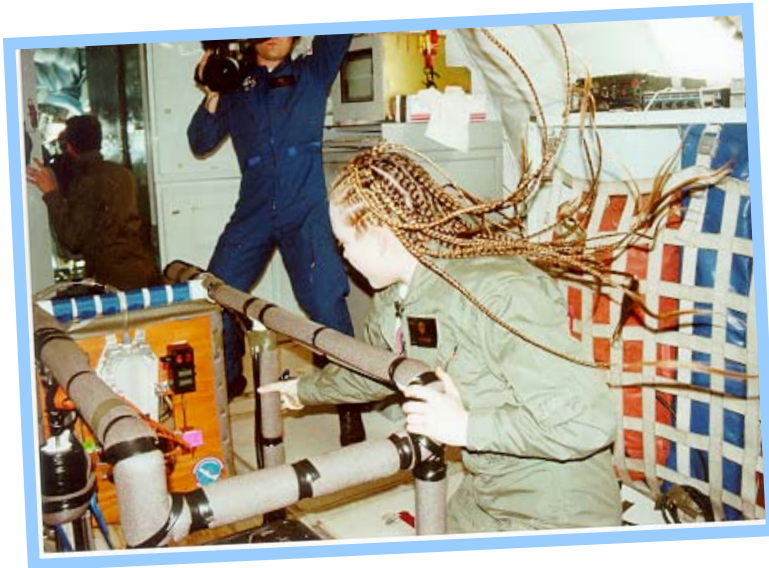


# Chemical Engineering Undergraduate Advising Guide

May 16, 2008

<http://www.cbee.oregonstate.edu/>



**Oregon State**  
UNIVERSITY

**OSU**

*Our Mission is to graduate students immediately prepared for professional practice.*

## Chemical Engineering

### The Program

The chemical engineering curriculum provides students with a background of fundamental knowledge that prepares them for responsible positions in research and development, design, technical service, plant operation, technical sales, and management in a wide variety of government, non-profit and industrial organizations. It places major emphasis on mathematics, chemistry and engineering sciences in addition to courses in design and analysis. Traditionally, the department has achieved prominence in research areas fundamental to chemical engineering, including mass transfer, heat transfer, chemical reaction engineering, fluidization, and thermodynamics.

In recent years excellence is being established in several emerging areas, including biochemical engineering, high-temperature ceramic materials, thin film materials processing, environmental control, waste minimization, polymer processing and rheology, and computerized process control.

The excellence of the program is evident in that over the past three years a large majority of the students have either received offers of employment or decided to pursue a graduate education. Graduates of the Chemical Engineering Program work in design, production, R & D, sales, and management positions all over the world. Particularly successful graduates include Linus Pauling (2 time Nobel Laureate), Robert Lundeen (former CEO of Dow Chemical) and Dale R. Laurance (current COE of Occidental Oil and Gas Corporation). Just a few of the employers of OSU CHE Alumni are:

ARCO	Georgia Pacific – Toledo	SEH America
AtoChem	Hercules Chemicals	Shell Companies
Battelle Pacific Northwest	Hewlett Packard	Siltronic
Bechtel	Hynix	Smurfit News Co
Betz-Dearborn Co.	Industrial Design Corp.	Simpson Paper Co.
Boeing	Intel	Stauffer
Bend Research	Johnson Matthey Elec.	Teledyne Wah-Chang
Boise Cascade	Kaiser Aluminum	Tektronix
Chevron USA	Longview Fibre	Union Oil
CH2M Hill	Louisiana Pacific Co.	US Bureau of Mines
Dow Chemical	LSI Logic	US-EPA
EI duPont deNemours	3M Company	US West
ENTEK Manuf. Inc.	Merix	Wafer-Tech
Exxon	Mitsubishi Silicon	Westinghouse
Fort James Corp.	NYPRO OREGON	Weyerhaeuser
Freightliner	OxyChem	Willamette Industries
Frito-Lay	Pope and Talbot	
Fujitsu	Praegitser Industries	
Fuji Silysia	Proctor and Gamble	

For those students whose professional goals include higher level engineering positions, engineering research, or engineering education, the chemical engineering curriculum provides an excellent background for graduate school. Many OSU CHE graduates have continued at Oregon State for graduate study or have gone on to graduate studies at such institutions as Massachusetts Institute of Technology, California Institute of Technology, University of Texas, University of Wisconsin, University of Minnesota, University of Washington, University of Illinois, University of New Mexico, University of Kansas, Carnegie Mellon and Arizona State University for advanced engineering degrees or the Oregon Institute of Health Sciences for MD degrees. Our alums are teaching at highly ranked schools: University of Illinois, Urbana Champaign and West Virginia University.

