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Introduction

Welcome to Union Engineering! We, your Engineering Department faculty, are glad you're here and look forward to working with you as you begin your engineering career and, most importantly, as you follow the Lord's plan for your life.

The purpose of this *Handbook* is to help you succeed in your engineering career at Union University and thereafter. It consolidates relevant information from the *Union University Undergraduate Academic Catalogue**, and it supplements that information with other program info and advice for success. This is "necessary but not sufficient" for your success: your energy, diligence, brains, creativity, and faith are even more important.

Onward and upward!

*Every effort has been made to ensure the accuracy of this *Handbook* and its agreement with the *Union University 2011-2012 Undergraduate Academic Catalogue*. In the unfortunate event that this *Handbook* is found to disagree with the *Catalogue*, the *Catalogue* shall govern.

Program Overview

The Union University Engineering program is accredited by the Engineering Accreditation Commission of ABET* (http://www.abet.org) as a "non-discipline specific" or "general" engineering program. Under the general engineering framework, it has two "concentrations": an electrical engineering concentration (EEC) and a mechanical engineering concentration (MEC). Students select a concentration, typically after the sophomore course sequence (more on that later), and all graduates receive a Bachelor of Science in Engineering (BSE) degree.

The Union Engineering program builds on the mathematics and science foundation common to all accredited engineering programs with the electrical, mechanical, materials, and industrial engineering fundamentals needed to do real-world engineering. We have a strong design emphasis, with design projects in most engineering courses and a year-long capstone design project in the senior year.

Union Engineering graduates are technical problem-solvers, educated with a Christian worldview. In addition, Union's liberal-arts core curriculum provides the broad education necessary to engage our (post)modern and ever-shrinking world.

Our graduates have found employment as electrical engineers and mechanical engineers in industries such as automobile, energy, and missile defense and in engineering consulting. They have done graduate work in a range of areas, including electrical engineering, aerospace engineering, chemical engineering, business, finance, and theology.

The official Program Educational Objectives are:

1. Graduates will be equipped to apply knowledge attained through a solid engineering education built on a strong science and liberal arts foundation.

*ABET is the accrediting agency for all engineering, technology, computing and applied science programs in the United States. Its name was officially changed a few years ago from the "Accrediting Board for Engineering and Technology" to simply "ABET."

2. Graduates will be equipped through the instructional environment to engage in inventive thinking and to use engineering skills.
3. Graduates will be prepared for successful careers or advanced studies in engineering or other professional fields.
4. Graduates will be prepared to think based on Christian principles and to act ethically in providing service to their employers, communities, churches and humanity.

In addition, the Union Engineering program is designed to achieve 13 Student Outcomes, 11 of which are prescribed by ABET and 2 of which are unique to Union Engineering. These can be found in Appendix A. ABET accreditation requires these Outcomes to be monitored, and, as part of Union Engineering's monitoring process, each student receives a report twice per year on his or her achievement of these outcomes.

In summary, a Union Engineering education prepares students for engineering careers in academia and industry, for careers outside engineering, and for life.

Curriculum

The standard, four-year curriculum map for the Union Engineering program is shown on pages 8 and 9, followed by a list of courses. The list of courses is broken into the three categories considered by ABET for accreditation purposes:

General Education (“Gen Ed”):	37 hours
Math and Basic Science:	41 hours
Engineering:	61 hours
Total:	139 hours

See Appendix B for a curriculum map in which general education courses are specified in a typical sequence.

Standard Bachelor of Science in Engineering (BSE) Curriculum Map

Freshman	***Fall***	Credits	***Winter***	Credit	***Spring***	Credits
	EGR 101 Intro. Eng. Design & Analysis	2			EGR 105 Engineering Graphics	3
	CHE 111 General Chemistry	4			EGR 109 Intro to MATLAB/Comp Programming	2
	MAT 211 Calculus I	4			PHY 231 Physics I	5
	Gen Ed	3			MAT 212 Calculus II	4
	Gen Ed	2			Gen Ed	3
	Gen Ed	1				
		16				17
Sophomore	EGR 240 Mechanical Engineering Fundamentals I: Mechanics	3	CHE 113 Chemical Instrumentation (Even Years)	2	EGR 210 Materials Engineering	3
	EGR 261 Electrical Engineering Fundamentals I: Digital Logic	3	Gen Ed (Odd Years)	3	EGR 250 ME Fund II: Thermo-fluid Dynamics I	4
	PHY 232 Physics II	5			EGR 262 EE Fund II: Electric & Electronic Circuits	4
	MAT 213 Calculus III	4			MAT 314 Differential Equations	3
	Gen Ed	1			Gen Ed (Even Years)	3
					CHE 113 Chemical Instrumentation (Odd Years)	2
		16		2-3		16-17

Junior	EGR 330 Engineering Economy	3	Gen Ed	3	EGR 375 Power Systems and Electrical Machines	3
	EGR 342 Engineering Experimental Methods	3	Gen Ed	3	EGR 352 Mechanical Engineering Lab (MEC)	1
	EGR 360 Analysis of Linear & Dynamical Systems	3			EGR 385 Energy Conversion (MEC)	3
	EGR 320 Mechanics of Materials (MEC)	3			EGR 405 Electronics (EEC)	4
	EGR 361 Digital Electronics (EEC)	4			CSC 255 Programming in C	3
	MAT 208 Statistics (MEC)	3			MAT 315 Linear Algebra (EEC)	3
	Gen Ed (EEC)	3			Gen Ed	3
		16, 15		6	Gen Ed (MEC)	3
						16
Senior	EGR 475 Control Theory & Design	4			EGR 492 Major Design II	3
	EGR 491 Major Design I	3			EGR 498 Eng. Seminar	1
	EGR 395 Spc. Study EE (EEC)	3			EGR 416 Solid State (EEC)	3
	EGR 450 Thermo-fluid Dynamics II (MEC)	4			EGR 456 Machines & Mechanisms (MEC)	3
	Gen Ed	3			Gen Ed	4
	Gen Ed	3			Gen Ed	3
		16, 17			Gen Ed	3
						17

Total Hours: 139

Electrical Engineering Concentration Courses:

EGR 361 Digital Electronics (4)
EGR 395 Special Study in Electrical Engineering (3)
EGR 405 Electronic Circuit Analysis and Design (4)
EGR 416 Physical Principles of Solid State Devices (3)

Mechanical Engineering Concentration Courses:

EGR 320 Mechanics of Materials (3)
EGR 385 Energy Conversion (3)
EGR 352 Mechanical Engineering Laboratory (1)
EGR 450 Thermo- fluid Dynamics II (4)
EGR 456 Machine & Mechanism Theory & Design (3)

