

The University of Connecticut

School of Engineering

COMPUTER ENGINEERING

GUIDE TO COURSE SELECTION

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for

Computer Engineering (CMPE) Majors

in the School of Engineering

Prepared by the
Electrical & Computer Engineering Curricula & Courses Committee
School of Engineering, University of Connecticut.

<http://www.engr.uconn.edu/ece/>

TABLE OF CONTENTS

- 1.0 Introduction**.....
- 1.1 Preparation of Plans of Study.....
- 2. Computer Engineering Program**
- 1.2 CompE Program Educational Objectives
- 1.3 CompE Outcomes and Assessment
- 2.0 Computer Engineering Curriculum**.....
- 2.1 Computer Engineering Program Educational Objectives.....
- 2.2 Requirements of the Degree.....
- 2.3 General Education Requirements (University Core Curriculum).....
- 2.4 Overview of the Freshman and Sophomore years.....
- 2.5 Overview of the Junior and Senior years.....
- 3.0 Double Majors, Minors, and Additional Degrees**.....
- 4.0 Filling out the Plan of Study Form**.....

1.0 INTRODUCTION

The objective of this Guide is to outline courses offered by the Computer Science and Engineering (CSE) and Electrical & Computer Engineering (ECE) Departments leading toward a degree in **Computer Engineering** (CMPE) which will prepare the student for a career in the chosen field, meet the curricular requirements of the Department, the School and the University, and meet nationally recognized standards for Computer Engineering as established by the Accreditation Board for Engineering and Technology (ABET). This Guide is intended to be used in conjunction with the University of Connecticut General Catalog as a source of information regarding degree requirements in Computer Engineering.

1.1 Preparation of Plans of Study

Prior to registration during the first semester of the Junior year (typically when a student is registering for ECE 202 and/or ECE 212), or for transfer students in the second semester at UConn, whichever is later, each student must complete a Plan of Study form documenting the program he/she intends to follow to satisfy the degree requirements of the chosen major in engineering. In order to help students in developing a suitable Plan of Study form which meets graduation requirements, the CSE and ECE departments usually hold Plan of Study meetings, normally scheduled sometime during the first five weeks of each semester. All students intending to file a Plan of Study form in CMPE should attend one of these meetings. Details about the process of filling out a Plan of Study form are provided later in Section 5.

2. COMPUTER ENGINEERING PROGRAM

The Computer Engineering Program at the University of Connecticut is continuously evolving and improving in response to feedback from our constituents and program assessment results.

We have developed a set of Program Educational Objectives which are periodically reviewed by all constituents (including our alumni and employers of our graduates). PEOs refer to the abilities and accomplishments of CMPE graduates several years after graduation. The feedback provided by our constituents is used to refine and improve the Program Educational Objectives.

We have determined a set of Program Outcomes which are necessary for the achievement of the Program Educational Objectives. They describe the abilities that our students will have at the time of graduation from the CMPE program. We use several assessment tools (including senior design project evaluation, alumni surveys, exit interviews, senior surveys, and course assessment surveys) to measure our success with respect to the Program Outcomes. The assessment results are reviewed periodically and used for the continuous improvement of the program and our courses.

The two-loop process involving the definition of the Program Educational Objectives (loop one) and the assessment / program improvement (loop two) is shown below.



