprofessionals (working adults who want to change careers). The high school market was determined using statistics from the Washington State Office of Superintendent of Public Instruction and the Oregon Department of Education Websites[7]. This market contains an estimated 589 students who would pursue electrical engineering. It is difficult to find any data on the paraprofessional market. This market gets very affected from the economic fluctuations. It is estimated that there are about 20 paraprofessionals each year in the target radius of WSU Vancouver who may consider going back to school for EE. The area community colleges including Clark College, Lower Columbia College (LCC), Mt. Hood Community College and Portland Community College have an estimated 111 students who are targeting electrical engineering. Therefore, the total potential number of EE students in the target market is estimated to be 720 (589 + 20 + 111).

During our frequent recruitment trips for our current ENCS programs to area community colleges and industry in the past six years, it has become evident that there is a significant desire for Electrical Engineering. In every classroom where we made presentations, at every company where we talked to the employees, in the open house events we held at WSU Vancouver, prospective students were always asking why WSU Vancouver did not offer an electrical engineering degree program. Over and over we heard them say "I would sign up immediately if you had electrical engineering at WSU Vancouver." As indicated by the data from the transfer instructors at the area community colleges, about 25% of all engineering transfer students in their programs are targeting electrical engineering. In our recruiting trips we asked these prospective students if they would consider WSU Vancouver as an option if we had electrical engineering. Almost all of these students indicated they would.

The target market of WSU Vancouver contains an estimated 720 students who are interested in electrical engineering. Based on a study conducted by WSU Vancouver[6], 17% of the surveyed high school students from the target market consider PSU. Therefore, 30 (175 x 17%) of the 175 EE students enrollment at PSU are considered to have come from the WSU Vancouver target area. Data is not available for UP. However, due to the significant tuition difference, the UP draw from the WSU Vancouver target area is considered to be much lower (estimated to be 10). As a result, about 40 students are drawn out of the WSU Vancouver target market by the PSU and UP local programs. The remaining 680 students go to other programs in the state or often out of state. While there are many reasons behind these choices, the unavailability of Electrical Engineering in SW Washington is an obvious reason.

[7] http://www.k12.wa.us/ , and http://www.ode.state.or.us/

According to an American Society for Engineering Education (ASEE) report[8], BS in electrical engineering was the second highest number with 11,915 degrees awarded nationwide in 2005-06. Similarly, in 2005-06 there were 75,302 undergraduates enrollment in electrical engineering closely following the highest enrollments in mechanical engineering with 80,288 undergraduates. The mechanical engineering enrollment in Vancouver has been strong with continuing growth. The national statistic imply that the student demand in the proposed electrical engineering program will also be very high.

[8] Gibbons, M., "Engineering by the numbers", http://www.asee.org/prism , 2006.

IV. Goals, Objectives, and Student Learning Outcomes

A. Goals and Objectives

The goal of our program is to prepare our graduates for successful professional practice and advanced studies by providing a broad education in electrical engineering and by offering the opportunity to deepen their technical understanding in a particular concentration area of related technical electives.

Our graduates will:

1. Apply technical knowledge and skills as electrical engineers to provide optimal solutions in industrial and government organizations.
2. Utilize effective communication, team, and project management skills to work productively within their professions and communities.
3. Conduct themselves as responsible professionals making contributions in technology for the greater benefit of society.
4. Pursue professional development and/or graduate studies to meet the challenging demands and increasing responsibilities of a successful career.

Review of Program Educational Objectives

In accordance with the EC2000 criteria of the national Accreditation Board for Engineering and Technology (ABET), the School of ENCS has already established a formal structure for the program review process.

The electrical engineering program will seek input on a systematic basis from its alumni, their employers and its Industry Advisory Board (EE-IAB) to assess and evaluate the achievement of the educational objectives. The continuous improvement model (Figure 1) shows the review process already in place at ENCS. The same process will be used to assess the new electrical engineering program. It consists of two loops:

1. Long term loop with a three-year cycle to assess the educational objectives, and
2. Short term loop with an annual cycle to assess the program outcomes (student learning outcomes).

Table 1 shows the data collection and review process plan. In the evaluation of the educational objectives, the constituencies provide input to the review process as follows:

1. ALUMNI: provide data through Alumni Surveys and Alumni Focus Group study,
2. EMPLOYERS: provide data through Employer Surveys, and
3. EE-IAB: provide input through discussions in tri-annual meetings

The assessment data obtained in the process will be reviewed annually by the curriculum assessment committee (EE-CAC) and shared with the faculty. As part of closing the loop, every three years the EE-IAB as well as the rest of the constituencies will be provided with a report on the level of achievement of the educational objectives. If necessary, actions will be taken to improve the educational objectives and the program to meet these objectives. These actions will flow to the program outcomes through the

mapping of the educational objectives to the program outcomes and the curriculum. The EE Undergraduate Studies Committee (EE-USC) will implement the changes in the curriculum.

In the sixth year, the relevance of the objectives themselves will also be reviewed with input from the constituencies.

TABLE 1. Data collection and review process plan for <u>educational objectives</u>.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Alumni survey	■		■		■	
Employer survey	■		■		■	
Alumni focus group			■			■
EE-IAB			■			■
Report to constituencies and take actions (close the loop)			■			■
EE-CAC review	■	■	■	■	■	■
Review relevance of the objectives						■

The first graduating class of the program will be in 2011-12 academic year. The process outlined in Table 1 will start in the 2012-13 academic year as "Year 1" in the Table above.

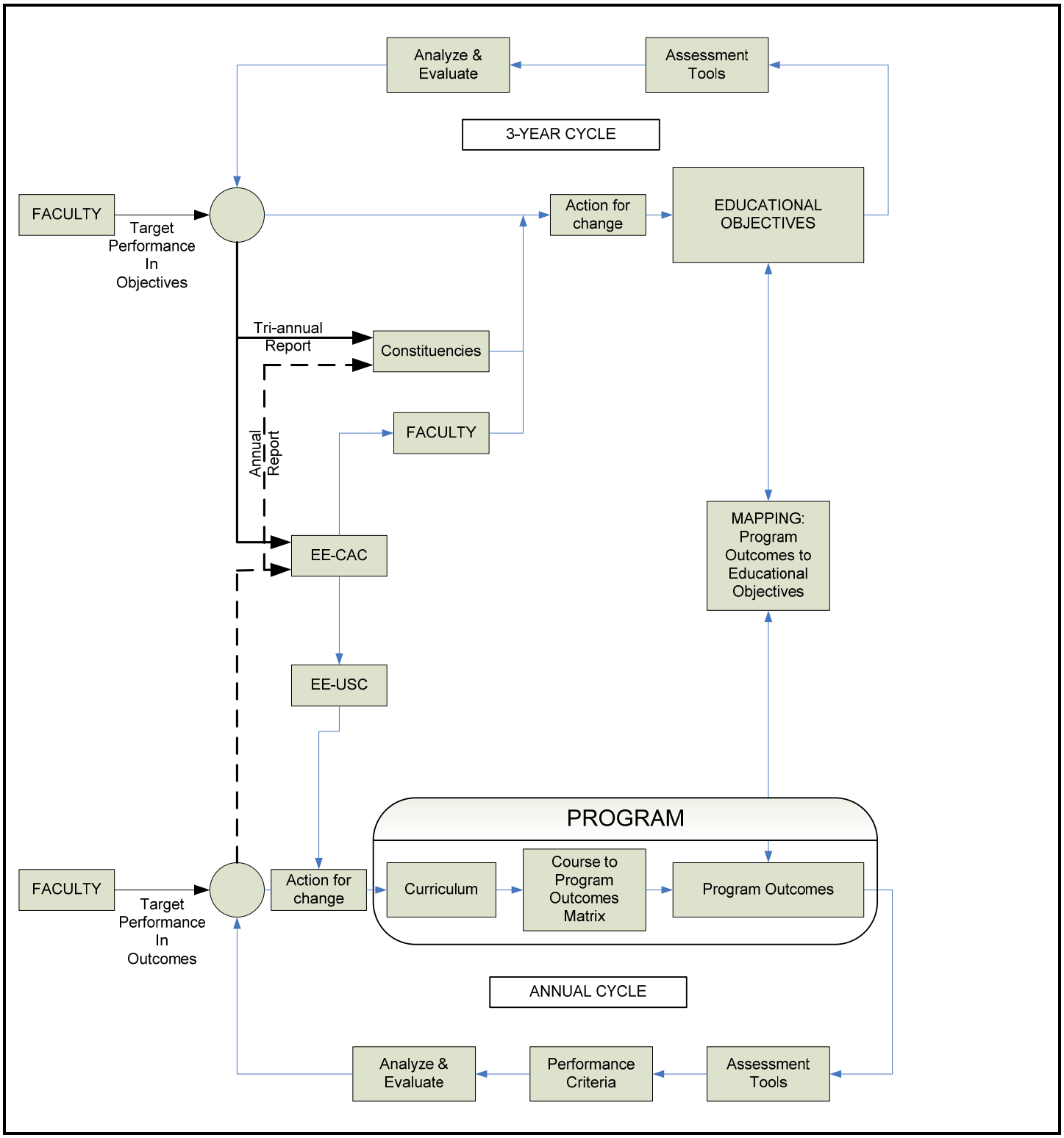


Figure 1. Continuous improvement model.

Assessment tools - We use the following tools to assess the *educational objectives*:

Alumni Survey – This is an online survey instrument for the alumni of the program. The survey consists of three sections. It starts with the personal data section containing a set of questions that are direct indicators of achieving the educational objectives. This is followed by a section where the alumni are asked to rate how well the program prepared them to meet the educational objectives and how important each objective is for them.

Alumni Focus Group – An outside consultant will be hired to conduct an interview exploring achievement of educational objectives by a group of program alumni. The consultant will submit a report and a set of scores on the 1-5 scale rating the level of achievement of the educational objectives as an independent evaluator.

Employer Survey – This is an online survey instrument for the employers of our alumni. It consists of two sections. The first section lists the educational objectives and asks the employer to rate them in terms of how well our graduate was prepared and also how important each objective is for their line of business. The second section lists certain program outcomes as questions. The employers are asked to rate their employee in achieving these outcomes.

B. Student Learning Outcomes

The desired outcomes of the BSEE program are that every graduate of the program should demonstrate the following:

A. Knowledge of mathematics, science and engineering principles and the ability to apply this knowledge for solving problems.

B. Ability to design and conduct experiments as well as to analyze and interpret data.

C. Ability to design and realize components, systems, or processes to meet desired needs and realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

D. Ability to function on multidisciplinary teams.

E. Ability to identify, formulate and solve problems encountered in the practice of electrical engineering.

F. Understanding of professional and ethical responsibility.

G. Ability to communicate effectively.

H. Ability to understand the impact of engineering solutions in a global, economic, environmental and societal context.

I. Recognition of the need for, and an ability to engage in life-long learning.

J. Knowledge of contemporary issues.

K. Ability to use the techniques, skills and modern engineering tools necessary for electrical engineering practice.

Assessment Process

The ENCS has a well-established assessment process in place. The same process will be used to assess the student learning outcomes of the new electrical engineering program.

In our process the program outcomes (student learning outcomes) are assessed annually. The loop labeled "Program" in the lower portion of Figure 1 shows this process. Although there appears to be a single loop, there are 11 parallel loops closed around each program outcome "a" through "k". In other words, using various assessment tools we measure how well our students are achieving each expected outcome.

To assess each outcome, we use performance criteria for that outcome. The performance criteria (PC) are measurable attributes describing the performance required to meet an outcome as a program. For example, in outcome "A" we defined seven such PCs that need to be met to successfully achieve that outcome at a minimum target performance level as a program. The success of the program in each of these PCs is based on the success of various activities that take place in many courses across the curriculum. The PCs are interpreted in the context of each course where they apply. This leads to the development of the course objectives.

In each course, we assess the level of achievement of each course outcome. The data are then combined to analyze and evaluate the program level achievement of each program outcome. Faculty set target levels for each outcome. If any program outcomes are not met at the targeted level, then actions are taken to improve the program. Figure 2 shows a sample analysis result for outcome "A" from the mechanical engineering program in the ENCS. Achievement of an outcome is scored on the scale of 1 to 5 (highest).