GENERAL EDUCATION: 37 hr	**Hours**	**Concentration**
ART 210 The Arts in Western Civilization	3	
CHR 111 Old Testament Survey	3	
CHR 112 New Testament Survey	3	
UNI 195 Gateway to Christian Learning	2	
COM 112 or 235	3	
Social Science and Humanities (SS&H)	3	
ECO 211 (**rec'd**), ECO 212, HON 210,PHL 240, PSC 211, PSY 213, or SOC 211		
ENG 111 English Composition I	3	
ENG 112 English Composition II	3	
HIS 101 World Civ. to the 18th Century	3	
HIS 102 World Civ. from the 18th Century	3	
Literature:	6	
Typically ENG 201 & 202, but French or Spanish literature may be used		
PEWS 100 Fitness for Health	1	
PEWS Activity Elective	1	

MATH & BASIC SCIENCE: 41 hr		
Biology: BIO 100, 112, 121, or 221	4	
CHE 111 General Chemistry	4	
CHE 113 Survey of Chem. Instrumentation	2	
CSC 255 Programming in C	3	
MAT 208 Statistics	3	ME
MAT 211 Calculus I	4	
MAT 212 Calculus II	4	
MAT 213 Calculus III	4	
MAT 314 Differential Equations	3	
MAT 315 Linear Algebra	3	EE
PHY 231 University Physics I	5	
PHY 232 University Physics II	5	

ENGINEERING: 61 hr		
EGR 101 Intro to Eng. Design & Analysis	2	
EGR 105 Engineering Graphics	3	
EGR 109 Intro to MATLAB & Comp. Prog.	2	
EGR 210 Materials Engineering	3	
EGR 240 Mechanical Eng. Fundamentals I	3	
Mechanics		

ENGINEERING (continued)	**Hours**	**Concentration**
EGR 250 ME Fundamentals II: Thermo-fluid Dynamics I	4	
EGR 261 Electrical Eng. Fundamentals I: Digital Logic	3	
EGR 262 EE Fundamentals II: Electric & Electronic Circuits	4	
EGR 320 Mechanics of Materials	3	ME
EGR 330 Engineering Economy	3	
EGR 342 Eng. Experimental Methods	3	
EGR 352 Mechanical Eng. Laboratory	1	ME
EGR 360 Analysis of Linear and Dynamical Systems	3	
EGR 361 Digital Electronics	4	EE
EGR 375 Power Systems and Electrical Machines	3	
EGR 385 Energy Conversion	3	ME
EGR 395 Special Study in Electrical Eng.	3	EE
EGR 405 Electronic Circuit Analysis and Design	4	EE
EGR 416 Physical Principles of Solid State Devices	3	EE
EGR 450 Thermo-fluid Dynamics II	4	ME
EGR 456 Machine & Mechanism Theory & Design	3	ME
EGR 475 Control Theory & Design	4	
EGR 491 Major Design I	3	
EGR 492 Major Design II	3	
EGR 498 Engineering Seminar	1	
Total Hours	**139**	

Overview by Year

The first ("freshman") year engineering courses introduce students to the engineering profession, problem-solving and design, and basic software tools. The first year also begins to lay the foundation in mathematics, chemistry, and physics on which the remaining engineering courses are built. In addition to the engineering-related courses, it is recommended that every Union University student take Written Composition I (ENG 111) the first semester.

The second ("sophomore") year essentially completes the math and science foundation and builds on top of it the *engineering foundation*: Electrical Engineering Fundamentals I & II (EGR 261, 262), Mechanical Engineering Fundamentals I & II (EGR 240, 250), and Materials Engineering (EGR 210). At the end of the second year, after having been introduced to the fundamentals of electrical and mechanical engineering, the engineering student selects either the Electrical Engineering Concentration or the Mechanical Engineering Concentration (or even both).

In the third ("junior") and fourth ("senior") years, the engineering student takes courses in his or her chosen concentration along with "general" engineering courses. In addition, engineering majors typically take their last mathematics course in the junior year: either Statistics (MAT 208) or Linear Algebra (MAT 315). Statistics is generally recommended for MEC students, and Linear Algebra is generally recommended for EEC students. However, each student, in consultation with his or her academic advisor, will decide which course to take, considering the student's individual circumstances and goals.

The culmination of the program is the year-long capstone design sequence Major Design I & II (EGR 491, 492) taken the last year.

Another Look: The View From Union

Besides the three categories of courses considered by ABET, the engineering curriculum also breaks down into three components characteristic of all Union University degrees (ref. *UU 2011-2012 Undergraduate Academic Catalogue,* pp. 21-24, 67):

General Core:	49 hours
Specific Core:	29 hours
Major courses:	61 hours
Total:	139 hours

The General Core is required for all undergraduate degrees at Union University. It corresponds in large part to ABET's General Education category, and ensures a broad education, consistent across all degrees earned at Union University, regardless of major. It has been rightly observed that the general education component is what makes a person *educated* – not the major. Even more importantly, the Union General Core promotes a Christian worldview and guides students to "exercise the gifts and skills of living in the knowledge of God" (ref. *Catalogue*, p. 22).

The engineering degree specifically requires Calculus I (MAT 211), which satisfies the math requirement of the General Core, and General Chemistry (CHE 111), which satisfies the physical science component ("Group A") of the Laboratory Science section. In addition, it is recommended that engineering majors take Macroeconomics (ECO 211) to satisfy the Social Science and Humanities requirement. The 6-hour literature requirement may be satisfied by French literature (2 of FRE 311, 312, 317) or by Spanish literature (2 of SPA 311, 312, 316, 317), but since few engineering students have the requisite French or Spanish proficiency, most take World Literature (ENG 201, 202).

The *Catalogue* states that the General Core totals 48 hours, but because engineering majors satisfy the 3-hour math requirement with a 4-hour math course (Calculus I), the General Core totals 49 hours for them.

Generally speaking, the Specific Core requirements depend on the specific type of degree sought: Bachelor of Science (BS), Bachelor of Arts (BA), Bachelor of Science in Engineering (BSE), and so on. Engineering majors follow the BSE Specific Core, which, in effect, houses math and science courses which are required for the engineering degree but which are not required by Union's General Core. It corresponds largely to ABET's Math and Basic Science

category.

The major courses are, of course, engineering courses, and a year-by-year overview was given above.

Summary of Course Recommendations

1. Engineering students are required to take either Linear Algebra (MAT 315) or Statistics (MAT 208). Linear Algebra is recommended for EEC students, and Statistics is recommended for MEC students.
2. Macroeconomics (ECO 211) is recommended for engineering majors to satisfy the Social Science and Humanities requirement of the General Core.
3. World Literature I & II (ENG 201, 202) are typically taken by engineering majors to satisfy the Literature requirement of the General Core, but French or Spanish literature may be substituted. There is no recommendation, but the language prerequisites for French or Spanish literature constitute "extra" courses for engineering majors.
4. There is no recommendation for engineering majors regarding the biology requirement of the General Core (Laboratory Science, Group B: BIO 100, 112, 121, 221).
5. There is no recommendation for engineering majors regarding the Oral Communication requirement of the General Core (COM 112, 235).

Minor: Not Required

Unlike most Union University students, engineering students are not required to have a minor, because the engineering major is so large and comprehensive. This is characteristic of and traditional for engineering degrees nationwide. However, a minor is certainly allowed. Several Union Engineering students have chosen to minor in mathematics, because the 18 hours of mathematics required for the engineering degree puts them very close to a math minor. Other minors are possible. Please consult your academic advisor and the *Catalogue* for more information.