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**Program educational mission and objectives.** The objectives of the Chemical Engineering Program are to provide high quality engineering programs that prepare students for successful careers, lifelong learning, and service to their profession and society. OSU chemical engineering graduates will be known for their technical competence and creativity; for their ability to apply, adapt, and extend their knowledge to solve a wide variety of problems; and for their effective communication skills. Their education will provide them with an understanding of the ways in which the humanities, social sciences, basic sciences, and technology interact to affect society. These programs will foster an environment that stimulates learning and promotes diversity. We need your formal PEOs listed here!

**CoaChEs.** The acronym “CoaChEs” stands for “Communication, organization, and analysis skills for Chemical Engineering students.” The philosophy is that learning best occurs when students receive immediate feedback on their performance through classroom interaction and small group teaching. The senior laboratory courses involve 6 hours/week of project management coaching with a high faculty/student ratio.

Preparing students for professional practice implies the formal teaching of many soft skills in addition to technical skills. Our endowed Linus Pauling Chair was created for the purpose of bringing seasoned engineering professionals into the classroom as full time teachers. Beginning in the freshman year, students are formally taught and coached in soft skills as they perform their technical laboratories and team projects. By the end of senior year, students are expected to be fully competent in project planning and management, formal meeting procedures, proposal writing and presentation, technical and non-technical presentations, and report writing. Writing exercises include memos, proposals, safety documentation, technical paper writing, and formal lab books. Students are coached through their work, having them repeat it until the mistakes are corrected. Additionally, all students receive formal team building and conflict resolution based on the Thomas-Kilman Conflict Mode Instrument and Self Awareness based on the Myers-Briggs Type Indicator (MBTI).

## Curriculum

The requirements for the BS degree in Chemical Engineering reflect the knowledge and skills necessary for the new engineer to take his or her place in society. General requirements are established by the College of Engineering (COE) and Oregon State University. The School of Chemical, Biological, and Environmental Engineering determines the specific requirements for graduation and audits those courses to ensure that the standards of the **Accreditation Board for Engineering and Technology (ABET)** are met by every student who receives a degree.

ABET is the national organization that accredits—or certifies—engineering and technology degree programs. ABET’s Engineering Accreditation Commission (EAC) applies standards set by practicing engineers and engineering educators to specify the general form and content of engineering programs. The School of Chemical, Biological and Environmental Engineering, with the advice of industry and government, determines the courses needed to help the student develop the knowledge and skills required of the modern chemical engineer. **In several situations the School’s regulations are more restrictive than the university’s regulation.**

The University (OSU) establishes a set of core requirements - called the Baccalaureate Core - which all undergraduate degree programs at OSU must incorporate. These requirements help the student develop the values, knowledge, and skills that all university graduates should possess. The current requirements are published each quarter in the Schedule of Classes for that quarter.

The following pages list the Chemical Engineering curriculum by the categories that are used for ABET accreditation. In both the *Oregon State University Bulletin* and the OSU College of Engineering *Advising Guide* (<http://www.engr.oregonstate.edu/advising/>), you will find the same curricula. Copies of the Curriculum Check Sheet for the chemical engineering curriculum and the Curriculum Block Diagrams are included in this guide. The official checklist is maintained in the main office. Please note that just because a course is required or recommended in the curriculum does not mean that it will be offered every term. Also, most courses have prerequisites, courses that must be completed satisfactorily before the course can be taken. Always consult the *Oregon State University Bulletin* or the OSU *Schedule of Classes*, or check with the appropriate department for availability and prerequisites before registering for a course. Required Technical Courses – these may NOT be taken S/U.

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## Summary by ABET Topic

This page lists, by course category, the requirements for the Chemical Engineering curriculum.

### Mathematics & Basic Science (ABET requirement; 48 credits)

#### Mathematics (20 credits)

# MTH	251 (4)	Differential Calculus
# MTH	252 (4)	Integral Calculus
# MTH	306 (4)	Matrix & Power Series Methods
# MTH	254 (4)	Vector Calculus
# MTH	256 (4)	Applies Differential Equation

#### Biological Science Course (4 credits)

#### Basic Science (27 credits)

# CH	221 (5)	Chemistry for CH/CHE Majors I
CH	222 (5)	Chemistry for CH/CHE Majors II
CH	223 (5)	Chemistry for CH/CHE Majors III
# PH	211 (4)	General Physics with Calculus I
# PH	212 (4)	General Physics with Calculus II
# PH	213 (4)	General Physics with Calculus III

### Advanced Chemistry (ABET requirement; working knowledge)

#### Required Upper Division Chemistry (17 credits)

CH	331 (4)	Organic Chemistry I
CH	332 (4)	Organic Chemistry II
CH	440 (3)	Physical Chemistry I *
CH	441 (3)	Physical Chemistry II
CH	442 (3)	Physical Chemistry III