The Two Loops of EC2000

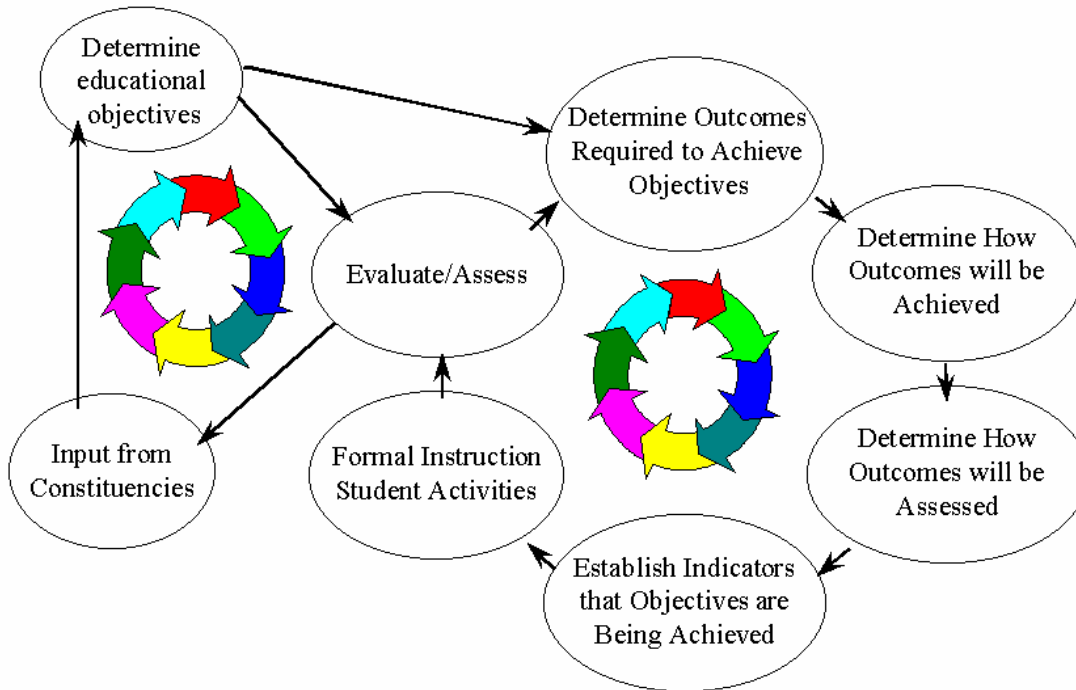


Figure 2.1. The two-loop process of Engineering Criteria 2000, as defined by Accreditation Board for Engineering and Technology (ABET).

2.1 Computer Engineering Program Educational Objectives (PEO)

The CMPE Program Educational Objectives are outlined below:

1. Our alumni will make *technical contributions* to design, development, and manufacturing in their practice of computer engineering.
2. Our alumni will demonstrate *professionalism and a sense of societal and ethical responsibility* in all their endeavors.
3. Our alumni will engage in *professional development or post-graduate education* to pursue flexible career paths amid future technological changes.

The Computer Engineering Curriculum described in Section 3 has been designed to achieve these three Program Educational Objectives.

2.2 Computer Engineering Outcomes and Assessment

Based on the Program Educational Objectives, we have defined Program Outcomes necessary for their fulfillment. Program assessment is used to insure that these outcomes are achieved. The **CMPE Program Outcomes**, identical to the ABET-defined (a-k) outcomes, are listed as follows. They stipulate that, at the time of graduation from the CMPE program, the graduates will have the abilities described.

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to **design a system, component, or process to meet desired needs within realistic constraints** such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on **multi-disciplinary teams**
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of **professional and ethical responsibility**
- (g) an ability to **communicate** effectively
- (h) the broad education necessary to understand the impact of **engineering solutions** in a global, economic, environmental, and **societal context**
- (i) a recognition of the need for, and an ability to engage in **life-long learning**
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

3. COMPUTER ENGINEERING CURRICULUM

The basic level curriculum has been designed to achieve the Program Educational Objectives and to meet the University General Education Requirements. Section 3.1 describes the University General Education Requirements. Section 3.2 describes the basic-level CMPE Curriculum with the courses and options offered in the lower and upper divisions provided in Sections 3.3 and 3.4.

3.1 General Education Requirements (University Core Curriculum)

As part of all baccalaureate degree programs at the University, students are required to satisfy a common core of coursework known as the General Education Requirements. These are described in what follows.

Foreign Languages

The minimum requirement is met if the student is admitted to the University with three years of a single foreign language in high school, or the equivalent. If the student has not met the minimum requirement through high school coursework, he or she must pass the second semester course of the introductory year-long course sequence in a language at the University.

Expository Writing

All students must take ENGL 110 Seminar in Academic Writing or ENGL 111 Seminar in Writing through Literature. In addition to these courses, all students must complete two Writing (W) courses. As shown in the following pages, two Writing courses are specified in the required coursework in Computer Engineering.

Arts and Humanities (Content Area One)

All students must take two Arts and Humanities courses. These courses must be from two different departments. All students in the School of Engineering are required to take PHIL 104, which satisfies one of these requirements.

Social Sciences (Content Area Two)

All students must take two Social Sciences courses. These courses must be from two different departments.

Science and Technology (Content Area Three)

All students must take two Science and Technology courses. These courses must be from two different departments. All engineering students satisfy this requirement automatically with required courses.