Engineering Pre/Corequisites

Because of the logical, sequential structure of modern engineering knowledge and its basis in math and science, the Union Engineering program is correspondingly rigorous and structured. On the next 4 pages are tables which summarize the prerequisite and corequisite courses for engineering courses and for the required math and science courses. The tables are accompanied by clarifying notes, and additional comments follow. If a course is listed in both columns – in the prerequisite column and the corequisite column – it is a "pre- or corequisite."

To reiterate: the Union engineering program is both rigorous and rigorously structured. It has been developed to prepare you to work at the necessary level of engineering excellence.

Definitions

Prerequisite: a course that must be successfully completed before taking the course under consideration

Corequisite: a course that must be taken concurrently with the course under consideration

Pre- or *corequisite:* a course that must be either completed successfully prior to or taken concurrently with the course under consideration

Engineering Course Pre/Corequisites

EGR Course	Prerequisite(s)	Corequisite(s)
101 Intro to Engineering Design and Analysis	None	
105 Engineering Graphics	None	
109 Intro to MATLAB & Computer Programming	None	
210 Materials Engineering	CHE 111, PHY 231	
240 Mechanical Engineering Fundamentals I: Mechanics	MAT 212, PHY 231	
250 ME Fundamentals II: Thermo-fluid Dynamics I	CHE 111, PHY 232, MAT 314	MAT 314
261 Electrical Engineering Fundamentals I: Digital Logic	None	
262 EE Fundamentals II: Electric & Electronic Circuits	MAT 212, PHY 232	
320 Mechanics of Materials	CHE 111, PHY 231, MAT 314	
330 Engineering Economy	None[1,4]	
342 Engineering Experimental Methods	Junior standing	
352 Mechanical Engineering Laboratory	EGR 342	
360 Modeling & Analysis of Linear and Dynamical Systems	EGR 240, EGR 262, MAT 314	

361 Digital Electronics	EGR 261	
375 Power Systems & Electrical Machines	EGR 262	
385 Energy Conversion	EGR 250	
405 Electronic Circuit Analysis & Design	EGR 262	
395 Special Studies in Electrical Engineering	Varies	
416 Physical Principles of Solid State Devices	EGR 210	
450 Thermo-fluid Dynamics II	EGR 250	
456 Machine and Mechanism Theory & Design	EGR 360	
475 Control Theory and Design	EGR 360	
491 Major Project Design I	Senior standing[1,2,4]	
492 Major Project Design II	Senior standing[1,3,4]	
498 Engineering Seminar	Senior standing[4]	

Notes:

[1]Union University requires a student who is more than one class rank below a course's level to obtain instructor permission to take the course (e.g. a freshman needs special permission to take a 300-level course).

[2]It is assumed that the student is in his or her last year of the engineering program.

[3]It is assumed that the student is in his or her last year of the engineering program and has taken EGR 491 the previous term.

[4]An "Add slip" signed by the student's academic advisor is required to register for this course.

Supporting Math and Science Course Pre/Corequisites

Course	Prerequisite(s)	Corequisite(s)
CHE 111 General Chemistry	None	
CHE 113 Survey of Chemical Instrumentation	CHE 111	
CSC 255 Programming in C	EGR 109	
MAT 211 Calculus & Analytic Geometry I	Pass Calculus Readiness Test or MAT 116[1] or AP credit[2]	
MAT 212 Calculus & Analytic Geometry II	MAT 211 or AP credit[2,3]	
MAT 213 Calculus & Analytic Geometry III	MAT 212 or AP credit[3]	
MAT 314 Differential Equations	MAT 213	

MAT 208 Statistics	MAT 201 or 211	
MAT 315 Linear Algebra	MAT 212	
PHY 231 University Physics I with Calculus	MAT 211	
PHY 232 University Physics II with Calculus	PHY 231, MAT 212	MAT 212

Notes:

[1]If credit for "Precalculus" is transferred, it must transfer as MAT 116 (not every course with "precalculus" in its title is equivalent).

[2]A score of 3 or higher on the Advance Placement Calculus AB exam will earn credit for MAT 211. Alternatively, it can function as the prerequisite for MAT 211. It is recommended that students who receive a score of 3 take MAT 211.

[3]A score of 3 or higher on the Advance Placement Calculus BC exam will earn credit for MAT 211 and MAT 212. Alternatively, it can function as the prerequisite for MAT 212. It is recommended that students who receive a score of 3 take MAT 212.

Perhaps the most important conclusion to draw from this is that, in order to graduate in four years, it is very important to take Calculus I (MAT 211) the first semester. In order to stay on the four-year plan, it is necessary to have completed Physics I (PHY 231) and Calculus II (MAT 212) before the fall of the sophomore year. However, it is very difficult if not impossible to do this if Calculus I is not taken the first semester of the freshman year. For freshmen who are not able to take Calculus I their first semester but instead take Precalculus (MAT 116), the most straightforward plan, and the one most likely to lead to student success, is a five-year plan, an example of which is included in Appendix C. For students in this situation, be encouraged and consider that it is better to finish and to finish well, even if it takes five years, than not to finish or to finish poorly.

For transfer students, the pre/corequisite structure implies that the program will require at least three years to complete, even for those transfer students who have completed all general education and math and science requirements.

Final Words on the Curriculum

The engineering major is a very challenging major. The engineering courses are numerous and challenging, as are the math and science prerequisites, and the major is rigorously structured.

Unfortunately, the curriculum lacks flexibility and electives. However, this is not unusual for engineering programs.

With 61 hours in the major and 139 hours in the degree, engineering is one of the “largest” majors on the Union University campus.

Finally, as a Union Engineering major, you will think hard and work hard. We think you will be pleased with the results.

Facilities

The Union University Engineering facilities are in the Penick Academic Complex (PAC).

Engineering faculty offices are in the Kyle L. Hathcox Physics and Engineering Suite, rooms B-1 through B-7. The Engineering Conference Room, which is available for faculty reservation, is B-38.

The Thermodynamics, Fluid Dynamics, Mechanics of Materials, and Control Engineering Laboratory is B-36. The Electrical and Electronics Engineering Laboratory is B-35. These labs are open to students only during lab sessions.

The Computing and Graphics Laboratory, the "engineering computer lab," is B-34. Each engineering student will have access via a 6-digit PIN to be assigned by the engineering department. Engineering students have access to this lab at all times except during times classes are held there. Food and drink are not allowed in the computer lab, and students are expected to behave in a manner conducive to productive study; that is, quietly and respectfully. The policy for use of the engineering computer lab is in Appendix D.

The Engineering Workshop is B-31. Only senior engineering students have regular access to the Workshop. Other engineering students may obtain access upon special request. The policies for use of the engineering workshop are in Appendix E.

In addition, B-40 is an Electronic Workshop, a workspace currently dedicated to robot projects.