#### Advanced Chemistry Elective-one class with a lab(6) \*\*

### Engineering Topics (ABET requirement; 72 credits)

#### Required Engr & ChE. Courses (68 credits)

# ENGR	201 (3)	Electrical Fundamentals I
# ENGR	211 (3)	Statics
CHE	101 (3)	Engineering Orientation I ***
# CHE	102 (3)	Engineering Methods—Programming
CHE	211 (3)	Material and Energy Balances

### Engineering Topics cont.

CHE	212 (3)	Energy Balances
CHE	213 (4)	Process Data Analysis
CHE	311 (3)	Thermodynamics I
CHE	312 (3)	Thermodynamics II
CHE	331 (4)	Transport I
CHE	332 (4)	Transport II
CHE	333 (3)	Transport III
CJE	361 (3)	Process Dynamics
CHE	411 (4)	Mass Transfer Ops I
● CHE	414 (3)	Chemical Engineering Lab I
CHE	415 (3)	Chemical Engineering Lab II
CHE	416 (3)	Chemical Engineering Lab III
CHE	431 (3)	Chemical Plant Design I
CHE	432 (3)	Chemical Plant Design II
CHE	443 (4)	Chemical Reaction Engineering
CHE	461 (3)	Process Control

#### Engineering Topics Electives (9 credits)

### General Education

#### Communication Skills (9 credits)

# WR	121 (3)	English Composition
WR	327 (3)	Technical Writing
# COMM or	111 (3)	Public Speaking
# COMM	114 (3)	Argument and Critical Discourse

#### Humanities and Social Sciences (24)

PERSPECTIVES	(12)	
DPD	(3)	
SYNTHESIS	(6)	
ETHICS	(3)	
BIOE	220	Bioe Ethics (3)
ENGR	221	Applications of Nanotechnology (3)

#### Fitness (3 credits)

HHS	231 (2)	Lifetime Fitness for Health
HHS	24x (1)	Lab

#### Free Electives ( 5 credits)

- # means that the course is a pre-engineering core course and is required for entry into the professional program.
- means that the course is a writing intensive course, which is part of the OSU BACC requirements for graduation.
- \* Not required for students receiving an option
- \*\* Some Options only require 4 credits of Advanced Chemistry elective.
- \*\*\* ChE 101 does not count towards the 72 credits required for Engineering Topics.

Required technical courses are those specifically required courses taught in the School of Chemical, Biological and Environmental Engineering or in a closely related field. Restricted Electives: Engineering Topics, and Advanced Chemistry – these may NOT be taken S/U.

The purpose of restricted electives is to develop specific interests of the students within the major and in related areas. The “Option Program” in Chemical Engineering offers the possibility of recognition of extra depth in a particular area through the choice of electives (see Options section). If you satisfy an options requirement, you do not need any more restricted electives. If you are not completing an option, you must take at least 5 elective classes including:

- 3 Engineering Topics classes with a minimum of 9 credits.
- 2 Advanced Chemistry classes with a minimum of 6 credits. One class must have a lab component.

**Before registering for any restricted elective course, even a recommended course, consult with your advisor.**

### Explanation of CHE Curriculum

**Mathematics.** Along with the natural and social sciences, mathematics provides an important base for chemical engineering. Required mathematics department courses cover calculus through differential equations. ST 314, CHE 213, CHE 414 and 415 contain material on probability and statistics, two important tools used by chemical engineers in the analysis of process data. NO mathematics course may be taken S/U.

**Basic Science.** CHE students are expected to have had a strong chemistry background in high school and are required to take CH 221, 222 and 223, which are 5-credit courses offered by the Chemistry department specifically for chemistry and chemical engineering majors during their first year of study. ABET requirements state that chemical engineering students must take chemistry courses equivalent to those taken by chemistry majors, thus other first year sequences may not be appropriate for CHE students. If you are transferring into the Chemical Engineering Program and have already taken some of these other first year chemistry courses, you must consult with your advisor to determine appropriate additional chemistry work.

All engineering majors are required to take PH 211, PH 212 and PH 213 calculus-based physics courses. These courses are part of the pre-engineering core and must be completed before entering the professional engineering program.

In addition to the required chemistry and physics courses, CHE students must take at least four credits of biological science (with lab) to satisfy the OSU Baccalaureate Core. The latest list is available in the OSU *Schedule of classes* for each quarter. Acceptable courses, as listed in the 2004-05 *Oregon State University Bulletin* (General Catalog) are:

ANS	121	(4)	Introduction to Animal Sciences
BI	101, 102, 103	(4)	General Biology
BI	211, 212, 213	(4)	Principles of Biology
BOT	101	(4)	Botany: A Human Concern
CSS	205	(4)	Soils: Sustainable Ecosystems
FOR	240	(4)	Forest Biology
MB	230	(4)	Introductory Microbiology (required by several options)

NO science course, required or elective, may be taken S/U.