Diversity and Multiculturalism (Content Area Four)

All students must take two Diversity and Multiculturalism courses. One of these courses may also count toward the Content Area One or Content Area Two. One of these courses must be an international course.

The list of approved courses has been furnished by the General Education Oversight Committee. It is available at <http://geoc.uconn.edu/CourseList0223.pdf> .

3.2 Computer Engineering Basic-Level Curriculum

The basic-level curriculum is given in Table 3.1. This basic-level curriculum typically includes 33 credit hours of Math and Basic Science, 64 credit hours of Engineering Topics, 22 credit hours of General Education, and 7 credit hours of Other topics (including 3 credits of a free elective), as defined by the Accreditation Board for Engineering and Technology.

**Table 3.1. Basic-Level Curriculum
Computer Engineering**

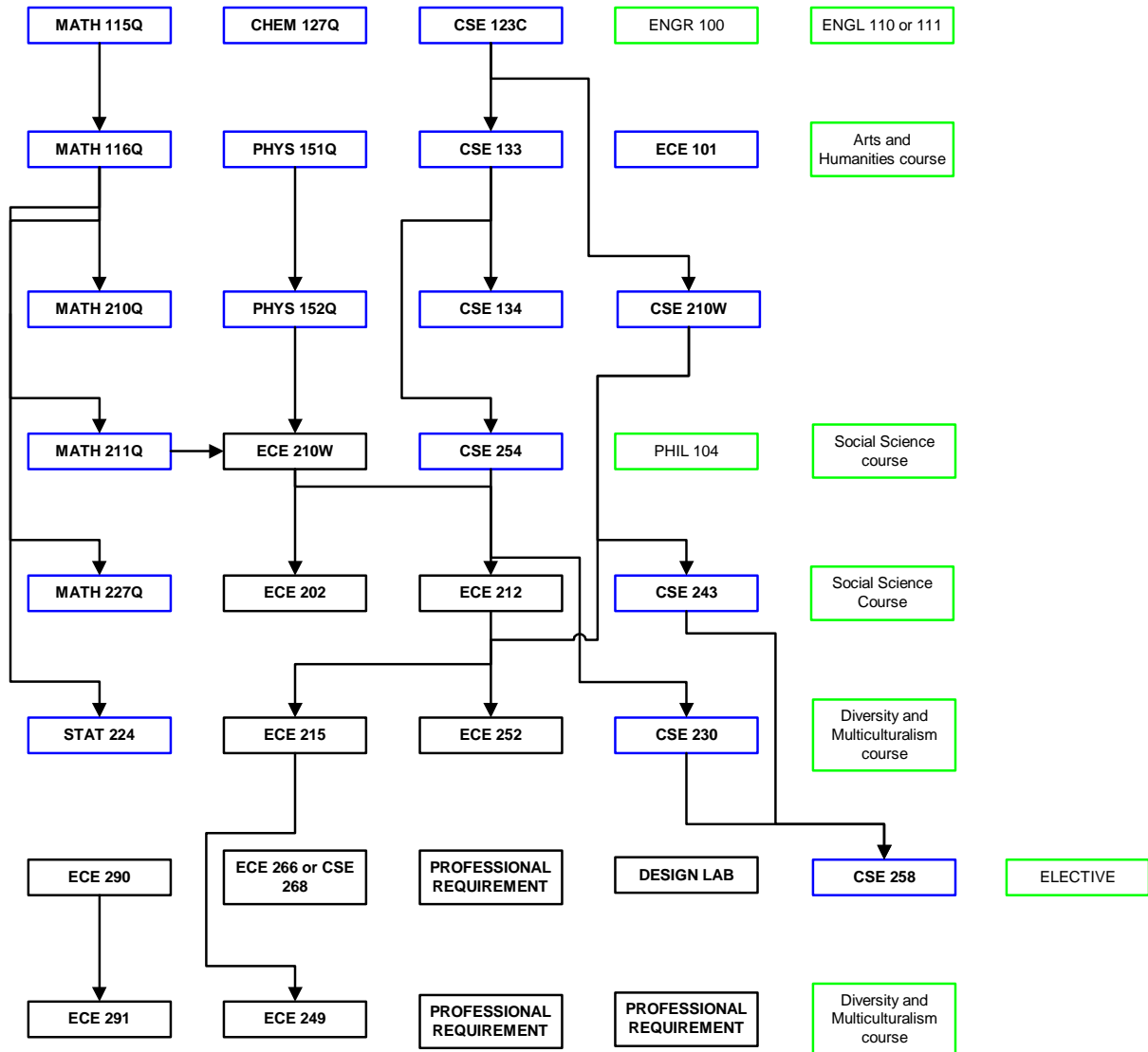
Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics	General Education.	Other
			Check if Contains Design (✓)		
Freshman Fall	CHEM 127Q General Chemistry	4	()		
	MATH 115Q Calculus I	4	()		
	ENGL 110 or 111 Writing Seminar		()	4	
	CSE 123C: Intro. to Computing		()		2
	ENGR 100 Orientation to Engineering		()		1
Freshman Spring	PHYS 151 Physics for Engineers I	4	()		
	MATH 116Q Calculus II	4	()		
	CSE 133 Object Oriented Design		3 (✓)		
	Arts & Humanities Course		()	3	
	ECE 101 Computer Tools				1
Sophomore Fall	PHYS 152Q Physics for Engineers II	4	()		
	MATH 210Q Multivariable Calculus	4	()		
	CSE 134 Data Structures & Algorithms		3 ()		
	CSE 210W Logic Design		4 (✓)		
			()		
Sophomore Spring	MATH 211Q Elementary Differential Equations	3	()		
	ECE 210W Electrical Circuits		4 (✓)		
	CSE 254 Intro. to Discrete Systems		3 ()		
	PHIL 104 Phil. & Social Ethics		()	3	
	Social Sciences Course		()	3	
Junior Fall	ECE 202 Signals and Systems		3 ()		
	ECE 212 Electronic Devices and Circuits		4 (✓)		
	CSE 243 Intro. to Computer Architecture and Hardware/Software Interface		4 (✓)		
	Math 227Q Applied Linear Algebra	3	()		
	Social Sciences Course		()	3	