We use the following assessment tools in our continuous improvement process.

- Course portfolio,
- Student course survey,
- Focus group,
- Senior exit survey,
- Alumni survey,
- Employer survey,
- Alumni focus group, and
- Design panel

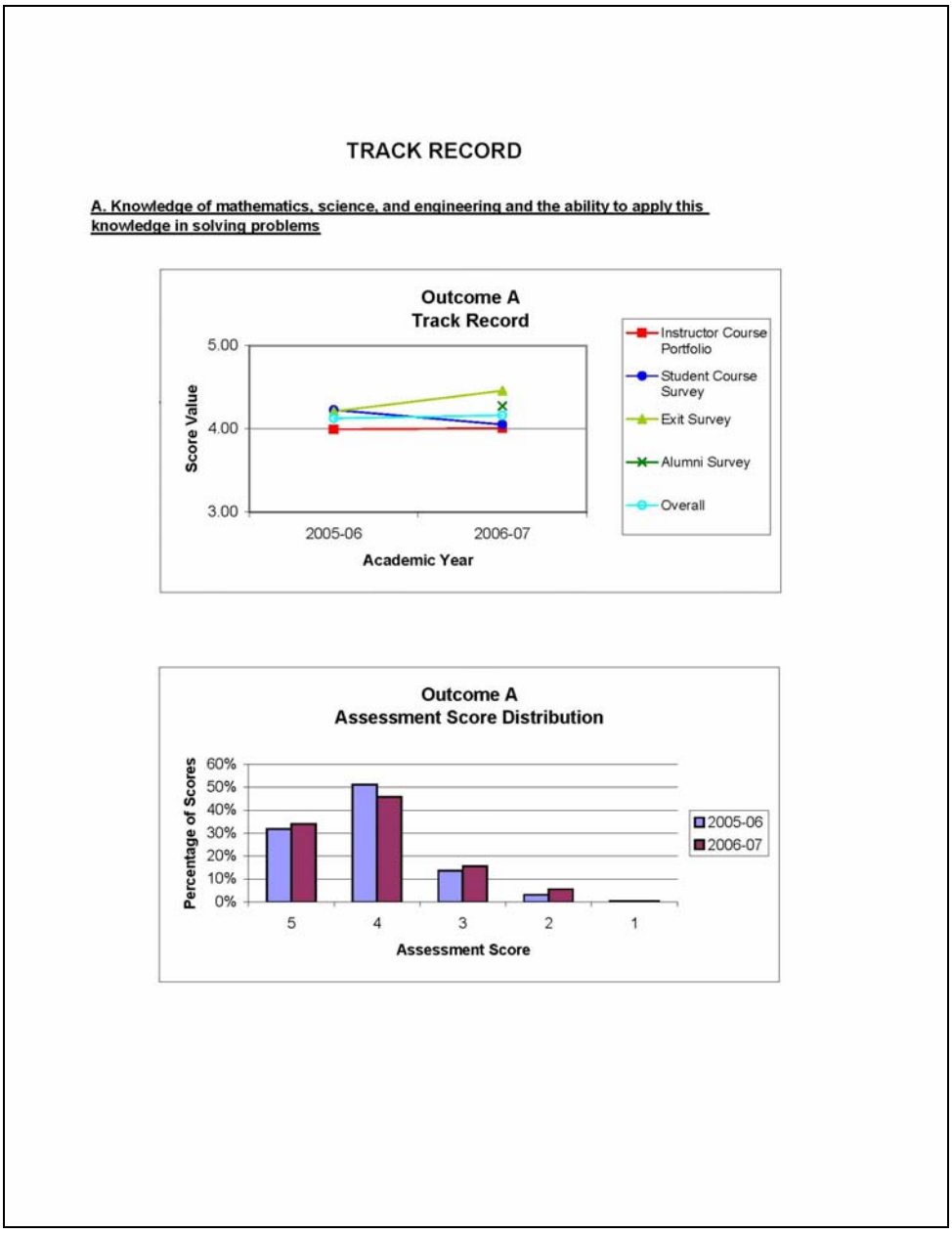


Figure 2. Sample outcome analysis (student learning goals) from the mechanical engineering program at WSU Vancouver. The proposed electrical engineering program will implement the same assessment system.

V. Curriculum

Questions to ask:

- What courses will the student be required to take?
- What electives (if applicable) will be available?
- What courses from other departments/colleges will be used? *(Document support from those units.)*
- If this is a branch campus, undergraduate program, how have the local community colleges and their faculty been involved in planning for it? What arrangements are in place to ensure that pre-requisites are readily available and that CC students will be appropriately prepared and well advised?

The lower division courses of the curriculum, with three exceptions, are already part of other programs, either computer science or mechanical engineering, or are part of the general education program in Vancouver. Thus, these courses are already being offered by WSU Vancouver for its own lower division students and by the community colleges for transfer students. The three exceptions are an introductory course in electrical engineering (ECE 120), circuits course and its associated laboratory (ECE 260) and an option course. Equivalent courses to the first two are already in place at the community colleges.

The curriculum shown in Table 2 below has been designed after examining the degree programs at the universities in the target radius of WSU Vancouver and some of the top-tier universities around the nation. Furthermore, meetings were held with an advisory group consisting of engineers and managers from the area industry:

- Linear Technologies,
- Hewlett Packard,
- SEHAmerica,
- nLight Photonics,
- Tektronix, and
- Columbia River Economic Development Council

Input from the High-Tech Council (CEOs of high-tech firms in the region) has also been incorporated. The curriculum satisfies all WSU general education requirements and the 2007-08 ABET accreditation requirements.

The curriculum contains a core group of courses that are required for each student. Beginning in the Spring semester of the sophomore year, it provides considerable flexibility to the students to design their own program through 9 electives. The program provides three option areas with 5 courses each. Students must choose one of the listed ECE option areas. To complete the degree program, they must complete the courses listed in the schedule of studies and the five courses required by the selected option area. In addition to the required courses, the students must also complete four elective courses selected from other option areas, or from the list of approved elective courses (Table 3), or may obtain approval from their faculty advisor for other coursework.

At full implementation, the program will have three option areas: (1) Digital systems, (2) Electronic devices and materials, and (3) Networks and communication systems (Tables 3, 4.a. – c.). In order to make the most efficient use of existing resources, the program will initially be started with only the first two options. As new faculty are added, the third option area will also be activated over time.

TABLE 2. Schedule of Studies for Electrical Engineering.

School of Engineering and Computer Science
Washington State University Vancouver
Schedule of Studies
Bachelor of Science in Electrical Engineering
Proposed - Effective Fall 2008

Year	Semester	Course	Notes	Course Title	Core Electrical Engineering	Advanced Electrical Engineering	Mathematics	Science	General Education or Other	
Freshman	Fall	ECE 101		Introduction to Electrical Engineering	2					
		Math 171 [N]		Calculus I			4			
		Chem 105 [P]		Principles of Chemistry I				4		
		Engl 101 [W]		Introductory Writing					3	17
		GE 101 [E]		Introduction to University Learning Goals					1	
		GE 110 [A]		World Civilizations I					3	
	Spring	CS 251		C Programming Language	3					
		Phys 201 [P]		Physics for Scientists and Engineers I				4		
		Math 172		Calculus II			4			17
		Econ 101 [S] or Econ 102 [S]		Fundamentals of Micro or Macro Economics					3	
		GE 111 [A]		World Civilizations II					3	
Sophomore	Fall	CS/ECE 214		Design of Logic Circuits	3					
		Biological Science [B] w/lab						4		
		Math 220		Linear Algebra			2			15
		Math 273		Calculus III			2			
		Phys 202 [P]		Physics for Scientists and Engineers II				4		
	Spring	ECE 260		Circuit Modeling and Analysis I w/lab	4					
		CS/ECE 234		Microprocessor Systems	3					
		Math 315		Differential Equations			3			16
		ECE Option Area Course	1			3				
		Arts & Humanities [H]							3	
Junior	Fall	ECE 321		Circuit Modeling and Analysis II	3					
		ECE 325		Electronic Devices and Applications w/lab	4					
		ECE Option Area Course or Elective	1			3				17
		Stat 360		Probability and Statistics			3			
		Engl 402 [W] or Engl 403 [W]		Technical Writing					3	
		GE 303 [E]		Connecting to Research Across the Disciplines					1	
	Spring	ECE 341		Signals and Systems		3				
		ECE 370		Electromagnetic Fields & Waves		3				
		ECE Option Area Course or Elective	1			3				15
		ECE Option Area Course or Elective	1			3				
		Intercultural Studies [I,G,K]							3	
Senior	Fall	ECE 405		Professional Issues and Ethics in Electrical Engineering					3	
		ECE 411		Energy Systems		3				
		ECE 451		Electrical Engineering Project Management		3				
		ECE Option Area Course or Elective	1			3				16
		ECE Option Area Course or Elective	1			3				
		GE 401 [E]		Connecting Learning to Life					1	
	Spring	ECE 452		Electrical Engineering Capstone Design Project		3				
		ECE Option Area Course or Elective	1			3				
		ECE Option Area Course or Elective	1			3				15
		ECE Option Area Course or Elective	1			3				
		Tier III Humanities or Social Science Course [T,D]							3	
					22	42	18	16	30	128

Note 1: Students must choose one of the listed ECE option areas. To complete the degree program, the student must complete the courses listed in this schedule of studies and the five courses required by the selected option area. In addition to the required courses, the student must also complete four elective courses selected from other option areas, or from the list of elective courses, or may obtain approval from their faculty advisor for other coursework.

ECE: new prefix for the courses of the electrical engineering program at WSU Vancouver. The existing mechanical engineering and computer science programs in Vancouver also have their own prefixes (**Mech** and **CS**).

TABLE 3. Electrical engineering option areas.

Electrical Engineering Option Areas

Digital Systems - Required Courses

1	CS 122	Data Structures
2	CS 360	Systems Programming
3	ECE 324	Digital Design II
4	ECE 366	Introduction to VLSI Design
5	ECE 424	Computer Architecture and Design

Electronic Devices and Materials - Required Courses

1	ECE 302	Properties of Electronic Materials
2	ECE 349	Principles of Solid State Devices
3	ECE 366	Introduction to VLSI Design
4	ECE 486	Solid State Device Design and Modeling
5	Mech 438	VLSI Device Fabrication

Networks and Communication Systems - Required Courses

1	ECE 295	Digital Communications I
2	ECE 345	Digital Communications II
3	ECE 464	Introduction to Digital Signal Processing
4	ECE 495	Wireless & Mobile Communication
5	ECE 425	RF Devices and Circuits

Other Approved Electrical Engineering Electve Courses

ECE 476	Computer Aided Design for VLSI
CS 466	Embedded Systems
Mech 468	Robotics
ECE 471	Antenna Design and Analysis
Mech 467	Automation
CS 464	Distributed Systems
ECE 475	Electro-Optical Devices and Systems
ECE 477	VLSI Testing and Design for Test

Note: The “Mech” and “CS” courses already exist in the School of ENCS at WSU Vancouver.

TABLE 4.a. Digital systems option flow chart.