"The Pit" is the engineering student study area in B-39, with access through B-37 via the same 6-digit PIN assigned for computer lab access. Engineering upperclassmen may have assigned study carrels. Engineering lowerclassmen may use the remaining space and carrels on a first-come-first-serve basis and may not leave books or other materials when they are not present. While students are welcome to eat and socialize quietly in the Pit, it is first and foremost a study area. If students are loud or rambunctious or otherwise misuse the Pit, access will be revoked.

It is expected that students will do their part to help maintain the facilities, to leave them in the same or better condition than they were found. Obviously, destruction of facilities or equipment is not acceptable. If damage occurs, those responsible will be held liable.

Some physics students also have assigned carrels in the Pit. These students also have access to the engineering computer lab.

Professional Licensure and the Fundamentals of Engineering Exam

The Union Engineering program strongly supports licensure as a professional engineer. One of the most significant ways we do this is requiring every Union Engineering student to take the Fundamentals of Engineering Exam (FE Exam), one of the first steps toward licensure. While graduation is not contingent on passing the FE, students are expected to do their best.

We are pleased that the class of 2011 had a pass rate on the FE of 100%. Moreover, the cumulative pass rate for Union Engineering graduates for the past four years is 90%, well above the national average of 74%.

Engineering Internships and Co-ops

The Department of Engineering encourages its students to participate in an engineering internship or co-op at least once during their careers at Union University. Both are excellent ways to gain professional experience and exposure (and money). See your academic advisor for details.

Engineering Student Advisory Council (ESAC)

Engineering students are the most important program constituency, and we desire and encourage your feedback. The Engineering Student Advisory Committee (ESAC) is one such venue to make positive changes in the department. This Committee informs the department of student concerns related to specific courses, the overall curriculum, and other academic matters. The Bylaws of ESAC provide a framework for this Committee and is included in Appendix F for more information. The Chair of the Engineering Department will serve as the faculty liaison for this Committee. Your active participation is highly encouraged.

Engineering Activities

Student Activities Council

A group of Union Engineering students forms the Student Activities Council to plan events ranging from back-to-school parties to tours of local engineering companies. Watch for news of specific plans as the semester unfolds!

Members of the Council are elected each year by their peers. If you are interested in serving, let Dr. Van know so you can be placed on the ballot.

IEEE

You might be wondering what IEEE stands for, and the answer is … nothing! When IEEE was founded, the letters were an acronym for Institute of Electrical and Electronics Engineers, but the organization has grown to include such a wide variety of technical fields that the name is now simply IEEE. IEEE has over 375,000 members, including over 80,000 student members. It provides a vast array of services to its members and to the technical community at large.

On Union's campus, three engineering professors, two computer science professors, and one physics professor are IEEE members. Union engineering students are working toward starting a student IEEE chapter. If you are interested in joining, see Dr. Jeannette Russ, the faculty advisor for the group. Benefits of membership include:

- Ability to participate in IEEE student contests, including the popular annual robotics competition.
- A subscription to IEEE's monthly magazine, IEEE Spectrum – an excellent source of information about current technological developments in an easy-to-ready format that is not only informative, but might also help you determine which areas of engineering interest you the most.
- Access to IEEE resources on the website (www.ieee.org).

Canstruction

Since 2006, engineering students have participated in the local

"canstruction" project with students from the art and social work departments. Canstruction is a fun and worthwhile program that involves building elaborate structures from canned foods, which are then donated to a local food bank. For more information, see Dr. Jeannette Russ or your advisor.

Mission Trips

Union engineering students have travelled to a Muslim-dominated country on four different occasions to investigate possible engineering solutions for specific concerns, to dialog with engineering students and professors in the country, and to assist local missionaries. The department is committed to providing students with opportunities to use their engineering skills locally and abroad, so that we can be "on mission" to a world that desperately needs to hear the gospel message – through actions and words. For more information, see Dr. Randy Schwindt or your advisor.

Academic Advising

Union Engineering majors are assigned an academic advisor from the Engineering Department faculty. Your academic advisor is a resource for you and is on your side. Your advisor's job is to help you succeed in the Union Engineering program and in your engineering career. More importantly, your advisor will support you as you find the academic and career path that the Lord has for you.

The most basic function of the academic advisor is to advise the student (the "advisee") on which courses to take. Each advisee will meet with his or her advisor at least one time each semester to do this, typically during Priority Registration. At that time the advisor will either register the advisee for the next semester's courses or authorize the advisee to register him or herself.

Your advisor will monitor and track your academic progress to make sure your progress toward the BSE is as smooth, effective, and efficient as possible. He or she accomplishes this in part via keeping an updated "curriculum-tracking" spreadsheet for each advisee. An example of a blank spreadsheet is in Appendix G. In addition, the advisee is expected to take an active role in planning his or her schedule and college career. The document in Appendix F may be used for this.

It should be emphasized that the academic advisor is an *advisor*. That is, you, as the advisee, are not obligated to follow your advisor's recommendations. However, your advisor is an expert and your advocate, and you are strongly encouraged to follow his or her recommendations. Not following your advisor's recommendations typically results in unnecessary problems.

Your advisor can help diagnose academic difficulties and/or refer to the appropriate resource. Similarly, while your advisor is not an expert counselor in nonacademic areas, he or she can refer you to the appropriate resource with complete confidentiality.

The role of the advisor also includes career guidance and mentoring. Furthermore, your academic advisor should be the first person you turn to for a reference or a letter of recommendation for internships,

co-ops, scholarships, graduate school, and full-time employment. That said, your advisor is not obligated to write a positive recommendation. You must do your part to cultivate a positive relationship with your advisor and to do work worthy of recommendation.

If it becomes necessary to change academic advisors, see the chair of the Engineering Department, and he will arrange it. A change in advisor would be called for if the advisor can no longer function effectively as the advisee's mentor and advocate. A change in advisor is not necessary if, for example, an EEC student's advisor is a mechanical engineer or if an MEC student's advisor is an electrical engineer. In fact, this situation is common and should not be cause for concern.

Grades

We assume you have a basic understanding of letter grades (A, B, C, D, F) and grade point average (GPA). This section will simply clarify certain points.

Union letter grades do not include pluses or minuses.

If a grade of F is earned in a course, no credit for the course earned, though the GPA is affected (negatively, of course). If the failed course is a prerequisite for another course, the failed course must be repeated and passed before the prerequisite is satisfied and the subsequent course can be taken.

A grade of D is officially passing, and credit is earned. However, especially in foundational, prerequisite courses for the engineering major – such as mathematics, physics, and chemistry—a D is very alarming, because it does not indicate the mastery of the material necessary for successful use of it in the future. It is recommended that the student repeat any foundational math or science course in which a D is earned. Repeating such a course will also significantly improve the student's GPA.

Moreover, even a grade of C in a foundational math or science course should cause concern. It has been shown, for instance, that if a grade of C or lower is earned in a course in the calculus sequence, the most likely grade in the next course in the sequence is one letter grade lower. For example, if a C is earned in Calculus I, the most likely grade in Calculus II is a D, and the most likely grade in Calculus III is, in turn, an F. It is not necessarily recommended that the student repeat a course in which a C is earned, but he or she should not rest easy.