(continued on next page)

**Table 3.1. Basic-Level Curriculum (continued)
Computer Engineering**

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Science	Engineering Topics Check if Contains Design (✓)	General Education	Other
Junior Spring	ECE 215 Digital Integrated Circuits		3 (✓)		
	ECE 252 Digital Systems Design		3 (✓)		
	CSE 230 Intro. to Software Engineering		3 (✓)		
	STAT 224Q Probability Models for Engineers	3	()		
	Diversity & Multiculturalism Course		()	3	
			()		
Senior Fall	ECE 290 Computer and Electrical Engineering Design I		2 (✓)		
	ECE 266/CSE 268 Microprocessors		3 (✓)		
	CSE 258 Operating Systems		3 (✓)		
	Professional Requirement		3 ()		
	Design laboratory		3 (✓)		
	Elective		()		3
Senior Spring	ECE 291 Computer and Electrical Engineering Design II		3 (✓)		
	ECE 249 VLSI Design and Simulation		4 (✓)		
	Professional Requirement		3 ()		
	Professional Requirement		3 ()		
	Diversity & Multiculturalism Course		()	3	
			()		
			()		
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		33	64 (✓)	22	7
OVERALL TOTAL FOR DEGREE		126			
PERCENT OF TOTAL		26%	51% (✓)	17%	6%
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5 %		

Computer Engineering Prerequisite Flow:



3.3 Overview of the Freshman and Sophomore Years

The lower division, or freshman and sophomore years, of the Computer Engineering curriculum are similar to the other engineering curricula. The recommended sequence of courses is as follows.

FRESHMAN YEAR			
First Semester	Credits	Second Semester	Credits
MATH 115Q ¹ - Calculus I	4	MATH 116Q-Calculus II	4
CHEM 127Q-Gen. Chem. I	4	PHYS 151Q-Engineering Phys. I	4
CSE 123C-Intro. to Computing	2	CSE 133-Object Oriented Design	3
ENGL 110 or ENGL 111-Acad. Writing	4	Arts and Humanities course ²	3
ENGR 100-Orientation to Engr.	<u>1</u>	ECE 101-Computer Tools	<u>1</u>
	15		15

SOPHOMORE YEAR			
First Semester	Credits	Second Semester	Credits
MATH 210Q-Multivariable Calculus	4	MATH 211Q-Differential Equations	3
PHYS 152Q-Engineering Phys II	4	ECE 210W- Electric Circuits	4
CSE 134- Data Structures & Algorithms	3	CSE 254-Intro to Discrete Systems	3
CSE 210W Logic Design	<u>4</u>	PHIL 104 - Phil. and Social Ethics	3
	15	Social Sciences course ²	<u>3</u>
			16

¹The three-semester sequence of MATH 112Q-113Q followed by Math 116Q may be taken instead to satisfy this requirement. MATH 112Q can not be used toward the required 126 credits for the Engineering degree.