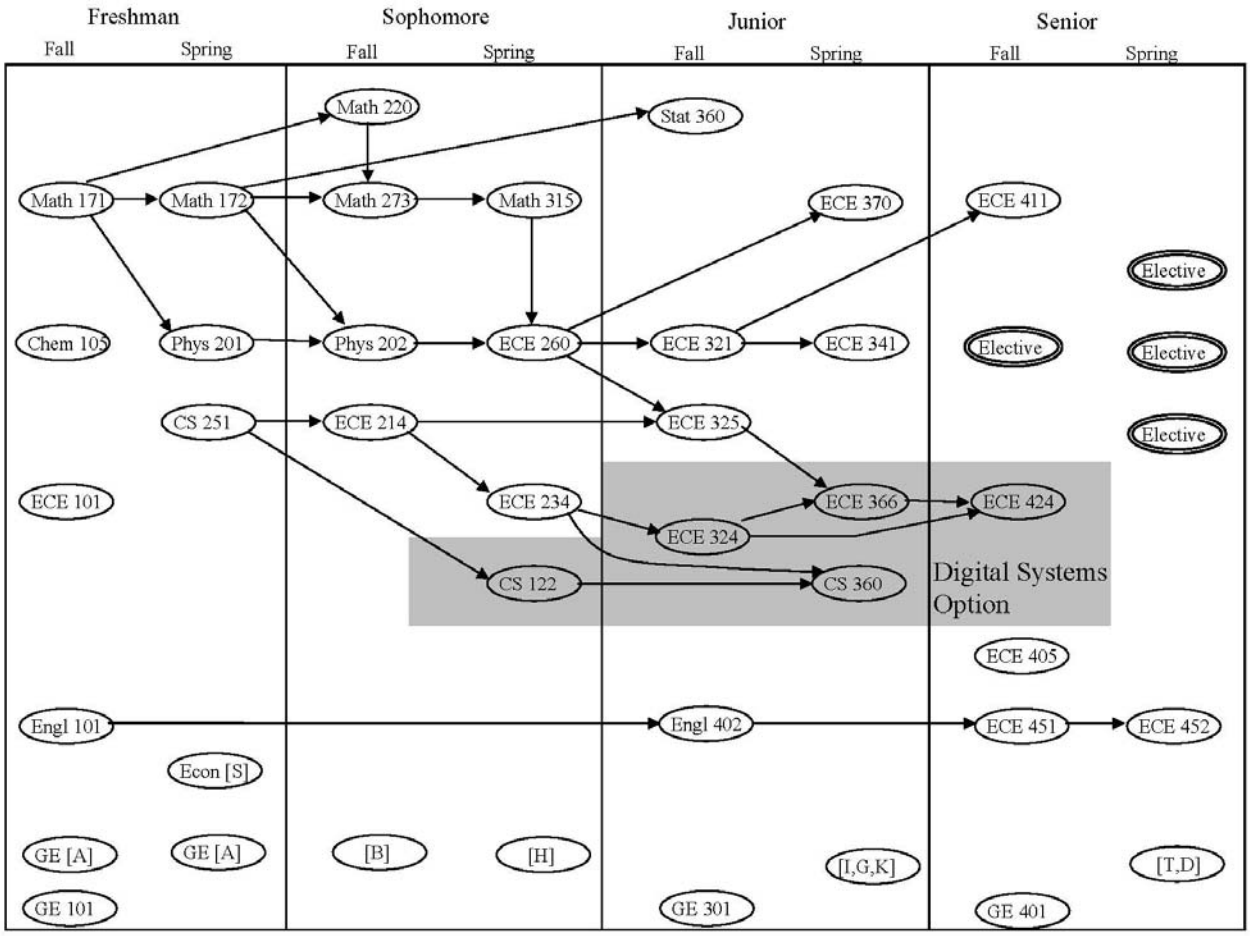


TABLE 4.b. Electronics devices and materials option flow chart.

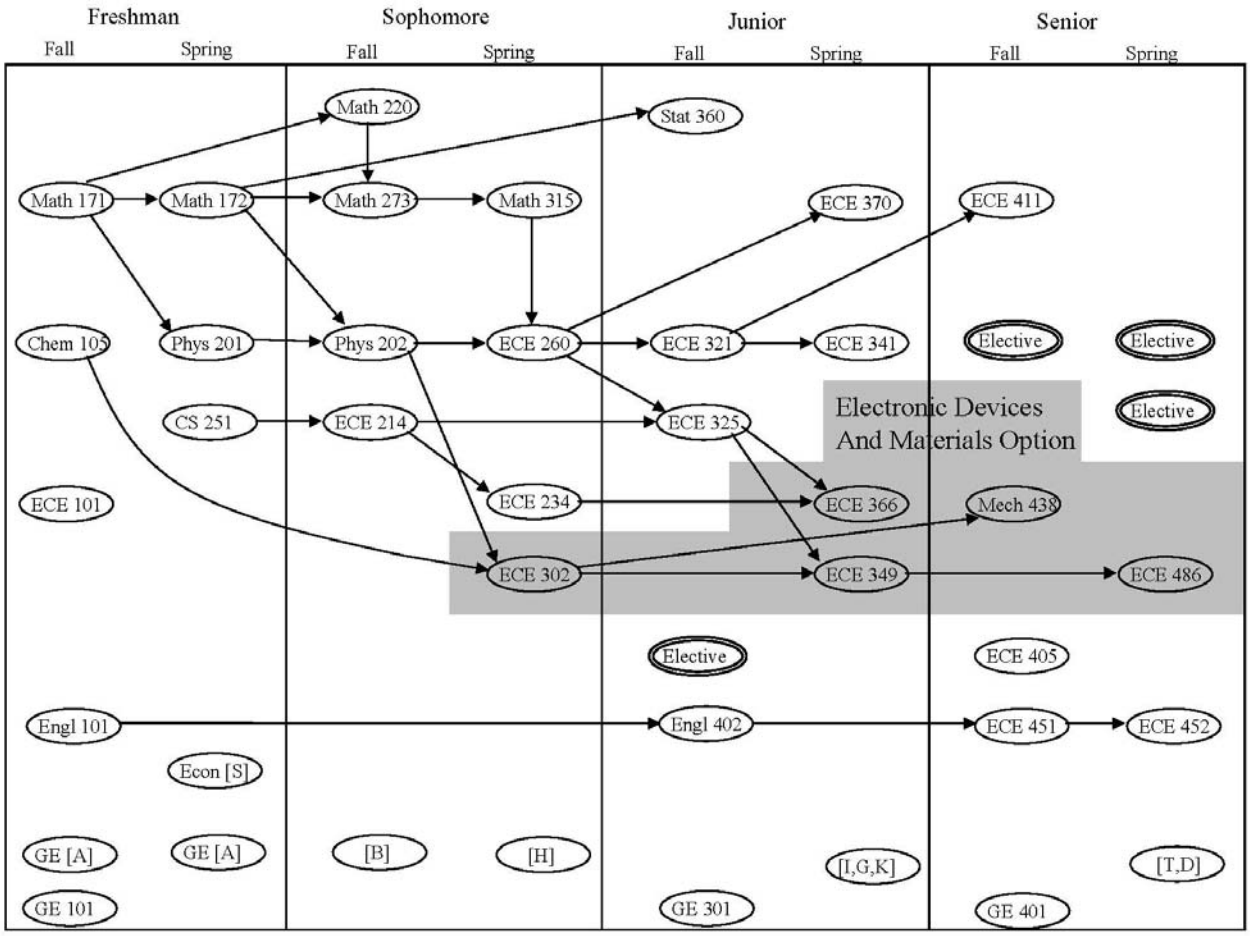
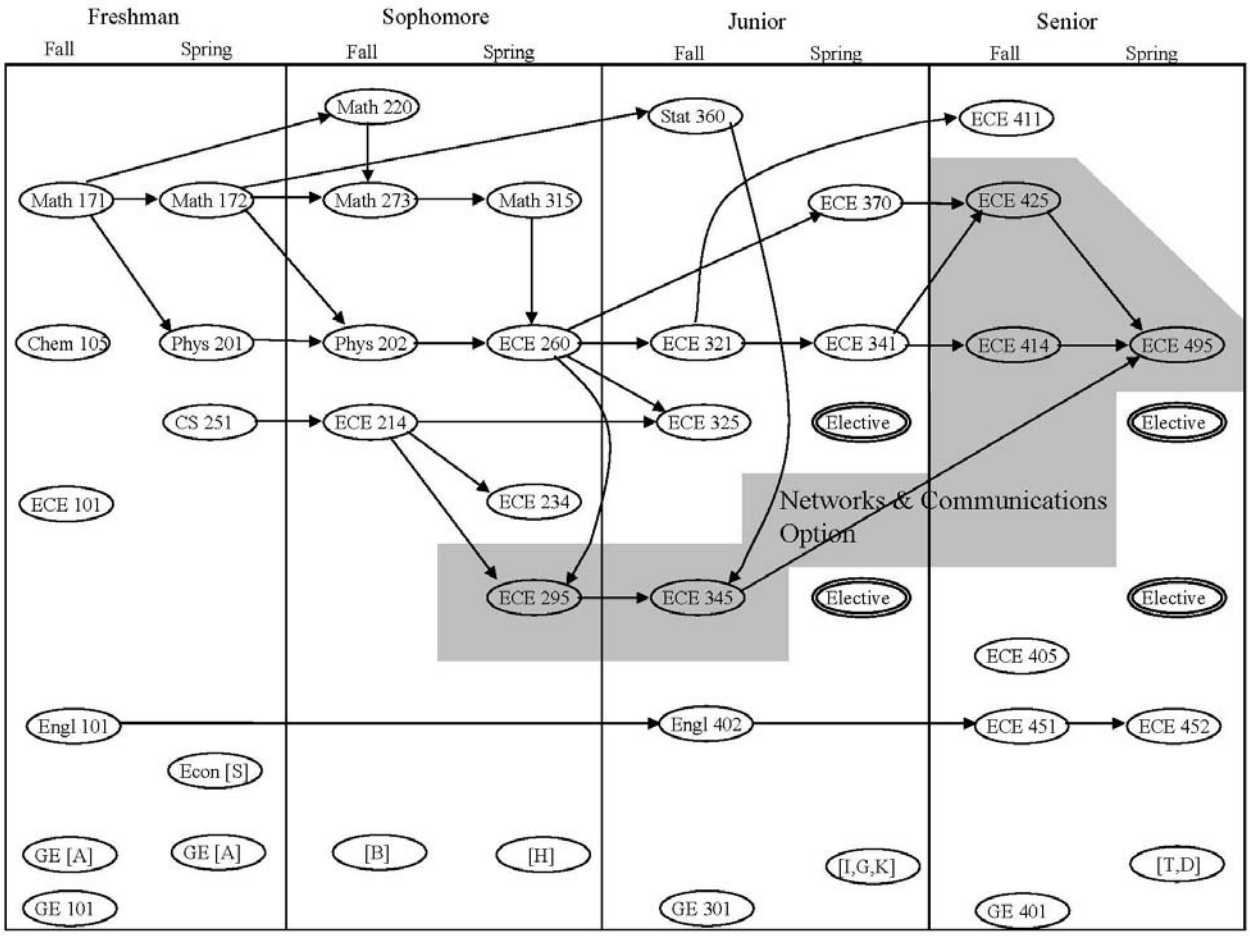


TABLE 4.c. Networks and communication systems option flow chart.



VI. Uses of Technology

Questions to ask:

- What kinds of technology will be used in teaching this curriculum?
- What technologies will the students learn to use in order to work in this discipline?

Many of the classrooms at WSU Vancouver are equipped with SmartBoards, computers and Internet access. Thus, in each classroom it is easy to access, display, and interact with the Internet and digital multimedia. All of these technologies are routinely used by engineering faculty.

Students will be learning various aspects of computer programming involving various computing platforms. They will use various Computer-Aided-Engineering software tools including electronics Workbench, pSPICE, network simulators and analyzers, various mathematical packages such as MATLAB and Mathematica. They will gain hands-on experience with laboratory instrumentation such as oscilloscopes, function generators, data acquisition systems, etc.

VII. Delivery methods

Questions to ask:

- Will this be an entirely campus-based, face-to-face program, or will part or all of it be delivered off-campus and/or electronically.
- If the latter, what parts and by what media?

The program will primarily be a campus-based, face-to-face program. However, as it is the case with many WSU programs, it is anticipated that occasionally some courses might be exchanged with the Tri-Cities and Pullman programs via AMS.

VIII. Students

A. How many students do you expect to serve with this program?

Number of Students	Year 1	Year 2	Year 3	Year 6
Headcount	35	45	83	120
FTE	25	30	55	80

In year 3 enrollment projections include transfer students as well as WSUV lower division students becoming juniors.

- Enter year number in which program anticipates reaching full enrollment
- If you expect a combination of various levels of part time and full time students, please use the FTE Calculator in Appendix II before completing this table.

B. Admission Requirements

Questions to ask:

- What are the certification requirements into this major (for undergraduates), or the departmental process and admission requirements (for graduate programs)?

Admission requirements will be the same as mechanical engineering and computer science programs in Vancouver[9]. The certification into the program requires completion of at least 30 semester hours of graded course work with an overall minimum 2.0 GPA and having completed the following courses with a minimum grade of "C" in each course: Chem 105, CS 251 or CS 121, Math 171, 172 and Math 273, and Phys 201 and Phys 202. A full-time student will have completed these requirements at the end of the fall semester of their sophomore year.