To transfer course credit to Union from another institution, a minimum grade of C must have been earned at the other institution. Credit will not transfer for a course in which a D was earned.

A C is the minimum passing grade for upper-level (300- and 400-level) courses in one's major.

Grade Point Average (GPA)

A student's Union University grade point average (GPA) is calculated according to the following basic formula:

GPA = (Total Grade Points Earned) ÷ (Total Credit Hours Attempted)

This formula is straightforward for the most part, but some of the rules regarding its calculation are not obvious. A few non-obvious rules:

- If a course is repeated, the new grade replaces the old grade in the GPA calculation. However, both grades will appear on the transcript. By the way, this is not a universal rule for colleges and universities; many institutions do not replace the old grade but simply add in the new grade when calculating GPA.
- If a student transfers credit from another institution to Union, the grades are not included in the Union GPA calculation; that is, "grades do not transfer."

See Appendix H for a primer on Union University GPA calculation.

In order to graduate from Union University, the student must have a minimum cumulative GPA of 2.000, a minimum GPA of 2.000 in each major, and a minimum GPA of 2.000 in each minor.

Academic Probation

If a student's GPA falls below 2.0, the student is placed on academic probation. This is a serious situation with serious consequences. See the *Catalogue*, p. 20 ("Scholastic Regulations") for details.

Tips for Success

1. Don't expect college to be easy. It won't be – and shouldn't be – especially in engineering.
2. Be curious. Find something interesting, fun, and/or relevant to you in every course.
3. Be efficient and disciplined in your use of time.
4. Work hard.
5. Get an engineering internship or co-op.
6. Learn how to learn. Your instructors will do their best to teach, but class time alone is insufficient to attain proficiency.
7. Attend every class period.
8. Participate in class.
9. Take notes in class.
10. Learn from reading your textbooks.
11. Learn from your fellow students.
12. Figure out how, when, and where you learn best and arrange your study around that as much as possible.
13. Keep up. This includes all reading, homework, and projects. Learning and good grades don't come from cramming and feverish last-minute efforts.
14. Don't be too proud to get the help you need.
15. Use the Hundley Center.
16. Cultivate a positive relationship with your professors and your academic advisor, and avail yourself of their experience and expertise.
17. Be wary of working a lot of hours at a part-time job, unless your financial situation absolutely requires it. Don't trade a successful engineering career later for a little extra money now.
18. Don't neglect your body. Exercise, eat well, and get enough sleep.
19. Participate actively in a local church.
20. Take pride in your accomplishments with the knowledge that it is the LORD "who gives you power to get wealth [i.e. to do anything productive], that he may confirm his covenant" (Deut. 8:18).
21. Esteem the gifts, accomplishments, and callings of others.
22. Have friends.

23. Have fun.
24. Make the most of this opportunity.
25. Honor God.

Homework Advice

1. Start early. Give yourself plenty of time.
2. Before starting homework problems, read the text and your class notes. Then tackle the homework, looking back at the text or your notes only when you must.
3. Be prepared to make multiple attempts and/or use multiple pages on a problem.
4. When you get stuck, take a break, take a walk, move on to another problem, or do something else, and then resume your attack.
5. Be aware that there's a right way to get help from textbook answers and friends, and there's a wrong way.

Last Things

Monthly Engineering Seminars

The Engineering Department sponsors monthly seminars that address technical and professional issues in engineering. These are for your benefit, and your attendance is expected (and some professors may grant extra credit for attendance!).

Other Opportunities for Credit

Besides the Winter-term courses shown in the curriculum map on pages 8 and 9, Union Winter and Summer terms provide opportunities for additional credit that have proven beneficial to some students. Other opportunities include credit by testing (*Catalogue* pp. 32-34) and summer courses in the student's hometown. Work with your academic advisor to understand your needs and options.

Classification

Union University uses the following definitions to determine a student's official classification:

- FRESHMEN: the first semester enrolled post high school graduation (and taking at least 12 credit hours)
- SOPHOMORES: 24 – 55 earned hours
- JUNIORS: 56 – 85 earned hours
- SENIORS: 86 earned hours and above

These classifications are used, for instance, in determining when a student can register during Priority Registration. However, in the engineering program, a student's classification is often (unofficially) referred to by his or her state of progress in the engineering program per the four-year curriculum map. A student taking first-year science, math, and engineering courses is a "freshman," a student taking second-year courses is a "sophomore," and so on. This is a useful shorthand, and it agrees with most students' official classification, but it can be confusing in some cases, such as that of transfer students.

Junior Degree Audit

At least one degree audit is required before graduation. The audit is performed by the Office of the Registrar and is typically done during the junior year (the Registrar recommends the audit when 64 credit hours have been completed). The audit officially documents the courses remaining before graduation. Both the student and the advisor receive a copy of the audit. Surprises have been few for Union Engineering students, but they are always unwelcome. The "junior degree audit" is late enough to provide a clear picture and early enough to make necessary adjustments. Each student must contact the Office of the Registrar to schedule ("apply for") an audit; academic advisors will remind their advisees to do this.

Graduation Requirements

Main items and issues for graduation follow. For complete details, such as credit hour and residency requirements, see *Catalogue* p. 21.

1. Schedule and keep a graduation (aka degree) audit, preferably in the junior year (see "Junior Degree Audit" above)
2. File an application for graduation
3. Clear all accounts and conditions with school offices
4. Minimum cumulative GPA: 2.000
5. Minimum GPA in each major: 2.000
6. Minimum GPA in each minor: 2.000

Appendix A: Student Outcomes

Union University Engineering Student Outcomes

From ABET's website (www.abet.org):

Engineering programs must demonstrate that their students attain the following outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering.
b. an ability to design and conduct experiments, as well as an ability 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 multidisciplinary 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 for engineering practice.

The following two additional Outcomes are distinctive of the Union Engineering program.

l. a recognition of the importance of professional education and licensing.
m. an awareness of the importance of integration of faith and learning.

Appendix B: Typical BSE Curriculum Map

Freshman	***Fall***	Credits	***Winter***	Credit	***Spring***	Credits
	EGR 101 Intro. Eng. Design & Analysis	2			EGR 105 Engineering Graphics	3
	CHE 111 General Chemistry	4			EGR 109 Intro to MATLAB/Programming	2
	MAT 211 Calculus I	4			PHY 231 Physics I	5
	ENG 111	3			MAT 212 Calculus II	4
	UNI 195	2			ENG 112	3
	PEWS 100	1				
		16				17
Sophomore	EGR 240 Mechanical Engineering Fundamentals I: Mechanics	3	CHE 113 Chemical Instrumentation (Even Years)	2	EGR 210 Materials Engineering	3
	EGR 261 Electrical Engineering Fundamentals I: Digital Logic	3	HIS 101 (Odd Years)	3	EGR 250 ME Fund II: Thermo-fluid Dynamics I	4
	PHY 232 Physics II	5			EGR 262 EE Fund II: Electric & Electronic Circuits	4
	MAT 213 Calculus III	4			MAT 314 Differential Equations	3
	PEWS activity elective	1			HIS 101 (Even Years)	3
					CHE 113 Chemical Instrumentation (Odd Years)	2
		16		2-3		16-17