²The courses from content areas one (Arts and Humanities) and two (Social Sciences) must be from four different departments. One course from either content area one (Arts and Humanities) or content area two (Social Sciences) may also be used to fulfill one of the requirements from content area four (Diversity and Multiculturalism). One course from content area four must be an international course.

3.4 Overview of the Junior and Senior years

The Computer Engineering upper division curriculum, as described below, includes required courses and a number of professional requirements. The professional requirements are used to allow the student to specialize in a particular area within Electrical Engineering or to broaden his or her knowledge.

JUNIOR YEAR			
First Semester	Credits	Second Semester	Credits
ECE 212- Electronic Devices and Circuits	4	ECE 215- Digital Integrated Circuits	3
ECE 202-Signals and Systems	3	ECE 252- Digital Systems Design	3
CSE 243-Intro. to Comp. Arch. and Hardware/Software Interface	4	CSE 230-Intro. to Software Engr.	3
MATH 227Q-Linear Algebra	3	STAT 224Q- Prob. Models for Engineers	3
Social Sciences course ²	<u>3</u>	Diversity and Multiculturalism course ²	<u>3</u>
	17		15
SENIOR YEAR			
First Semester	Credits	Second Semester	Credits
ECE 290-Comp. & Elec. Engr. Design I	2	ECE 291-Comp and Elec. Engr. Design II	3
ECE 266-Microprocessor Applications Lab or CSE 268-Microprocessor Laboratory	3	ECE 249-VLSI Design & Simulation	4
CSE 258-Operating Systems	3	Professional Requirement ³	3
Professional Requirement ³	3	Professional Requirement ³	3
Design Laboratory ⁴	3	Diversity and Multiculturalism course ²	<u>3</u>
Elective	<u>3</u>		16
	17		

The entire program of professional requirements is selected by the student, subject to approval by his/her advisor, the Department Head, and final approval by the Dean of Engineering.

¹The three-semester sequence of MATH 112Q-113Q followed by Math 116Q may be taken instead to satisfy this requirement. MATH 112Q can not be used toward the required 126 credits for the Engineering degree.

²The courses from content areas one (Arts and Humanities) and two (Social Sciences) must be from four different departments. One course from either content area one (Arts and Humanities) or content area two (Social Sciences) may also be used to fulfill one of the requirements from content area four (Diversity and Multiculturalism). One course from content area four must be an international course.

³Choose three (3) from: ECE 232, ECE 234, ECE 247, ECE 241, ECE 242, ECE/CSE 257, CSE 221, and CSE 245.

⁴Choose one (1) from: ECE 280, CSE 261/ECE 281, ECE 268, and ECE 292.

4.0 DOUBLE MAJORS, MINORS, AND ADDITIONAL DEGREES

Opportunities exist to pursue a double major program in Computer Engineering and one of the other undergraduate engineering curricula, to pursue a minor degree program in conjunction with the CMPE degree, or to pursue an additional degree within the University. Any student pursuing a second baccalaureate degree must i) submit an Additional Degree Petition (which requires the consent signature from the Dean of the School of Engineering) and ii) meet the course requirements of both degrees; and iii) earn at least 30 credits more than the requirements of the degree with the higher credit minimum.

Double Major with another Engineering program

Opportunities exist to pursue a double major program in Computer Engineering and one of the other undergraduate engineering curricula. Of the other curricula, the Electrical Engineering (EE) and the Computer Science and Engineering (CSE) majors have the most overlap with the CMPE curriculum and are the most popular double majors for CMPE students. If a student wishes to be a double major within Engineering, he or she should notify the Dean. Careful planning of course selection should be done each semester in consultation with the student's advisor. A separate Plan of Study form for each major must be prepared and submitted for approval.

Minors

Several minors are available within the University that may be attractive to students pursuing the Computer Engineering degree. Examples include minors in Mathematics and Statistics, within the College of Liberal Arts & Sciences, as well as the Biomedical Engineering minor within the School of Engineering.