C. Expected time for Program Completion

Questions to ask:

- Will most students be full time or part time?
- How long will it take each type of student?
- If this is an undergraduate program, can it be completed in four years (if so, please outline a 4-year course of study; if not, please explain), and
- How can transfer students articulate smoothly into the program and complete it with approximately the same number of total credits as students who enter WSU as freshmen?

The current student demographics in ENCS is a mix of traditional students and non-traditional students (working adults coming back to school part-time). The proposed electrical engineering program will most likely have the same characteristics. As more high school graduates are admitted to the lower division courses at WSU Vancouver, the student demographic has been shifting towards a group of mostly full-time students going through the program. As this cohort is moving from the lower division to the upper division, part-time transfer students coming from other institutions will join in the program at the junior level.

The schedule of study as shown in Table 2 in Section V was designed for completion of the degree in 4 years. The upper division schedule will enable a full-time transfer student to graduate in two years. The transfer students will be able to smoothly articulate into the program. The lower division of the electrical engineering program consists mainly of courses that are already in place for the Mech and CS programs. Therefore, all articulation agreements for transfer students are already in place at WSU Vancouver.

D. Advising

Questions to ask:

- Who will provide academic advising for the students?
- How will advisors be assigned?

[9] WSU Vancouver admissions, http://www.vancouver.wsu.edu/ads/admiss_list.htm

The ENCS has an Academic Coordinator. As the EE program admits its first freshmen class in Fall 2008, advising will be provided by the ENCS academic coordinator. However, we plan to hire a second advisor for the ENCS to better accommodate the growing number of students in the School.

The ENCS academic coordinator assists all prospective students, advises all incoming students for completion of prerequisites to get them started in the program, assists the faculty advisors with general education requirements (GER), maintains the student records, and helps facilitate the solving of student's academic problems.

Students continue to see the Academic Coordinator each semester until after being certified in the junior year. Then, they are referred to a faculty advisor beginning the second semester of their junior year. Every Fall and Spring semester, there is a designated two-week period for the current students to meet with their faculty advisors. Announcements are sent to all current students through the *myWSU* portal each semester telling them about the upcoming advising/registration period. At this time, faculty will post sign-up sheets on their office doors with available advising appointment times.

Faculty advisors review the student's checksheet each semester, help them select classes and monitor their progress towards the completion of the degree. After this meeting, the faculty advisor removes an "advising hold" which otherwise prevents students from registering. Once the hold is released, a student can register by phone or over the web using the *myWSU* registration system. At present, *myWSU* system cannot check to determine if a student has the required prerequisites for a course. It is the student's responsibility to register for the courses approved by the faculty advisor. The ENCS Academic Coordinator tracks enrollment in the courses between when registration begins and the first week of class to make sure all students meet the prerequisites or that they have special consent with documentation.

E. Diversity

- Please describe specific efforts planned to recruit and retain students who are persons of color, disabled, or whose gender is underrepresented in this discipline.

WSU Vancouver is committed to diversity. The WSU Vancouver Diversity Task force organizes various events including the Annual MOSAIC Student Fair (Meet Our Students And Investigate College). The purpose of this fair is to encourage diverse students from area schools to explore what WSU Vancouver has to offer, become acquainted with our programs, students, faculty, and staff, and to receive advice on applying and paying for college. The engineering faculty actively participate in this and other multicultural on-campus and off-campus events to recruit women and minorities into our programs.

MESA

The School of ENCS is host to the Southwest Washington MESA program, the newest of six MESA centers in the state of Washington. MESA (an acronym for mathematics, engineering, and science achievement) works to bridge the achievement gap through academic support for K-12 students who, as adults, are underrepresented in science, engineering, and math professions, namely African Americans, Latino/as, Native Americans, and women. MESA works with students, teachers, families, community business, area school districts, and its partners in academia to bring engaging learning, field trips, and exposure to college campuses and to a variety of math, engineering, and science career opportunities to its students and their families.

Through our sponsorship of MESA, two annual spring MESA engineering design competitions and an autumn math and science exploration day for middle schools students have been held on the WSUV campus since May 2004. This year MESA's pilot summer science and engineering program attendance was 45% minority students. In each of these events Engineering faculty, as well as other WSUV and MESA volunteers have engaged students in dynamic, hands-on math, engineering, and science learning experiences. Through these experience, 600 MESA students from three school districts have "done engineering, math, or science" on a college campus, including study in our computer and materials testing labs. Most of these students have never seen a college campus before and are often the first in their family to plan to attend college. These MESA events have been covered with section feature articles in the Columbian, Vancouver's newspaper, with mention of WSUV. Over the past three years MESA has also run nine teacher professional development trainings in ENCS facilities. These trainings are integral to the support MESA offers its students, and the teachers are now "at home" here. Through ENCS sponsorship of MESA, underrepresented students have access to learning and opportunities that engage them in engineering and move them toward college enrollment.

The new electrical engineering program will immediately be integrated into all of these on-going efforts.

IX. Faculty

Name (or "New" if not yet hired)	Rank	Status (part, full, regular, adjunct)	% Effort in Program
New	Prof. or Assoc. Prof.	Full time	100
New	Assoc. Prof.	Full time	100
New	Assist. Prof.	Full time	100
New	Assist. Prof.	Full time	100
New	Assist. Prof.	Full time	100
New	Assist. Prof.	Full time	100
Total FTE Faculty in Program			**6**

The EE program will start with its first faculty in Fall 2008 (faculty search is already underway for this position). In the second year of the program a new faculty will be hired. In the third and fourth years of the program two more faculty will be added each year bringing the total up to 6 full-time faculty.

X. Facilities

Questions to ask:

- Will this program require new teaching laboratories?
- Will this program require new research facilities?
- Will this program require specialized equipment?
- If so, what resources are available for this purpose?

The ENCS faculty and staff are housed in the 61,000 sq. ft. Engineering and Life Sciences building. Approximately 50% of the ELSB is utilized by Engineering Programs (ME and CS). This space is primarily labs, but also contains offices and classrooms.

Because of the significant overlap in the lower division of the electrical engineering with the existing mechanical engineering and computer science programs, the existing facility will be able to support the program in its first two years, including the laboratory course ECE 260 in the Spring semester of the sophomore year (Table 2, Section V.).

The upper division courses of the program will require new laboratories. At the time of this writing, the pre-design of a new electrical engineering building at WSU Vancouver has already been finished. The pre-design of the new building (WSU project name: Applied Technology Building) includes state-of-the-art laboratories for the program. These are computer labs, electronics lab, digital systems and IC testing lab, power systems lab, RF and networking lab and IC design lab along with a clean room facility for semiconductor device fabrication. All facilities have been designed as integrated teaching/research spaces. Therefore, additional research labs will not be necessary.

WSU Vancouver has been working with Washington Technology Center (WTC) to build a user facility for WTC on the WSU Vancouver campus along with a new electrical engineering. The facility will be providing capabilities for product development, education and research to support the fabrication, characterization and packaging of semiconductor materials and devices in the Vancouver, Washington area and in conjunction with Washington State University's expanded engineering program at the Vancouver campus.

This facility will, at full functionality, support work in area of photonics, optics, materials, packaging and micro and nanotechnology fabrication. It is expected to lead to enhancements for existing products and development of new products in:

- Electronics, including display technologies and sensing devices
- Telecommunications, including optical switching and networking devices
- Energy, including solar cells and systems, fuel cells, and photovoltaic devices
- Biotechnology, including microfluidics, and DNA/protein patterning

In the 2007-09 biennium the state provided $4.7 million funding for the design phase of the electrical engineering building and the WTC user facility. We plan to request funding for the construction phase in the 2009-11 biennium.

The electrical engineering program will require specialized equipment. The 2007-09 funding secured for the program includes $2 million for start up costs, including equipment. The future building construction funds will include an allocation for the initial equipment for the program. Furthermore, based on our interactions with the industry, it is anticipated that substantial equipment contributions will be made by the regional industry. Finally, as new faculty are hired for the program, they will apply for grant funding to equip their laboratories.

XI. Finances

Insert the table from page X of the *Workbook for Analyzing Demand and Cost* here:

Summary of Program Costs - Year 6 - Full Enrollment (Replace "N" with academic year when pgm is expect to reach full enrollment.)						
Line Item	**FTE**	**Bnfits %**	**Internal Reallocation**	**New State Funds**	**Other Sources**	**Total**
Administrative salaries						
Benefits for Administrative		26.90%				
Faculty salaries				$570,000		$570,000
Benefits for Faculty		26.90%		$153,330		$153,330
TA/RA salaries				$67,500		$67,500
Benefits for TA/RA		30.00%		$20,250		$20,250
Clerical salaries				$120,000		$120,000
Benefits for Clerical		30.00%		$36,000		$36,000
Contract Services (Adjuncts)				$18,000		$18,000
Benefits for contract salaries		30.00%		$5,400		$5,400
Goods and services				$25,000		$25,000
Travel				$10,000		$10,000
Equipment (hardware/software)				$40,000		$40,000
Other (F&S, phone)				$7,800		$7,800
Subtotal				$1,073,280		
Indirect (37%)				$397,114		$1,470,394
Total Cost						$1,470,394
Student FTE						80
Cost per student FTE						$18,380

New state funds: Funding for the following items has already been secured in the 2007-09 biennium:

- 25 FTE High demand funding for electrical engineering starting in Fall 2008,
- $2 million start-up funding,
- $3.7 million for design phase of the new electrical engineering building at WSU Vancouver,
- $1 million for design phase of the new Washington Technology Center (WTC) lab facility at WSU Vancouver

Faculty: 6 FTE (1 Full, 1 Assoc. and 4 Assistant Profs)
TA: 5 positions at 0.5 FTE each
Clerical: 1 FTE Secretary, 1 FTE technician, and 1 FTE Academic Coordinator,
Contract: 5 Adjunct faculty

XII. External Reviews

If this program is new to the Washington State University system, please provide the names and addresses of 3 – 4 external experts who could be contacted to provide reviews of this program.

1. Jake Bell, VP Defense Group
   nLight Photonics Corp.
   5408 NE 88th St. Bldg. E.
   Vancouver, WA 98665
   jake.bell@nlight.com

2. Victor Liang, Plant Manager
   Linear Technology Corp.
   4200 NW Pacific Rim Blvd.
   Camas, WA 98607
   vliang@linear.com

3. Ken Carlson, Senior Test Engineering Manager
   Tektronix, inc.
   P.O. Box 500, D/S 19-899
   Beaverton, OR, 97977
   Ken.carlson@tektronix.com

4. Terri Fiez, Professor and Director
   School of Electrical Engineering and Computer Science
   Oregon State University
   1148 Kelley Engineering Center
   Corvallis, OR 97331-5501
   terri@eecs.oregonstate.edu

Workbook for Analyzing Library Capacity

The Faculty Senate Library Committee reviews all proposals for new degree programs, new centers, etc., for adequacy of library holdings and services. To assist the committee in its deliberations, please address the topics below in your proposal in collaboration with the librarian(s) responsible for collection development in your discipline(s). The names of appropriate librarians are available from the Director of Libraries at 335-4558 or at kaag@wsu.edu.

1. **In specific terms, describe the adequacy of existing capacity:**

   The statewide WSU Libraries strive to build strong core collections at the regional campus libraries. A system-wide approach, adopted by the WSU Libraries when the branch campuses were created in 1989, has successfully supported the research and scholarship needs of students and faculty at the regional campuses. The Libraries provide access to the important and expensive research level collections at WSU Pullman through extensive use of system-wide site licenses for electronic resources, both databases and full-text materials. The Libraries support a rapid document delivery system for in-print materials through our participation in the Orbis-Cascade Alliance courier.

   The Electrical Engineering collection at WSU Vancouver has been growing as the other Vancouver engineering programs have developed. The WSU Vancouver Library concentrates on providing access to engineering-related library databases, full-text journals, and subject-oriented reference resources.

   The Vancouver campus library presently provides access to major engineering online **indexes and full-text databases** including INSPEC, EI Engineering Village (including combined Compendex, NTIS & Referex databases), IEEE Xplore (the IEEE / IEE Electronic Library), Dissertation Abstracts, and Web of Science.