Junior	EGR 330 Engineering Economy	3	CHR 111 (MEC)	3	EGR 375 Power Systems and Electrical Machines	3
	EGR 342 Engineering Experimental Methods	3	CHR 112 (EEC)	3	EGR 352 Mechanical Engineering Laboratory (MEC)	1
	EGR 360 Analysis of Linear & Dynamical Systems	3	ENG 201	3	EGR 385 Energy Conversion (MEC)	3
	EGR 320 Mechanics of Materials (MEC)	3			EGR 405 Electronics (EEC)	4
	EGR 361 Digital Electronics (EEC)	4			CSC 255 Programming in C	3
	MAT 208 Statistics (MEC)	3			MAT 315 Linear Algebra (EEC)	3
	CHR 111 (EEC)	3			CHR 112 (MEC)	3
					HIS 102	3
		16, 15		6		16
Senior	EGR 475 Control Theory & Design	4			EGR 492 Major Design II	3
	EGR 491 Major Design I	3			EGR 498 Eng. Seminar	1
	EGR 395 Spc. Study EE (EEC)	3			EGR 416 Solid State (EEC)	3
	EGR 450 Thermo-fluid Dynamics II (MEC)	4			EGR 456 Machines & Mechanisms (MEC)	3
	COM 112 or 235	3			ART 210	3
	ENG 202	3			Biology	4
					SS&H	3
		16, 17				17

Total Hours: 139

Electrical Engineering Concentration Courses:
EGR 361 Digital Electronics (4)
EGR 395 Special Study in Electrical Engineering (3)
EGR 405 Electronic Circuit Analysis and Design (4)
EGR 416 Physical Principles of Solid State Devices (3)

Mechanical Engineering Concentration Courses:
EGR 320 Mechanics of Materials (3)
EGR 385 Energy Conversion (3)
EGR 352 Mechanical Engineering Laboratory (1)
EGR 450 Thermo- fluid Dynamics II (4)
EGR 456 Machine & Mechanism Theory & Design (3)

Appendix C: Typical Five-Year BSE Map

1st Year	Fall		Winter	Credit	Spring	Credits
	EGR 101 Intro. Eng. Design & Analysis	2			EGR 105 Engineering Graphics	3
	CHE 111 General Chemistry	4			MAT 211 Calculus I	4
	MAT 116 Precalculus	4			Biology	4
	ENG 111	3			ENG 112	3
	UNI 195	2			COM 112 or 235	3
		15				17
2nd Year	PHY 213 Intro Physics I*	4			EGR 109 Intro to MATLAB/Programming	2
	MAT 212 Calculus II	4			PHY 231 Physics I	5
	HIS 101	3			MAT 213 Calculus III	4
	CHR 111	3			CHR 112	3
	PE elective	1			PE elective	1
		15				15
3rd Year	EGR 240 Mechanical Engineering Fundamentals I: Mechanics	3	CHE 113 Chemical Instrumentation (Even Years)	2	EGR 210 Materials Engineering	3
	EGR 261 Electrical Engineering Fundamentals I: Digital Logic	3			EGR 250 ME Fund II: Thermo-fluid Dynamics I	4
	PHY 232 Physics II	5			EGR 262 EE Fund II: Electric & Electronic Circuits	4
	SS&H	3			MAT 314 Differential Equations	3
		14		0-2	CHE 113 Chemical Instrumentation (Odd Years)	2
						14-16

4th Year	EGR 330 Engineering Economy EGR 342 Engineering Experimental Methods EGR 360 Analysis of Linear & Dynamical Systems EGR 320 Mechanics of Materials (MEC) EGR 361 Digital Electronics (EEC) MAT 208 Statistics (MEC)	3 3 3 3 4 3 13, 15			EGR 375 Power Systems and Electrical Machines EGR 352 Mechanical Engineering Laboratory (MEC) EGR 385 Energy Conversion (MEC) EGR 405 Electronics (EEC) CSC 255 Programming in C MAT 315 Linear Algebra (EEC) ART 210	3 1 3 4 3 3 3 16, 13
5th Year	EGR 475 Control Theory & Design EGR 491 Major Design I EGR 395 Spc. Study EE EGR 450 Thermo-fluid Dynamics II (MEC) Literature	4 3 3 4 3 13, 14			EGR 492 Major Design II EGR 498 Eng. Seminar EGR 416 Solid State (EEC) EGR 456 Machines & Mechanisms (MEC) HIS 102 Literature	3 1 3 3 3 3 13

Total Hours: 147

Electrical Engineering Concentration Courses:
EGR 361 Digital Electronics (4)
EGR 395 Special Study in Electrical Engineering (3)
EGR 405 Electronic Circuit Analysis and Design (4)
EGR 416 Physical Principles of Solid State Devices (3)

Mechanical Engineering Concentration Courses:
EGR 320 Mechanics of Materials (3)
EGR 385 Energy Conversion (3)
EGR 352 Mechanical Engineering Laboratory (1)
EGR 450 Thermo- fluid Dynamics II (4)
EGR 456 Machine & Mechanism Theory & Design (3)

Note

*Intro to Physics I (PHY 213) is added here on the assumption that the student needs more background in physics before taking Physics I (PHY 231, whose official title is “University Physics I with Calculus”). PHY 213, a non-calculus-based physics course, is nevertheless a challenging course, sufficient for premed and other preprofessional students.

PHY 213 and Precalculus (MAT 116) are the only courses added to the standard engineering program in this five-year plan. This results in relatively light courseloads most semesters. Interested students could add electives or even a minor.

Appendix D: Computer Lab Usage Policy

Adopted 6/8/09

I. General Usage
   A. The engineering computer lab is available for use by engineering students, students currently enrolled in at least one course with an EGR prefix, and physics students who have access to the Pit.
   B. Eligible students will be provided with a key-pad entry code during the first week of each semester.

II. Special Usage
   A. During the regular fall and spring semesters, use of the lab is restricted to students described in I.A., but exceptions may occasionally be made for individual non-engineering students who need to use software unique to the engineering computer lab.
      i. A request for an exception must be made in writing and must be submitted to the department chair, an engineering professor, or the departmental administrative assistant.
      ii. Requests should include the specific software needed and the expected time frame of the need.
      iii. Requests will be considered on a case-by-case basis and will be granted or denied at the discretion of the department chair or the chair's designated proxy.
      iv. No exceptions will be made for lab use by non-engineering students during the fall and spring semesters for software that is available elsewhere on campus.
   B. At all times other than the regular fall and spring semesters, the engineering computer lab may be available for use on a limited basis by non-engineering students.

i. All requests for access during the off-terms should follow the procedure outlined in section II.A.
ii. Permission is most likely to be granted for the use of software unique to the computer lab, but it may occasionally be granted for use of non-unique software during the off-terms if a compelling need is presented.

III. Lab Rules
A. Food and drink are prohibited in the engineering computer lab.
B. The engineering computer lab is a study area, and students are expected to behave accordingly.