Additional Degree with another major outside of Engineering

From time to time students wish to obtain an additional degree in a field outside of the School of Engineering. One example of an additional degree would be that found in the EUROTECH program in which the completion of a degree in German Studies within the College of Liberal Arts & Sciences is achieved at the same time the student completes the primary degree in a major within the School of Engineering. Students who have such an interest should discuss the procedure for pursuing the additional degree with the Director of Undergraduate Advising, Prof. David Jordan (486-5462).

5.0 FILLING OUT THE PLAN OF STUDY FORM

All students in the first semester of their Junior year in the Engineering curriculum must prepare a written Plan of Study form. These students should work with their advisors to determine a Plan of Study which meets the degree requirements of the School of Engineering and the University.

After an initial consultation with the advisor, the student should prepare two (2) original copies of the Plan of Study form (http://www.engr.uconn.edu/ece/ece_ce_pos.htm) by following the guidelines given below. Once the two original copies are prepared, the student should make an appointment with his/her advisor to have him/her review and approve the form. Both the advisor and the student should check his/her transcript to be sure that all Lower Division

(freshman/sophomore) requirements have been met and should check that the proposed Upper Division (junior/senior) plan satisfies Department, School, and University requirements. After the form is approved by the advisor, the two originals should be forwarded to the Associate Department Head, Prof. Rajeev Bansal, for approval, prior to being forwarded to the Director of Undergraduate Advising, Prof. David Jordan.

The Associate Department Head will indicate his approval of the Plan of Study, and then will send the two originals to the Director of Undergraduate Advising. The Director of Undergraduate Advising will evaluate the Plan and indicate his approval of it. In the event that approval is not given, the difference of opinion must be worked out among the advisor, the student and the Director of Undergraduate Advising or Associate Department Head, as appropriate.

The Dean's Office will return two copies of the approved tentative Plan of Study form to the advisor: one of the two "originals" which is to be kept in the student's counseling folder, the other being a photocopy to be given to the student.

Note that an approved Plan of Study form can be modified at any time if course offerings and student objectives warrant it. However, no modification that jeopardizes the meeting of requirements will be approved. Modification must be made in consultation with the student's advisor and will usually involve the submission of a "revised" Plan of Study form for approval, in the same manner as the "original" form was prepared and submitted. Although not required until the last semester, it is suggested that a "revised" form be submitted each semester rather than waiting until the final semester. This way any problems can be caught as early as possible. This "revised" Plan of Study form may be created as done initially by forming two new originals, or by marking the changes on the approved "original" and having this "revised" form circulated for approval. Alterations to the courses listed should be made by crossing out the course(s) not taken, writing in those that were, and having the advisor initial and date each change. If extensive changes are to be made, or if a second revision is necessary, a new "original" Plan of Study form must be submitted.

The Plan of Study form should be reviewed at each subsequent registration period. ***In the student's last semester, he/she is required to file a "final" Plan of Study form which accurately lists all the courses that were taken to satisfy degree requirements.*** Any modifications to an already approved Plan of Study form should then be submitted for final approval following the above procedure.

The Plan of Study forms (available on the departmental website <http://www.engr.uconn.edu/ece/>) should be filled out neatly in ink. Alternatively, the webfile can be edited directly (the preferred method) with subsequent updates being very convenient by editing the saved Plan of Study file. All approval initials and signatures should be in ink and dated. Expected date of graduation and year of catalog requirements must be clearly shown. The following guidelines should be adhered to:

Double Major: If you plan to follow a double major, indicate at the bottom of the Plan of Study form what it will be; i.e. " Double Major: department ". Note that some double majors will require submitting a completed Plan of Study form from each department. The approval of the Department Head from the double major department is also required as indicated on the form.

Catalog year and date of graduation: It is extremely important that you accurately list what catalog year you are filing under and your intended date of graduation. Both items are needed

for use by the Registrar so that completion of your degree requirements may be certified by your graduation date.

Courses taken: The Plan of Study form must show exactly the courses being used to satisfy degree requirements. Exemption from specific School of Engineering course requirements or substitution of alternative courses must be clearly indicated on the Plan of Study form, explained in the "Comments" section and/or with an attachment, and may require approval via petition by the Director of Undergraduate Advising (see "Exemption and Substitution" below).

Foreign Language Requirement: The Foreign Language requirement calls for three years of a single foreign language in High School or passing the second semester course of the introductory year-long course sequence in a language at the University. The words "High School" should be circled if the student has met this requirement in High School. If not, the appropriate university courses should be listed.