   In addition, we have access to **electronic reference books** useful to electrical engineering via EngNetBase (which includes the CRC Handbooks Online), Idea Group E-Access, and Books 24x7. WSU Vancouver Library also has access to several major **full-text journal subscription services** with coverage in electrical engineering. These include Science Direct, Wiley Interscience, ACM Digital Library, SIAM (plus the SIAM Archive) and Ingenta Connect.

   WSU Vancouver continues to increase its financial commitment toward our percentage of the WSU Libraries system-wide electronic resources site license costs. This year additional funds were added to the Vancouver library's budget to bring it back into balance with our increasing site license expenses. As the Vancouver campus has added new academic programs permanent funding has always been added to the library to support the development of core collections.

2. **What is the need for new library collections:**

   The WSU Library does need additional **monographs** in Electrical Engineering. The WSU Vancouver Library spent $2500 for monographs in the Electrical Engineering subject area this summer, and has an allocation of $7500 more to spend in 07/08 in consultation with faculty to build the core monographic collection in Electrical Engineering. These funds come from PBL monies, not one-time funds. There will be funds available to continue building this collection.

3. What new library personnel will be needed?

The librarian presently responsible for provision of reference service, instruction, and collection development functions to the Mechanical Engineering and Computer Science programs will provide these services for the Electrical Engineering program.

4. What additional library services will be needed?

No additional interlibrary loan services will be required. The services already provided to the mechanical engineering program will be available to the electrical engineering program.

5. For Branch Campuses/Extended University Proposals: To what extent will collections and services be provided from Pullman and to what extent by the branch campus or other local libraries?

We believe that initially this program will generate slightly more use of the Electrical Engineering monograph collection in the Owen Library than we already see. Our plan is that when monographs are borrowed from Owen we will learn which materials are needed at the Vancouver campus. We can then be sure that we are spending our funds wisely because we will have good evidence of real need for specific topics and titles. Electrical Engineering monographs are very minimally used presently and any borrowing from Owen should not have a noticeable impact. Our ever-growing access to electronic full-text journals will off-set any increased demand for document delivery from the WSU Libraries.

6. Are there any other library resource considerations *(e.g., additional space):*

No other considerations.

Submitted by: Leslie Wykoff , WSU Vancouver Library, August 2007

Workbook for Analyzing Demand and Cost

I. Situational Analysis:

The purpose of this section is to identify the strengths and weaknesses of the department(s) as they relate to competition.

Strengths:

Questions to ask:

- What does our department do best?
- What have we done similarly that has worked well in the past?
- What do we believe are the key reasons for our department's success in the past?
- Which of these "key reasons" sets our department apart from our competitors (i.e., other departments and/or other educational institutions)?

The Engineering programs at WSU Vancouver have small class sizes leading to personal attention to students and close interactions between faculty and students. All full time faculty hold Ph.D. degrees. Almost all of the courses are taught by the full time faculty. However, we also hire some adjunct faculty from regional industry. This allows us to bring the latest engineering practices and technologies into the classroom. All faculty are engaged in research and scholarly activities. Some of the faculty are recognized nationally and internationally for their research and scholarly contributions.

The proposed Electrical Engineering program will complement the existing Mechanical Engineering and Computer Science programs and will have similar characteristics. The new faculty hires will be required to have Ph.D. degree and a demonstrated research accomplishments and publication record.

The key reasons for the success of the existing programs have primarily been the easily accessible high quality research faculty, small student-to-faculty ratio, location of the program in an industrial and metropolitan area and the high quality of education. These key factors will continue to be in place for the new EE program. The low student-to-faculty ratio, personal attention to students, research faculty, location and the WSU reputation for quality education will set the program apart from the competition.

Weaknesses:

Questions to ask:

- What does our department do least effectively?
- What do we consider to be or have been a "failure" within our department in the past?
- What are the key factors causing this deficiency?
- How are other departments or universities doing it better?

A major barrier up to this point, in general, has been the 2+2 being the only opportunity for a student to obtain a bachelors degree without leaving southwest Washington. The campus became 4-year starting in Fall 2006 removing this barrier. However, we have not established recognition as a 4-year institution in the region yet. We are actively engaged in marketing and recruitment efforts but it will take some time

before this recognition can be established. Portland State University, our primary competition, has been in this region for a long time with a regionally established name recognition.

Opportunities: Opportunities, as related to this degree program, are developed from your department's strengths or positive circumstances.

Questions to ask:

- What is happening in the state/nation/higher education now that we can take advantage of?
- What prevents our department from taking advantage of it?
- How can we best take advantage of it?
- How long will this "window of opportunity" be available?

There is great excitement about the micro/nano scale systems and how they will be the next industrial revolution. National research priorities are centered around these ideas. Electrical engineering is in the center of all of these technologies. There are many companies in Washington already working on these next-generation technologies. Large semiconductor companies are around us but our collaboration with them is limited due to the lack of the EE degree.

Unfortunately, higher education in southwest Washington is less available than elsewhere in the state. WSU Vancouver is the only public institution in southwest Washington. Most of the prospective students are place-bound leaving them with Portland State University as the only option for electrical engineering degree. This is an expensive option since they have to pay out-of-state tuition. The commute and traffic across the interstate bridge are added burdens.

Electrical engineering is a well-established and acknowledged degree and is sought by many industries in the area. Hence, there is considerable demand and a breadth of employment opportunities for graduates.

A study was commissioned in 2002 by the Technology-Alliance in Seattle[10]. The study concluded that three key factors were the main factors driving a successful technology-based economy: (1) Sound K-12 and higher education system; (2) Capacity to produce a high volume of quality research; and (3) A robust entrepreneurial climate. Development of technology-based sectors of the economy is very important to the state of Washington. In turn these industries depend on higher education and especially the availability of local degree programs and research partners.

We now have an opportunity to take advantage of the place-bound student market by expanding the portfolio of engineering degrees at WSU Vancouver. We can offer the high demand electrical engineering program and tie it to the needs of the local industry through the digital systems, device design and networks and communications foci. We can develop close links with the regional industry creating opportunities for collaborative research for the electrical engineering faculty at all WSU campuses.

Threats: A threat is a problem. It is anything that appears to endanger your current situation or future opportunities.

[10] Sommers, Paul, "The drivers for a successful technology-based economy: Benchmarking Washington's performance," Technology Alliance Report, Seattle, WA, May 2003.

Questions to ask yourself:

- What uncontrollable factors can influence our success?
- What is the worst that is likely to happen?
- For how long is the threat likely to continue?
- How can we eliminate or minimize its effects?

Past state funding for higher education has been fairly limited compared to many of the other states in the nation. In recent years, the state seems to be changing its funding model to a priority-based one (high-demand FTE funding). State funding is crucial for the success of the proposed program. Lack of continued funding can lead to rapid faculty turnover and destabilize the program.

It is well accepted that excellent companies and the people behind them gather in places with strong educational and research institutions, enthusiastic supporters, and other businesses and individuals who share similar high standards. Development of technology-based sectors of the economy is very important to the state of Washington. Therefore, although budget cuts are an unavoidable consequence of the economy, funding high demand engineering programs will most likely remain a high priority for the state.

II. Competitive Analysis:

The competitive environment includes other colleges and universities, both public and private.

Determine who your top competitors are. Examine other institutions providing a similar program. Be aware that the "competitor" may not look like Washington State University and may not provide education in the same manner that you are proposing. For example, the new online MIS program might compete for the same students not just with other MIS providers but also with some technical training and computer science programs. Don't think too narrowly in this area. Choose competitors whom you believe are actively seeking the students you would like to attract.

Select a strongest, geographically nearest, and lowest price competitor and describe each of them as completely as possible using the following characteristics:

CHARACTERISTICS:

Name of program and credit hours – indicate the program that is currently being offered. Theirs may not be exactly the same as yours, but should be similar enough to be considered a competitor.

Total Enrollment - number of existing students enrolled in this certificate and/or program.

Cost per credit hour/Total for Certificate and/or Program

Access – what medium is used to communicate with the students.

Faculty to student ratio

Support Services – Other than the instructor, what staff and/or services are provided for the student. How does the student gain access to these support services.

How long has this certificate and/or program been offered? – if not currently offered, what is expected timing of entry into the market.

What is each program's weakness? – Think in terms of areas that may work to your advantage.

What is each program's advantage? - What specific characteristic makes each institution "stand out"? Why would someone choose the other program over yours? This is also called a differential advantage – the trait that makes you "different" and puts you at an advantage. This should help you in determining what marketing strategy you will take. For example, if you know that one of the others is "cheaper", you can then decide if you want to lower your prices to compete head-to-head, or take the "quality" approach in marketing your program.

WSU Vancouver is the only public institution offering baccalaureate and graduate degree programs in Southwest Washington. Other options in the region include Portland State University (PSU), the University of Portland (UP), and Lewis and Clark College.

The Lewis and Clark College has a lower division engineering transfer program. Oregon State University, The Evergreen State College, WSU Tri-Cities and Pullman, and the University of Washington in Bothell, Seattle and Tacoma, and Western Washington University are all located relatively far from the Vancouver area. Hence, they are not a likely option for the place-bound students. Therefore, the only likely competitors for the new EE program are PSU and UP.

Washington State University Vancouver

Name of program:	Electrical Engineering
Credit hours:	127 total semester credits
Total enrollment:	120 (in 2014) total headcount
Cost per credit:	Resident (10-18 hours): $3145 per semester Non-resident: $8302 per semester
Access:	Classroom instruction
Student/faculty ratio:	20 (headcount)
Number of faculty:	6
Support Services:	1 technician, 1 clerical staff, 1 academic advisor
Begin offering:	Fall 2008 (Freshmen admission)
Weakness:	New program therefore it will take a while to build up and establish recognition.
Advantage:	State-of-the-art facilities, low student/faculty ratio, WSU world class research university reputation, high quality education, personal attention, research faculty, lower total cost due to transfer potential from local community college with lower tuition rates, and the only option in southwest Washington.

Competitor 1: <u>Portland State University</u>

Name of program:	Electrical Engineering
Credit hours:	189 quarter credits (= 128 semester credits).
Total enrollment:	Approximately 175 total headcount.
Cost per credit:	Resident (9-16 hours): $1921 per quarter Non-resident: $5943 per quarter
Access:	Classroom instruction
Student/faculty ratio:	44 (headcount)
Number of faculty:	4
Support Services:	1 technicians, 1 clerical staff
Being offered since:	1970s

Weakness:	Higher student/faculty ratio, limited facilities, not Research-1 university. Also some campus issues – higher cost of living in Portland, parking and campus access issues due to traffic congestion.
Advantage:	It has been around for a while and therefore quite established and visible. The university has an ongoing aggressive marketing and outreach program.

Competitor 2: <u>University of Portland</u>

Name of program:	Electrical Engineering
Credit hours:	131 semester credits.
Total enrollment:	Approximately 75 total headcount.
Cost per credit:	Resident/Non-resident (flat fee 12+ credits): $13,980 per semester Per credit (under 11 credits): $1,105/credit
Access:	Classroom instruction
Student-to-faculty ratio:	19 (headcount)
Number of faculty:	4
Support Services:	2 technicians, 2 clerical staff (shared with the rest of the Engineering department)
Being offered since:	1970s
Weakness:	No research, very limited facilities, private and expensive.
Advantage:	It has been around for a while and therefore visible. Can provide relatively small class sizes in engineering in a private liberal arts college setting.

III. Demand Analysis:

Demand – the willingness of individuals to pay to participate in your program. It is a basic measure used in determining whether or not your program will be financially viable.

FACTORS IN ASSESSING DEMAND:

Market – the geographic area from which the program will attract students.

Questions to ask:

- Where are your potential students physically located? (e.g., international, national, state-wide, regional, local, etc.)
- Would potential students be required to relocate or can they remain at home via distance-learning?

The market for WSU Vancouver programs is regional. WSU Vancouver target radius includes Washington counties with an approximate two-hour commute and Oregon counties specifically named in the border bill. These are Lewis, Wahkiakum, Cowlitz, Skamania, Clark, Columbia, Clatsop, Washington, Multnomah and Clackamas counties.