Appendix E: Engineering Workshop Policies

Students must have permission of the faculty to use the workshop for personal or course related work.
Each student who receives permission will be able to use the code on the workshop lock.

Students must wear safety glasses at all times while in the workshop. Students are welcome to bring their own safety glasses.

Power tools will only be used when at least two people are in the workshop. This is so that there is someone who can call for help if the other is injured and unable to get help.

Students are responsible for learning how to use tools properly. If in doubt, ask the Department for help.

Students are responsible for maintaining a clean and safe working environment in the workshop.

Request permission to use the Engineering Workshop

I am requesting permission and access code to use the engineering workshop for the following purposes:

_____
_____
_____
_____

I will observe the engineering workshop policies as mentioned above.

Student: _____
Date: _____

Project advising faculty:

_____
Date: _____

Appendix F: Engineering Student Advisory Committee (ESAC) Bylaws

1. Purpose of the Committee:
   The purpose of the Engineering Advisory Committee is to suggest academic improvements for the engineering program to the engineering faculty on behalf of the students.
2. Membership:
   A. Members consist of the following:
      1. President
      2. Senior Representative (s)
      3. Junior Representative (s)
      4. Sophomore Representative (s)
      5. Freshman Representative (s)

      There is a 1:15 representative to student ratio per class.
   B. Nature of Selection:
      1. President
         President must be an engineering junior or senior. Any junior or senior who wishes to be president must nominate themselves before the faculty. Faculty will review and vote among themselves. In the case of a tie or no decision, a seminar will be included for the engineering students to vote. April 15th is the last day for all nominations.
      2. Representatives
         Representatives shall be elected by their fellow students of their class determination. In the case of a tie or no decision, the faculty decides with veto power.
   C. Voting Rights of Committee Members:
      Each committee member has an equal vote.
   D. Term of Office:
      The term of office begins in the fall and ends in the spring for one full year. Representatives follow same rule in running for position as does the president as stated in 2B.1. In the case of a committee member leaving the university during the second semester, a fill-in will be named by the

Engineering Student Advisory Committee President.

E. Attendance:

Meetings will be prioritized into two categories as stated by the president.

Priority 1 – A mandatory meeting for all representatives or there will be a cancellation of the meeting. After second attempted meeting, the representative's class has no say and will be left blank on the report.

Priority 2 – This meeting is mandatory of the president and at least 60% present including the president. All those who are not present, forfeit rights of opinion and their vote for their class in the matter.

3. Meeting:

A. Frequency:
There will be at least one Priority 1 meeting per semester. The president may schedule more meetings as needed.

B. Meeting Schedule:
It is the president's duty to arrange date and location of meetings that will best suit the representatives.

C. Agenda:
The agenda will be planned by the President.

D. Special Meetings:
Any representative may request a meeting through the President.

E. Governance to Conduct Meetings:
President will conduct meetings unless previously agreed upon by committee members prior to the meeting.

F. Minutes:
Scribe will elected by the committee members for a semester. The same scribe may run again for the position after the semester. The scribe takes minutes during each meeting. If the scribe does not arrive for a meeting, a temporary scribe for the meeting will be assigned by the President.

G. Drafting of Reports:
This is the Vice Presidents duty. The Vice President is

voted within the committee in first meeting of the school year. The Vice President's term will last for the Fall and Spring semester consecutively.

H. Quorum:
The Quorum is the numerical majority of the Priority 1 or Priority 2 meetings.

I. Voting:
The voting will be by voice or hand gesture. A secret ballot may be arranged if previously approved by the committee.

J. Invited Guests:
All invited guests may attend if agreed upon by the committee prior to the start of the meeting.

K. End of the Semester Report:
The report is developed in the last meeting of Fall and Spring semester. The report will contain the recommendations from the committee as a whole presented to the engineering faculty.

4. Officers:
   A. President of the Committee:
   The president is responsible for the agenda of the meetings, contacting the members of committee prior to the meetings, and communicating with the engineering faculty concerning the committee.
   B. Vice President:
   The Vice President will write and prepare official reports inside and outside of meetings as needed.
   C. Scribe:
   A scribe is needed for every meeting and will take the minutes from each meeting.
5. Subcommittees:
   Subcommittees may be assembled by the committee for a specific issue at any time.
6. Ratification of Bylaws and/or Amendments:
   When a new bylaw or amendment is introduced it can be passed with 2/3 membership votes. Any member of the board may create a new bylaw or amendment. The board member must present the bylaw or amendment to the chair so that it can be put on the agenda during a meeting.

Appendix G: Curriculum Tracking Spreadsheet

Advising Schedule (Undeclared Concentration)							
Student Name							
		Hours	Semester recommended	Semester taken	Level of Course	Grade	Notes
CHE 111	General Chemistry	4	**1a**		LL		
EGR 101	Introduction to Engineering Design and Analysis	2	1a		LL		
ENG 111	English Composition I	3	1a		LL		
MAT 211	Calculus I	4	1a		LL		
PEWS 100	Fitness for Health	1	1a		LL		
UNI 195	Gateway	2	1a		LL		
EGR 105	Engineering Graphics	3	**1c**		LL		
EGR 109	Intro to Matlab & Computer Programming	2	1c		LL		
ENG 112	English Composition II	3	1c		LL		
MAT 212	Calculus II	4	1c		LL		
PHY 231	General Physics I	5	1c		LL		
EGR 240	Mechanical Engineering Fundamentals I: Mechani	3	**2a**		LL		
EGR 261	Electrical Engineering Fundamentals I: Digital Lo	3	2a		LL		
MAT 213	Calculus III	4	2a		LL		
PEWS	Elective	1	2a		LL		
PHY 232	General Physics II	5	2a		LL		
CHE 113	Survey of Chemical Instrumentation	2	**2b**		LL		
EGR 210	Materials Engineering	3	**2c**		LL		
EGR 250	ME Fundamentals II: Thermo-fluid Dynamics I	4	2c		LL		
EGR 262	EE Fundamentals II: Electric & Electronic Circuit	4	2c		LL		
HIS 101	World Civilization to the 18th Century	3	2c		LL		
MAT 314	Differential Equations	3	2c		UL		
CHR 111	Old Testament Survey	3	**3a**		LL		EEC
EGR 320	Mechanics of Materials	3	3a		UL		MEC
EGR 330	Engineering Economy	3	3a		UL		
EGR 342	Engineering Experimental Methods	3	3a		UL		
EGR 360	Analysis of Linear & Dynamical Systems	3	3a		UL		