Expository Writing Requirement: The General Education Requirement for Expository Writing is met through ENGL 110 or ENGL 111 and two "W" (writing) courses which are part of the engineering curriculum for each department (for CMPE majors, CSE 210W and ECE 210W are required). Thus, the Plan of Study form (and the student transcript) must show these courses. If, for some reason beyond the student's control, the major "W" courses are not taken, the student will have to take the required "W" courses outside the department curriculum.

Arts and Humanities (Content Area One): All students must take two Arts and Humanities courses. These courses must be from two different departments. All students in the School of Engineering are required to take PHIL 104, which satisfies one of these requirements.

Social Sciences (Content Area Two): All students must take two Social Sciences courses. These courses must be from two different departments.

Science and Technology (Content Area Three): All students must take two Science and Technology courses. These courses must be from two different departments. All engineering students satisfy this requirement with required courses.

Diversity and Multiculturalism (Content Area Four): All students must take two Diversity and Multiculturalism courses. One of these courses may also count toward the Content Area One or Content Area Two. One of these courses must be an international course.

Required courses: Required courses are shown on the form. If there are alternatives listed, the course(s) that the student has taken or intends to take should be circled (e.g. ENGL 110 or ENGL 111, circle 110 or 111 depending on which one was taken).

Professional Requirements: The Professional Requirements which are not specified on the Plan of Study form are chosen in consultation with the student's advisor.

Restrictions: The following courses may not be counted for credit toward graduation: MATH 112Q and 118Q along with other mathematics courses numbered below 110Q; PHYS 101Q,

103Q; CSE 101C; STAT 100; and courses labeled "independent study" or "variable topics" (e.g. courses numbered 298 and 299) taken in departments outside of the School of Engineering. No course taken on a Pass/Fail basis may be counted for credit toward graduation or used to meet any course requirement of the School of Engineering. Many general University restrictions are shown in the Academic Regulations and Procedures section of the University Catalog.

Exemption and Substitution: Students who desire to be excused from any of the requirements, or to substitute other courses for those prescribed, must do so by submitting a petition to the Dean. Some examples of this type of departure from a published regulation are as follows: exemption from MATH 115Q for a student who had Calculus in high school and started in our MATH 116Q or substitution of PHYS 121Q, 122Q, 125Q for PHYS 151Q, 152Q. Note that a substitution of three courses for two (as in the Physics example) results in only the credits for the two being counted for graduation, i.e. you are making a substitution for the equivalent work. Note that substitutions for courses taken as departmental Professional Requirements usually do not require a petition for approval by the Dean, but may be indicated on the Plan of Study form directly. Students must not write down or leave unchanged anything on the Plan of Study that they have not actually taken or plan to take.

Transfer Courses: Transfer courses should be listed on the Plan of Study form just as any other course, with a superscript of "T" to indicate which courses were transferred. Transfer courses may be counted at their University of Connecticut equivalent credit in the category totals if the transcript does not show the number of credits granted for the particular course.

For transfer work that does not have an exact University of Connecticut equivalent; e.g., 4.25 credits of ECE 1000 (ECE 100-level), the credits should be listed as follows:

ECE 1000 (4.25)^T

In other words, the discipline followed by the level with an indication of how many credits are needed.

The total transfer credit granted (not the sum of the University of Connecticut equivalents) less any equivalent restrictions (such as subtracting 3 credits if MATH 107Q is listed since this course does not count for credit in the School) should be listed on the line labeled "Transfer Credits". The total of all credits taken at the University of Connecticut should be listed on the line labeled "University of Connecticut Credits". The sum of the "Transfer Credits" and the "University of Connecticut Credits" should be listed on the "Total Credits" line. The total credits must equal or exceed 126.

Changes: Changes to a previously submitted Plan of Study form may be made in consultation with the advisor and will require submission of a "revised" Plan of Study form for approval, in the same manner as the "original" form was prepared and submitted. This may be done by marking the changes on the previously approved original Plan of Study form, available from the advisor or the Office of the Dean, and having the advisor initial and date each change. No modifications of a photocopy will be accepted. If a second revision of an "original" is necessary, or if extensive changes are to be made, the submission of a new "original" Plan of Study form is required. In the student's last semester, he/she must submit a "final" Plan of Study form which accurately lists all the courses that were taken to satisfy degree requirements.