Market size – the number of potential students in the market area.

Questions to ask:

- What is the current number of students in existing programs in your market area in this field?
- What is the potential number of students forecasted?

Existing programs in the market area of WSU Vancouver are at PSU and UP with approximately 175 and 75 students, respectively.

Potential high school market size:
Our target market contains (1) Public and Private high schools; (2) community colleges; and (3) local paraprofessionals (working adults who want to change careers).

The high school market was determined using statistics from the Washington State Office of Superintendent of Public Instruction and the Oregon Department of Education Websites[7]. The 2006 data (most recent calendar year for which complete data is available) indicates a potential market of 8,490 public and private high school seniors in Washington counties and 18,863 public and private high school seniors in Oregon counties.

An estimated 60% of high school graduates in the Washington and Oregon Counties in our target market immediately continue on to higher education according to an HEC Board study. With a total potential prospect market of 27,353 this indicates a potential general college enrollment market size for the high school segment of 16,412 (27,353 X 60%)

According to the survey administered by the study, 15.5% of the high school students are planning to major in engineering and 24.2% are undecided. This suggests that there are an estimated 2,544 (15.5% x 16,412) high school students within WSU Vancouver target radius who are planning to pursue

engineering. In addition, there exists a pool of about 3,972 (24.2% x 16,412) undecided students some of whom may consider engineering.

A conservative estimate is that about 20% of the students who indicate engineering will go into electrical engineering. Therefore, there are about 509 (2,544 x 20%) high school graduates who are prospective EE students. In addition, if an estimated 2% of the undecided students decide to go to EE, (3,972 x 2%) we will have 80 more students added to the market bringing the total high school graduates going into EE up to 589.

Paraprofessionals market:
It is difficult to find any data on the paraprofessional market. This market gets very affected from economic fluctuations. It is estimated that there are about 20 paraprofessionals each year in the target radius of WSU Vancouver who may consider going back to school for EE.

WSU Vancouver enjoys a significant advantage in marketing to the Paraprofessional for several reasons:

1. The campus is relatively new and spaciously designed, making this a comfortable place for adult learners
2. There is easy freeway access for working adults
3. The recent history of serving primarily graduate and upper-division students has created a diverse and respectful social environment

Community college market:
Engineering transfer program instructors at Clark College indicate that there are on average 230 transfer students entering their programs each year. About 25% of these students (58 students) indicate an interest in electrical engineering. The Lower Columbia College has about 10 engineering transfer students each year. 50% indicate an interest in electrical engineering (5 students). Portland Community College transfer program has an estimated 130 total freshmen each year starting in different quarters. About 25% of them plan to pursue electrical engineering (33 students). Finally, Mt. Hood Community College has about 60 engineering transfer students each year. About 25% declare an interest in electrical engineering (15 students). Hence, the total electrical engineering market size currently in the area community colleges is estimated to be approximately 111 students.

Therefore, the total potential number of EE students in the target market is estimated to be 618 (487 + 20 + 111).

Market share – a portion of the total market for this type of program that belongs to one institution, usually represented as a percentage of the whole market.

Example: **Market:** all students enrolled in 4-year public colleges in state (WA)
Market size: 89,200 students (source: internet sites for all 6 colleges)
WSU enrollment: ~ 21,000 (all locations) (source: www.wsu.edu)
WSU's Market share: approximately 24%

WSU Pullman and University of Washington (UW) are the only public research universities in Washington that offer a BS in Electrical Engineering. In 2004 Eastern Washington University was

authorized to offer a BS-EE program. This program has not graduated its first class yet. In 2006, the UW program had about 497 students[11]. In the same year, WSU Pullman and Tri-Cities programs had approximately 160 students[12]. Therefore, WSU's market share is approximately 24%.

Market capacity – the upper boundary of a market. This would represent and include every potential student interested in the program within the market area. If all of the needs are served and there is an excess of supply over demand, then the market is considered saturated.

Growth rate – how rapidly institutions in the current market are introducing programs to reach market capacity. Often in new markets where demand is high, growth rates are extremely high. However, in markets that are more mature, the growth rate is usually flat or declining.

Barriers to entry – considerations that might inhibit institutions to enter this market. These might include required economies of scale, brand identity, accreditation standards, access to distribution, switching costs and government policy.

Market Place Analysis:

(Please attach supporting documents such as information from professional societies and their publications, industry advisory groups and advocacy groups, internal studies, department of education, department of labor, or employment security department statistics, letters of support, etc.).

What is the demand among students for your program?

During our frequent engineering recruiting trips to area community colleges and industry in the past six years, it has become evident that there is a significant desire for Electrical Engineering. In every classroom where we made presentations, at every company where we talked to the employees, in the open house events we held at WSU Vancouver, prospective students are always asking why WSU Vancouver does not offer an electrical engineering degree program. Over and over we heard them say "I would sign up immediately if you had electrical engineering at WSU Vancouver." As indicated by the data from the transfer instructors at the area community colleges, about 25% of all engineering transfer students in their programs are targeting electrical engineering. In our recruiting trips we asked these prospective students if they would consider WSU Vancouver as an option if we had electrical engineering. Almost all of these students indicated they would. Furthermore, community college faculty indicate that many students end up choosing another program at WSU Vancouver because the EE program is not available.

The electrical engineering (EE) degree is well known and is sought after by many industries in the area but is not available for the place-bound students in SW Washington.

There is demand and a breadth of employment opportunities for graduates. A marketing study conducted by a group of WSU Vancouver MBA students was administered in 2002 to develop a marketing plan for the WSU Vancouver Engineering program[13]. A total of 299 responses, including 223 high school students, 39 Clark College and Lower Columbia College students and 37 industry paraprofessionals from four area businesses, were compiled and analyzed. Survey respondents were asked to indicate the degree

[11] University of Washington, College of Engineering data resources Website, 2007.
[12] WSU Institutional Research, http://www.ir.wsu.edu/ , 2007.
[13] Marketing plan for manufacturing engineering program, WSU Vancouver, April 2002.

they were targeting. On a scale of 1 to 6 mechanical engineering scored highest in all three groups (high school sample: 4.62, community college sample: 5.19, paraprofessional sample: 4.21) followed by electrical engineering as the second choice for degrees (high school sample: 3.82, community college sample: 4.96, paraprofessional sample: 3.86).

What is the current academic or industry demand for graduates of your program?

The electrical engineering (EE) degree is well known and is sought after by many industries in the area but is not available for the place-bound students in SW Washington.

Southwest Washington is home to Washington's Silicon Forest, a concentration of high technology industries in the Vancouver/ Portland metropolitan area. The Washington semiconductor industry emerged as a significant economic cluster during the 1990s. The region joined San Jose, Austin, and Phoenix as national concentrations of technology based industries. SW Washington's technology cluster is unique in the nation in that it did not evolve in proximity or collaboration with a major research university.

A major challenge facing the regional cluster is the lack of local graduates in electrical engineering. The foundation for an innovation economy is human talent. Competition for this scarce resource is fierce. Local technology companies desire the ability to recruit interns and full time employees from the region. They believe enhanced local production of Bachelors and advanced degrees at Washington State University Vancouver will heighten their ability to recruit and retain talent.

Electrical engineering is one of the high-tech fields in demand in Washington[4]. In 2004 there were an estimated 3,390 electrical engineers employed in the state. As of April 2007 there were 173 statewide openings. Electrical engineers also work as electronics engineers. In this category, there were 183 statewide openings as of April 2007.

What growth rate do you project for this demand?

The state data is based on 10 year projections for the period of 2004-2014. Between 2004 and 2014 an average annual long-term growth rate of 1.4% is estimated for electrical engineering jobs in the state. For SW Washington the growth rate is 1.73%. Electrical engineers also work as electronics engineers. In this category, the Long term growth rate is projected as 1.3%. In SW Washington the annual average growth rate is projected as 3.5%[4].

In your opinion, what is the market capacity?

The target market of WSU Vancouver contains an estimated 720 students who are interested in electrical engineering. Based on a study conducted by WSU Vancouver[6], 17% of the surveyed high school students from the target market consider PSU. Therefore, 30 (175 x 17%) of the 175 EE students enrollment at PSU are considered to have come from the WSU Vancouver target area. Data is not available for UP. However, due to the significant tuition difference, the UP draw from the WSU Vancouver target area is considered to be much lower (estimated to be 10). As a result, about 40 students are drawn out of the WSU Vancouver target market by the PSU and UP local programs. The remaining

680 students go to other programs in the state or often out of state. While there are many reasons behind these choices, the unavailability of Electrical Engineering in SW Washington is an obvious reason.

What barriers exist to competitive entry into this market?

There are no barriers for this program to enter the market. The program will have WSU's brand identity and reputation for the quality of its academic programs – attributes often cited by prospective students as their top reasons for their college choice.

In addition, there is no electrical engineering program offered in southwest Washington to serve the needs of the place-bound students in the region.

Market Place: Target Market

The first step in determining the "demand" for your program is to identify who is willing to "buy" it. What is the population of students that you want to serve? Are employers, as well as students, willing to pay for the program?

Segmentation: A selection process that divides the broad market into manageable groups with common characteristics.

Questions to ask:

- What are the characteristics of students currently in your department's programs (age, location, employment, goals, etc.)?
- Why do they choose WSU?
- What kind of students choose to go elsewhere for programs like yours? Why?

The current student demographics in ENCS is a mix of traditional students and non-traditional students (working adults coming back to school part-time). The proposed electrical engineering program will most likely have the same characteristics. As more high school graduates are admitted to the lower division courses at WSU Vancouver, the student demographic has been shifting towards a group of mostly full-time students going through the program. As this cohort is moving from the lower division to the upper division, part-time transfer students coming from other institutions will join in the program at the junior level.

They choose WSU Vancouver primarily because of location. Students who want to attend larger, more established programs, or prefer the traditional college setting over the urban, commuter campus setting of WSU Vancouver choose to go to other programs like ours.

Target Market – your primary target market is the first segment you will look at. This is the group of people whose needs you will focus on fulfilling better than anyone else does.

Questions to ask yourself:

- Who are they?
- What is their need?
- How will we serve it?

WSU Vancouver serves primarily place-bound students. Our target market contains three segments: (1) Community college transfer students; (2) Paraprofessionals; and (3) High school students.

Primarily they are place-bound due to family or employment connections. Therefore they need access to higher education in SW Washington. The electrical engineering program will fulfill this need for the prospective students. It will also meet the needs of the local industry for skilled workers in the high-tech areas.

Estimate the number of individuals you expect to enroll from your target market for the 1st, 2nd and 3rd years. This market segment can be based on demographics e.g., the number of students who complete community college in WA each year with an AA degree with a business emphasis, or (for a graduate program) the number of students who graduate with an undergraduate degree in this field in the Northwest. This will help you identify potential trends and your target market.

Your **target market** is usually the segment that has the largest numbers of individuals in it. However, if that segment's needs are already being taken care of by one of your competitors, you may wish to target another group or go for the specialty "niche," or secondary market. Note that it may be better to target 50% of a smaller group rather than 2% of a global market

	1st year	**2nd year**	**3rd year**
Target* *(High school)*	35	35	35
Secondary *(CC transfer and paraprofessionals)*	0	0	15

**Table indicates target freshmen headcount for the first two years. In the third year transfer students are expected to be admitted the program.*

To whom will your marketing efforts be directed? What are the key characteristics of that segment to which you will appeal?

TARGET MARKET:	**Characteristics:**
High school graduates, CC transfers and paraprofessionals	• Location, • Want EE, • Local four-year option, • Low cost (option for lower division at local community college rates), • WSU reputation, • Small classes, • Research university, • State-of-the-art facilities, • Connections to local industry for internship and jobs, • Diverse student population creates inclusive environment

IV. Recruitment Plan

1. How and where are students going to find out about this program?

Students will find our about the electrical engineering program through a variety of vehicles:

1) Website:
The existing School of ENCS Website will be expanded to promote and to provide all details of the new electrical engineering program at WSU Vancouver. Prospective students who are interested in the electrical engineering program will be directed to the website through a layered strategy of advertising, promotions and via college and high school counselors.