EGR 361	Digital Electronics	4	3a		UL		EEC
MAT 208	Statistics	3	3a		LL		MEC
CHR 111	Old Testament Survey	3	**3b**		LL		MEC
CHR 112	New Testament Survey	3	3b		LL		EEC
Literature**		3	3b		LL/UL		ENG 201 typically
CHR 112	New Testament Survey	3	**3c**		LL		MEC
CSC 255	Programming in C	3	3c		LL		
EGR 352	Mechanical Engineering Laboratory	1	3c		UL		MEC
EGR 375	Power Systems and Electrical Machines	3	3c		UL		
EGR 385	Energy Conversion	3	3c		UL		MEC
EGR 405	Electronic Circuit Analysis and Design	4	3c		UL		EEC
HIS 102	World Civilization from the 18th Century	3	3c		LL		
MAT 315	Linear Algebra	3	3c		UL		EEC
COM	112 or 235	3	**4a**		LL		
EGR 395	Special Study in Electrical Engineering	3	4a		UL		EEC
EGR 450	Thermo-fluid Dynamics II	4	4a		UL		MEC
EGR 475	Control Theory & Design	4	4a		UL		
EGR 491	Major Design I	3	4a		UL		
Literature**		3	4a		LL/UL		ENG 202 typically
ART 210	The Arts in Western Civilization	3	**4c**		LL		
Biology***		4	4c		LL		
EGR 416	Physical Principles of Solid State Devices	3	4c		UL		EEC
EGR 456	Machine & Mechanism Theory and Design	3	4c		UL		MEC
EGR 492	Major Design II	3	4c		UL		
EGR 498	Engineering Seminar	1	4c		UL		
SS&H*		3	4c		LL		
	Total Hours EEC	139					
	Total Hours MEC	139					

Appendix H: Union University GPA Calculation

A student's Union University grade point average (GPA) is calculated according to the following basic formula:

GPA = (Total Grade Points Earned) ÷ (Total Credit Hours Attempted)

"Total Grade Points Earned" and "Total Credit Hours Attempted" are self-explanatory, but there are rules and situations that complicate their calculation.

First, the grade points earned for an individual course are calculated as:

Course Grade Points = (Course Credit Hours) × (Grade Points)

where "Grade points" = 4 for a course grade of A
3 for a course grade of B
2 for a course grade of C
1 for a course grade of D
0 for a course grade of F

Example 1: Calculate the Course Grade Points for a student earning a B in MAT 211

MAT 211: 4 credit-hour course
B → 3 grade points

Course Grade Points = 4 × 3 = 12

"Total Grade Points" is the sum of grade points for all courses.

Example 2: Calculate the GPA for a freshmen engineering major at the end of her first semester. Her grades are:

EGR 101: A; 2 credit-hour course
CHE 111: B; 4 credit-hour course
MAT 211: A; 4 credit-hour course
ENG 111: D; 3 credit-hour course
PEWS 100: A; 1 credit-hour course

UNI 195 (“Gateway”): A; 2 credit-hour course

$$\text{GPA} = \frac{(2\cdot 4)+(4\cdot 3)+(4\cdot 4)+(3\cdot 1)+(1\cdot 4)+(2\cdot 4)}{2+4+4+3+1+2} = \frac{51}{16} = 3.188$$

Example 3: The student from Example 2 decides to retake ENG 111 in the winter term at Union, and she earns a B. What is her GPA going into the spring semester? We encounter a wrinkle:

*When a course is retaken at Union, the previous grade is **replaced** in the GPA calculation.*

$$\text{GPA} = \frac{(2\cdot 4)+(4\cdot 3)+(4\cdot 4)+(3\cdot 3)+(1\cdot 4)+(2\cdot 4)}{2+4+4+3+1+2} = \frac{57}{16} = 3.563$$

More rules regarding calculating Union University GPA:

1. If a course is taken “Pass/Fail”, and a grade of P (pass) is earned, credit is earned, but the course is completely excluded from the GPA calculation: no grade points and no contribution to “hours attempted.”
2. While an F contributes zero grade points, the hours attempted are included in “Total Credit Hours Attempted.” An F in a Pass/Fail course counts like an F in a graded course – bringing the GPA down.
3. Course credit transferred from other institutions does not contribute to the Union University GPA.
    - A grade of at least a C is required for credit to transfer to Union.
4. If a course is retaken at another institution and credit is transferred to Union, the previous Union grade is removed from the Union GPA calculation. It is as though the course were taken Pass/Fail and passed.
    - However, the course must be *identical*: the same course with at least as many credit hours as the Union course.

5. If a CLEP test is taken and passed after having taken the corresponding Union course, GPA is calculated like the course were retaken at another institution and the credit transferred: the Union grade is removed from the GPA calculation.
6. All grades remain on the student's transcript, even for retaken courses.

Note: Other institutions and organizations may calculate GPA differently, say, by including all grades, even for retaken courses. For instance, the HOPE Scholarship has GPA requirements, and its calculation of GPA allows only one grade to be replaced -- and the student must request the replacement. Other than the single allowed grade replacement, the "HOPE Scholarship GPA" includes all grades from all institutions (not just from Union).

Example 4: A non-engineering student has a little too much fun his first semester. His grades are as follows:

ENG 111: C; 3 credit-hour course
CHR 111: D; 3 credit-hour course
HIS 101: D; 3 credit-hour course
MAT 111: F; 3 credit-hour course
PEWS 100: A; 1 credit-hour course
UNI 195 ("Gateway"): F; 2 credit-hour course

How many credits were *earned*?
10 hours, because credit was earned only for courses with a grade of D or higher. This is the number of hours that the transcript will show as having been earned.

How many credits were *attempted*?
15 hours. Even though UNI 195 was failed, all 15 hours are used in the GPA calculation.

$$\text{GPA} = \frac{(3\cdot 2)+(3\cdot 1)+(3\cdot 1)+(3\cdot 0)+(1\cdot 4)+(2\cdot 0)}{15} = \frac{16}{15} = 1.067$$

By the way, this student is now on academic probation.

If the student transfers to another institution, how many credits will transfer, assuming the other institution has the same criterion as Union (which is typical)?
Only 4 hours will transfer: for ENG 111 and PEWS 100.

Example 5: The student from the previous example gets serious over Christmas break. In the spring he takes and passes the College Algebra CLEP test, retakes CHR 111 and HIS 101. He also takes ENG 112, CHR 112, and PEWS 107. His grades for the spring classes are:

ENG 112: B; 3 credit-hour course
CHR 111: B; 3 credit-hour course
CHR 112: B; 3 credit-hour course
HIS 101: B; 3 credit-hour course
PEWS 107: A; 1 credit-hour course

What does his Union GPA become?

Passing the CLEP test removes the MAT 111 grade from the GPA calculation. His transcript will show that he has *earned* a total of 20 hours. Of these, 17 will be used in the GPA calculation. Due to the F in UNI 195, he has *"attempted"* 19 credit hours.

$$\text{GPA} = \frac{(3\cdot 2)+(3\cdot 3)+(3\cdot 3)+(1\cdot 4)+(2\cdot 0)+(3\cdot 3)+(3\cdot 3)+(1\cdot 4)}{19}$$

$$\text{GPA} = \frac{50}{19} = 2.632$$

This student is no longer on academic probation. Good work!

Two Final Observations:

1. *Typically*, retaking a course at Union in which a low grade was earned will improve the GPA more than taking a new course; replacing a grade is typically more beneficial to the GPA than averaging in another course's grade.
2. The more courses you take (hence, the more credits you have), the harder it is to change your GPA significantly.