2) Open Houses:
The Electrical Engineering program will be featured in a series of campus Open Houses for prospective students and their families. At the Open Houses students can meet with faculty and academic coordinators, financial aid and scholarship representatives, current students and local alumni. In addition, lab tours with graduate students and campus tours will be given by Student Ambassadors.

3) Advertising & Promotions:
A series of advertising strategies will be employed to target potential college bound students focusing on the 20 high schools in Clark and Cowlitz County as well as high achieving community college students at Clark and Lower Columbia Colleges. In the future, marketing efforts will expand to a broader geographic area including all six counties of southwest Washington and the Portland metropolitan area. All these materials will have specific content about the electrical engineering degree program.

4) WSU Vancouver recruitment materials
All existing WSU Vancouver recruitment materials will be immediately updated to provide promotional information about the electrical engineering degree. These materials include

- WSU Vancouver Search Piece,
- WSU Vancouver Transfer Guide,
- WSU Vancouver Fact Sheet,
- WSU Vancouver Engineering program brochures,
- WSU Vancouver Catalog, and many others

5) Related Events:
WSU Vancouver will have an opportunity to attract potential students to the electrical engineering program through a variety of related events that the campus hosts or sponsors: These include

- National College Fair in Portland
- High School Junior College Fair (on campus)
- MESA events on campus
- Center for Youth Workforce Preparation events
- Campus Tours with Student Ambassadors
- And many others

2. **How are you going to educate and inform professionals who will assist you in promoting by word-of-mouth?**

   We have developed a thorough educational and promotion plan (printed materials, website, curricular guides, scholarship information, a professional admission/recruitment booth display, etc.) for a variety of professionals and influencers in the region that will assist in word of mouth promotions. These include targeting information and events for:

   - High School counselors,
   - High School Math and Science teachers,
   - Advanced Placement (AP) and International Baccalaureate (IB) teachers,
   - Career counselors,
   - Community College advisors,
   - Community College faculty – especially in engineering, math, science and technology,
   - Parents of potential students,
   - Professional and Trade Associations,
   - Grant information sessions produced by the Washington Technology Center for local businesses, which are hosted on our campus,
   - Through participation in trade and professional association events, and
   - Technology firms in the region.

3. **Who specifically will be helpful in your promotion activities? How will you access them?**

   There are many individuals and departments that will be involved in promotion of the degree program. Two offices in particular will be highly engaged with promotion of the degree. Furthermore, faculty and admission counselors will visit high school and community college classrooms.

   Office of Student Services in general and specifically the Admissions department within that unit will be very involved and active in the promotion of the Electrical Engineering program. Key WSU Vancouver staff includes:

   - Kim Hiatt, Assistant Director of Admissions,
   - Julie Miller, Admissions Counselor,
   - Janet Cleveland, Transfer Admissions Advisor for WSU Vancouver at Clark College, and
   - Student Ambassadors

   The Office of Marketing and Communications will help promote the Electrical Engineering program through press releases to the media as well as articles in various campus publications about faculty appointments, research grants and awards and student achievements. Additionally, the program will be indirectly promoted through the selection of images used in general recruitment advertising (billboards, newspaper advertisements, etc.) that are reflective of electrical engineering activities and research projects. The Office of Development and Alumni Relations will also assist in raising funds for student scholarships, lab equipment and research support for faculty in electrical engineering. Key WSU Vancouver staff include:

   - Jennifer Crooks, Director of Development & Alumni Relations
   - Lori Brockman, Director of Marketing and Communications
   - Sheri Byrd, Communications Coordinator

4. **How can you provide recruiting training to necessary departments and support staff? Who will represent this department in its promotion activities?**

   There will be ample opportunities for training admissions staff and recruiters as well as other departments and support staff. A training session will be held each semester to give lab tours, updates on curriculum, and new information about the program and faculty. The department will be represented in every major opportunity to recruit students (e.g. National College fair) through faculty involvement as well as the academic coordinators. The Website will be constantly updated so that all those involved in promoting the degree will have up to date information about the program.

5. **What specific venues can you use to promote an awareness of this new program?**

   There are myriad venues for promotion of the electrical engineering degree, many of which have been mentioned previously:
   - traditional recruitment venues:
     - on-campus recruiting events,
     - Website,
     - National college fair,
     - community college and high school visitations,
     - local college tours (i.e. high school juniors tour)
   - new venues:
     - multicultural student fair on campus,
     - new student orientation,
     - business and industry visits/fairs,
     - Portland State University's engineering building,
     - Diversity newsletter and advisory board meetings,
     - WSU Vancouver Advisory Board,
     - WSU Vancouver student government events (BBQ, Oktoberfest, Spring Fling, etc)
     - Vancouver mall display

6. **What means will be used to access and educate businesses, industry, agencies, and/or institutions about this offering?**

   - Existing and future industry advisory board members are made up of a broad array of firms in the region. Regular communication with these key leaders and influencers helps educate them about the degree and program.
   - Information about the degree will be disseminated to all area employers, and specifically high technology employers through their electronic newsletters, personal visits and presentations to employees.
   - Engineering societies and local chapters of associations will be targeted for presentations, materials and promotions. These include Society of Women Engineers (SWE), Institute of Electrical and Electronics Engineers (IEEE), the America Electronics Association (AEA), Tau Beta Pi (Engineering Honor Society), American Society for Engineering Education (ASEE) and others.
   - Regional WSU Pullman alumni with electrical engineering degrees will be specifically informed via newsletters, and all regional alumni will be informed through WSU publications including WSUVista, WSU Vancouver Community Report, CEA's communications and WSU Magazine.

- Area partners, the Columbia River Economic Development Council, the Greater Vancouver Chamber of Commerce and the high tech council have offered to co-host industry events on campus that will feature the new electrical engineering program.

V. Financial Analysis:

One of the major factors in determining whether or not a proposed program is viable is its financial feasibility. The University is known for its quality of education and is willing to invest resources in developing quality programs, but at some point there is a consideration of return on investment.

The following pages are a simplified look at the income and expenses related to the proposed program. A web link, http://www. . . . , will take you to an Excel budget worksheet, which can be pasted into the proposal template document after it is completed. Both your college's Finance Officer and the University Budget Office are available to assist you with this worksheet.

Enrollment Objectives

Enrollment objectives are established to provide a measurement of the cost of the program. They are based on expected enrollment trends and the capacity of your unit to realize those opportunities by meeting student needs. Projecting enrollment also assists you in determining how many students you will need to attract in order cover costs. This will direct your marketing efforts.

(Enrollment X Tuition) + (Other Fees) + (Other Revenue) = University Revenue

This information is important. In the long term, the University needs to show a net positive contribution to University operations from new programs. While it is difficult to associate revenue directly with any one program, the University must consider the overall cost of its programs relative to tuition and other revenues. When considering a new program, the focus will be on its cost per student FTE (full time equivalent). There are guidelines available through the Higher Education Coordinating Board Cost Study (available in the Budget office) that help the University assess which programs are high or low cost, compared to other programs in the same discipline, as well as the overall cost mix for all University programs.

Note: there may be other sources of income to consider either based on enrollment or potential contributions. Be sure to include all sources in worksheet.

Consider all the sources of funding listed below as you complete your cost template. Donations of equipment or in-kind resources should be included in your template, under the Other Sources column.

- Tuition
- State Subsidies
- Private Grants
- State/Federal Grants
- Research Funding
- Private Industry
- Other

Describe these sources and describe any deliverables (products or reports, for instance) that may be required in return for the resources:

Cost Projections

Many of the expenses involved in creating courses for new programs are absorbed into the existing structure. However, when one really evaluates the courses on a stand-alone basis, it is evident that there are many expenses involved.

Fixed expenses are those that your department will have in offering a course regardless of the number of students in the classes – they will not change (not considering inflation) as you move from Year 1 to Year N when you reach what you consider to be "Full Enrollment." **Variable** expenses are those costs that vary depending upon the number of students. These costs will grow from Year 1 to Year N. Some costs exhibit a step function pattern; that is, they are fixed for X number of students, but increase for X+1 students and again for 2X students. For purposes of this worksheet, assume your enrollment goals will be met.

If the new program is a variation on an existing program, using similar kinds and sizes of courses and similar methods of delivery, you may be able to project the costs of the new program fairly closely by determining the cost of the existing program. Check with your college's Finance Officer or the Budget Office for this information.

Direct Expenses - Those costs specifically tied to the proposed program.

Instructor salaries and benefits
Administrator salaries and benefits
Clerical Support salaries and benefits
Graduate Assistant salaries and benefits
Equipment costs
Travel costs
Goods and Services – phones, copying, etc.
Classroom materials costs
Other_____

Indirect Expenses – Those costs that are often associated with existing or additional support services that increase incrementally because of the addition of the program. These costs should not be confused with the Facilities and Administrative (F&A) costs that are applied to grants and contracts. The indirect costs related to new programs are the facilities, academic support, administrative support and student services costs that are in place to support the delivery of the University's academic programs. The Budget Office tracks the overall cost of these services, and the appropriate rate is included in the template. (Note: if you are developing a program that will be delivered via EDP, you should reduce the indirect percentage to .32 in the template. Please call the budget office if you have questions).

Opportunity Costs – the cost of not doing something else. This is not a separate category, but should be kept in mind. For example, if an instructor or other existing resources are "re-allocated" to this proposal, what area will be affected and what is the value of these resources? Every time a new program is proposed, we should carefully consider that it is subtracting resources from other programs. If a new program is not taking resources from other programs, the implication is that we have resources that are underutilized. How does your proposal address this?

Projected Revenues and Expenses

Summary of Program Costs - Year 6 - Full Enrollment (Replace "N" with academic year when pgm is expect to reach full enrollment.)						
Line Item	**FTE**	**Bnfits %**	**Internal Reallocation**	**New State Funds**	**Other Sources**	**Total**
Administrative salaries						
Benefits for Administrative		26.90%				
Faculty salaries				$570,000		$570,000
Benefits for Faculty		26.90%		$153,330		$153,330
TA/RA salaries				$67,500		$67,500
Benefits for TA/RA		30.00%		$20,250		$20,250
Clerical salaries				$120,000		$120,000
Benefits for Clerical		30.00%		$36,000		$36,000
Contract Services (Adjuncts)				$18,000		$18,000
Benefits for contract salaries		30.00%		$5,400		$5,400
Goods and services				$25,000		$25,000
Travel				$10,000		$10,000
Equipment (hardware/software)				$40,000		$40,000
Other (F&S, phone)				$7,800		$7,800
Subtotal				$1,073,280		
Indirect (37%)				$397,114		$1,470,394
Total Cost						$1,470,394
Student FTE						80
Cost per student FTE						$18,380

New state funds: Funding for the following items has already been secured in the 2007-09 biennium:

- 25 FTE High demand funding for electrical engineering starting in Fall 2008,
- $2 million start-up funding,
- $3.7 million for design phase of the new electrical engineering building at WSU Vancouver,
- $1 million for design phase of the new Washington Technology Center (WTC) lab facility at WSU Vancouver

Faculty: 6 FTE (1 Full, 1 Assoc. and 4 Assistant Profs)
TA: 5 positions at 0.5 FTE each
Clerical: 1 FTE Secretary, 1 FTE technician, and 1 FTE Academic Coordinator,
Contract: 5 Adjunct faculty

APPENDIX II

FTE Calculator				
Please show ANNUAL AVERAGE FTE. For undergrads, 15 annual average credits is equal to one full time equivalent (FTE). For undergrads divide total annual credits by 2 to get annual average, then by 15 (or divide total credits by 30).For grads, 10 annual average credits is equal to one FTE. For grads, divide total annual credits by 2 to get annual average, then by 10 (or divide total annual credits by 20).				
Credit Hours	Fall	Spring	Total	
Per Student	Headcount	Headcount	Headcount	Total Credits
20			0	0
19			0	0
18			0	0
17			0	0
16			0	0
15	38	25	63	945
14			0	0
13			0	0
12			0	0
11			0	0
10			0	0
9	70	60	130	1170
8			0	0
7			0	0
6	12	35	47	282
5			0	0
4			0	0
3			0	0
2			0	0
Total	120	120	240	2397
Divide by 2 to get annual average				2
Annual average credits				1198.5
Divide by 15 for undergrads or 10 for grad or prof. students. Enter 15 or 10 >				15
Annual average FTE				80

*Table estimates annual average FTE when the program is anticipated to reach full enrollment in year 6.

ATTACHMENTS

Course Syllabi

School of Engineering and Computer Science
Washington State University Vancouver
Schedule of Studies

Bachelor of Science in Electrical Engineering

Proposed - Effective Fall 2008

Year	Semester	Course	Notes	Course Title	Core Electrical Engineering	Advanced Electrical Engineering	Mathematics	Science	General Education or Other	
Freshman	Fall	ECE 101		Introduction to Electrical Engineering	2					17
		Math 171 [N]		Calculus I			4			
		Chem 105 [P]		Principles of Chemistry I				4		
		Engl 101 [W]		Introductory Writing					3	
		GE 101 [E]		Introduction to University Learning Goals					1	
		GE 110 [A]		World Civilizations I					3	
	Spring	CS 251		C Programming Language	3					17
		Phys 201 [P]		Physics for Scientists and Engineers I				4		
		Math 172		Calculus II			4			
		Econ 101 [S] or Econ 102 [S]		Fundamentals of Micro or Macro Economics					3	
		GE 111 [A]		World Civilizations II					3	
Sophomore	Fall	CS/ECE 214		Design of Logic Circuits	3					15
		Biological Science [B] w/lab						4		
		Math 220		Linear Algebra			2			
		Math 273		Calculus III			2			
		Phys 202 [P]		Physics for Scientists and Engineers II				4		
	Spring	ECE 260		Circuit Modeling and Analysis I w/lab	4					16
		CS/ECE 234		Microprocessor Systems	3					
		Math 315		Differential Equations			3			
		ECE Option Area Course	1			3				
		Arts & Humanities [H]							3	
Junior	Fall	ECE 321		Circuit Modeling and Analysis II	3					17
		ECE 325		Electronic Devices and Applications w/lab	4					
		ECE Option Area Course or Elective	1			3				
		Stat 360		Probability and Statistics			3			
		Engl 402 [W] or Engl 403 [W]		Technical Writing					3	
		GE 303 [E]		Connecting to Research Across the Disciplines					1	
	Spring	ECE 341		Signals and Systems		3				15
		ECE 370		Electromagnetic Fields & Waves		3				
		ECE Option Area Course or Elective	1			3				
		ECE Option Area Course or Elective	1			3				
		Intercultural Studies [I,G,K]							3	
Senior	Fall	ECE 405		Professional Issues and Ethics in Electrical Engineering					3	16
		ECE 411		Energy Systems		3				
		ECE 451		Electrical Engineering Project Management		3				
		ECE Option Area Course or Elective	1			3				
		ECE Option Area Course or Elective	1			3				
		GE 401 [E]		Connecting Learning to Life					1	
	Spring	ECE 452		Electrical Engineering Capstone Design Project		3				15
		ECE Option Area Course or Elective	1			3				
		ECE Option Area Course or Elective	1			3				
		ECE Option Area Course or Elective	1			3				
		Tier III Humanities or Social Science Course [T,D]							3	
					22	42	18	16	30	128

Note 1: Students must choose one of the listed ECE option areas. To complete the degree program, the student must complete the courses listed in this schedule of studies and the five courses required by the selected option area. In addition to the required courses, the student must also complete four elective courses selected from other option areas, or from the list of elective courses, or may obtain approval from their faculty advisor for other coursework.

ECE: new prefix for the courses of the electrical engineering program at WSU Vancouver. The existing mechanical engineering and computer science programs in Vancouver also have their own prefixes (**Mech** and **CS**).

Electrical Engineering
Option Areas

Digital Systems - Required Courses

1	CS 122	Data Structures
2	CS 360	Systems Programming
3	ECE 324	Digital Design II
4	ECE 366	Introduction to VLSI Design
5	ECE 424	Computer Architecture and Design

Electronic Devices and Materials - Required Courses

1	ECE 302	Properties of Electronic Materials
2	ECE 349	Principles of Solid State Devices
3	ECE 366	Introduction to VLSI Design
4	ECE 486	Solid State Device Design and Modeling
5	Mech 438	VLSI Device Fabrication

Networks and Communication Systems - Required Courses

1	ECE 295	Digital Communications I
2	ECE 345	Digital Communications II
3	ECE 464	Introduction to Digital Signal Processing
4	ECE 495	Wireless & Mobile Communication
5	ECE 425	RF Devices and Circuits

Other Approved Electrical Engineering Electve Courses

ECE 476	Computer Aided Design for VLSI
CS 466	Embedded Systems
Mech 468	Robotics
ECE 471	Antenna Design and Analysis
Mech 467	Automation
CS 464	Distributed Systems
ECE 475	Electro-Optical Devices and Systems
ECE 477	VLSI Testing and Design for Test

Note: The “Mech” and “CS” courses already exist in the School of ENCS at WSU Vancouver.

Washington State University Vancouver
School of Engineering and Computer Science
Electrical Engineering Undergraduate Course List
Proposed for Fall 2008

Prefix	Number	GER Designation	Course Title	Credit		Prerequisites	Catalog Description	Equivalent WSU Pullman Course (if any)	
ECE	101		**Introduction to Electrical Engineering**	2	(1-3)	Math 171 or c//	Survey of the field of electrical engineering. Introduces students to the fundamental concepts behind electronic devices and systems. The material is integrated with laboratory experiments in which students will design, construct and analyze electronic c	ME	120
ECE	214		**Design of Logic Circuits**	3	(2-3)	CS 121 or 251	Design and application of combinational logic circuits with exposure to modern methods and design tools; introduction to sequential logic circuits. Same as CS 214.	EE	214
ECE	234		**Microprocessor Systems**	3	(2-3)	ECE 214	Microprocessor system architecture, instruction sets, and interfacing; assembly language programming. Same as CS 234	EE	234
ECE	260		**Circuit Modeling and Analysis I**	4	(3-3)	Math 315 or c//; Phys 202	Introduction to circuit modeling and analysis, Component models, circuit theory. Introduction to circuit simulation tools. Application of network theory to solve linear and non-linear circuits under static and dynamic operation. Laboratory measurement	EE	261 & 262
ECE	295		**Digital Communications I**	3		ECE 214; ECE 260 or c//	Introduction to hardware and protocols for digital communications systems. Ethernet, ATM, physical and media access layers; encoding and modulation techniques. Shannon and Nyquist Theorems and their application.		
ECE	302		**Properties of Electronic Materials**	3		Chem 105, Phys 202	Schrodinger's wave equation, potential barrier problems, crystal structure and bonds, band theory of solids, semiconductors, super conductor, dielectric and magnetic material properties.		
ECE	321		**Circuit Modeling and Analysis II**	3		ECE 260	Laplace transforms, Fourier analysis, state space analysis, two port networks	EE	321
ECE	324		**Digital Design II**	3	(2-3)	ECE 234	Implementation of datapaths and controllers, use of HDLs and automated synthesis tools, filed programmable gate arrays and simulation. Introduction to integrated circuit layout.		
ECE	325		**Electronic Devices and Applications**	4	(3-3)	ECE 260; ECE 214	MOS small and large signal models, bipolar transistors, biasing and parasitics, amplifier design and feedback, frequency response. Circuit simulation and device models.	EE	311
ECE	341		**Signals and Systems**	3		ECE 321	Discrete and continuous systems, sampling, convolution, Fourier and Z transforms, modulation. Introduction to distributed parameter	EE	341
ECE	345		**Digital Communications II**	3		ECE 295; Stat 360 or c//	Digitally modulated signals and their spectral characteristics, modulation/demodulation techniques, coherent/non-coherent detection methods with AWGN, error performance, band-limited channels with ISI and AWGN, channel capacity, bandwidth efficiency, link		
ECE	349		**Principles of Solid State Devices**	3		ECE 325, ECE 302	Fundamentals of semiconductor theory; carrier diffusion and drift, direct and indirect energy materials, homo and hetereojunctions, operations principles of bipolar junctions and MOS field effect transistors, metal-semiconductor contacts.	EE	496
ECE	366		**Introduction to VLSI Design**	3	(2-3)	ECE 325; ECE 234	CMOS devices and deep-submicron fabrication technology. CMOS circuits and layout extending from gates and inverters to the design of large logic blocks. Interconnect modeling, power and clock distribution, area, power and speed optimization. Hands on d	EE	466
ECE	370		**Electromagnetic Fields and Waves**	3		ECE 260	Electrostatic and magnetostatic fields; Faraday's laws, Maxwell's equations, electromagnetic properties of matter, uniform plane waves, and transmission lines.	EE	331
ECE	405	[M]	**Professional Issues and Ethics in Electrical Engineering**	3		certified in ECE; completion of University Writing Portfolio	Social, legal, ethical and professional issues that arise in the context of electrical engineering.		
ECE	411		**Energy Systems**	3	(2-3)	ECE 321	Investigation and analysis of the design, tradeoffs and efficiency of conventional and alternative energy sources. Principles and economics of energy transmission, storage and conversion systems.		
ECE	414		**Introduction to Digital Signal Processing**	3	(2-3)	ECE 341	Discrete and fast Fourier Transforms, Z-Transform, sampling, discrete convolution, digital filter design, effects of quantization.	EE	464
ECE	424		**Computer Architecture and Design**	3	(2-3)	ECE 324; ECE 366	Survey of architectural approaches to computer instruction sets and organization. Design, analysis and simulation of student computer designs. Implementation and testing of designs in an FPGA.		
ECE	425		**RF Devices and Circuits**	3	(2-3)	ECE 341; ECE 370	Introduction to semiconductor devices and circuit design targeting wireless applications		
ECE	451		**Electrical Engineering Project Management**	3		certified in ECE; senior standing; Engl 402 or 403	This is the first of a two course senior design project sequence. Design for manufacture, schedule estimation and tracking, costing, ethics and proposal writing will be covered. Successful completion of this course will require the completion of a desig	EE	415
ECE	452	[M]	**Electrical Engineering Capstone Design Project**	3	(1-6)	ECE 451	This course is the execution phase of the senior design project course sequence. An independent or team project proposed in ECE 451 is designed and, to the extent possible, implemented. Students will regularly report their progress and present results t	EE	416
ECE	471		**Antenna Design and Analysis**	3	(2-3)	ECE 425	Antenna types and radiation, wire antennas, antenna arrays, broadband and apertaure antennas. Theory and simulation of antenna performance, laboratory testing and measurement.		
ECE	475		**Electro-optical Devices and Systems**	3		ECE 370; Stat 360	Electromagnetic reflection and refraction, waveguide theory. Theory and application of optical source and sensor devices. Coupling, dispersion and loss in waveguides and optical fiber.		
ECE	476		**Computer-aided Design for VLSI**	3	(2-3)	ECE 366	Algorithms and design flows for VLSI design synthesis and verification. Logic synthesis, floorplanning, placement and routing are covered with consideration of scalability and complexity. Simulation and design rule checking tools are used to verify stud		
ECE	477		**VLSI Testing and Design for Test**	3	(2-3)	ECE 366	Test pattern generation for digital devices, controllability and observability. Tester characteristics and capabilities. Pseudo random test patterns. Fault modelling and analysis of test coverage. Built-in self-test techniques, scan path and boundary sc		
ECE	483		**Topics in Electrical Engineering**	V	1-4	Certified in ECE; junior	Current topics in electrical engineering.	EE	483
ECE	486		**Solid State Device Design and Modeling**	3	(2-3)	ECE 349	Cross-sectional design of CMOS devices. Simulation and optimization of device design using CAD tools such as PISCES and use of SUPREM for process integration. Device model extraction for circuit simulation and parametric testing.		
ECE	490		**Work Study Internship**	V	1-9	Certified in ECE; by interview only	Experience in electrical engineering and systems analysis in a working environment under supervision of industrial or governmental professionals and faculty. S, F grading.	EE	495
ECE	495		**Wireless and Mobile Communication Systems**	3	(2-3)	ECE 345; ECE 425; ECE 414	Wireless communication with an emphasis on cellular and multiple access communication. RF environment, duplexing and multiple access, cellular, mobile systems, standards and applications. Introduction to wireless ad hoc networks.		
ECE	499		**Special Problems**	V	1-4	ECE 341; Certified in ECE; by interview only	May be repeated for credit. S, F grading.	EE	499