**Advanced Chemistry.** CHE students must take advanced chemistry elective courses beyond the required advanced chemistry courses. These courses must have a 1 year college science prerequisite, a substantial science content (advanced concepts or chemical methods) and cannot be courses which are classified as engineering topics. Because the organic and physical chemistry sequences required of CHE students at OSU do not include laboratory experience, it is required that one of these elective courses include a lab component. A substantial portion of the CHE Curriculum inherently covers chemistry. **Thus, CHE majors are not allowed to declare a chemistry minor since it is redundant.**

#### Acceptable Advanced Chemistry Electives

CHE	417	Lab	(4)	<b>Instrumentation in Chemical, Biological and Environmental Engineering</b>
CH	324	Lab	(4)	<b>Quantitative Analysis</b>
CH	337	Lab	(3)	<b>Organic Chemistry Lab</b>
CH	411		(3)	<b>Inorganic Chemistry</b>
CH	412		(3)	<b>Inorganic Chemistry</b>
CH	413		(3)	<b>Chemical Applications of Group Theory</b>
CH	418		(3)	<b>Nuclear Chemistry</b>
CH	435		(3)	<b>Structure Determination by Spectroscopic Methods</b>
CH	445		(3)	<b>Physical Chemistry of Materials</b>
CH	448		(3)	<b>Surface Chemistry</b>
CH	450		(3)	<b>Introductory Quantum Chemistry</b>
CH	453		(3)	<b>Chemical Thermodynamics</b>
CH	467		(4)	<b>Molecular Spectroscopy</b>
WSE	316		(3)	<b>Wood and Fiber Chemistry</b>
OC	450		(3)	<b>Chemical Oceanography</b>
ATS	413		(3)	<b>Atmospheric Chemistry</b>

The following are NOT acceptable as Adv. CH electives: CH 334, 335, 336, 374, 390, 490, 595 or 596 – see FAQ section. Advanced science other than chemistry (physics for example) can be used to satisfy the advanced chemistry electives. Consult your advisor to see if a class that you are interested in is appropriate.

**A petition to the Head Advisor of Chemical Engineering is required to use a class outside of the list above.**

NO Advanced Chemistry required or elective course may be taken S/U.

**Engineering Topics: *Engineering Science & Design.*** These courses cover concepts and techniques that are essential to engineering analysis and design. More importantly they cover the *philosophy and process* of engineering problem solving. The engineering topics courses specifically required in the chemical engineering curriculum cover engineering mechanics, electrical fundamentals, material and energy balances, thermodynamics, momentum, energy and mass transfer, reactors, and process dynamics and control. Your advanced level engineering topics elective courses may be prescribed by your option. You are required to take 9 credits of advanced engineering topics beyond the standard curriculum.

### **Selected list of Engineering Topics (ET) Electives**

CHE	214	(4)	Material & Energy Balances in Nanotechnology
CHE	444	(4)	Thin Film Materials Processing
CHE	445	(4)	Polymer Engineering and Science
CHE	514	(4)	Fluid Flow
CHE	520	(4)	Mass Transfer
CHE	525	(4)	Chemical Engineering Analysis
CHE	537	(4)	Thermodynamics
CHE	540	(4)	Chemical Reactors
BIOE	450	(4)	Biomechanics
BIOE	451	(4)	Biomaterials
BIOE	457	(4)	Bioreactors I
BIOE	458	(3)	Bioreactors II
BIOE	462	(4)	Bioproduct Recovery
ENVE	321	(4)	Environmental Engineering Fundamentals
ENVE	421	(4)	Water and Wastewater Characterization
ENVE	422	(4)	Environmental Engineering Design
ENVE	425	(3)	Air Pollution Control
ENVE	431	(4)	Fate and Transport of Chemicals in Environmental Systems
ENVE	451	(4)	Environmental Regulations and Hazardous Substance Management
CE	412	(3)	Hydrology
ECE	317	(3)	Electronic Materials and Devices
ECE	417	(3)	Basic Semiconductor Devices
ECE	418	(3)	Semiconductor Processing
*ENGR	221	(3)	Applications of Nanotechnology
ENGR	321	(3)	Materials Science
ENGR	322	(4)	Mechanical Properties of Materials
IE	355	(4)	Statistical Quality Control
IE	356	(4)	Experimental Design For Industrial Processes
ME	479	(3)	Amorphous Materials

The following classes CANNOT be taken as an ET elective: ENGR 248, ENGR 350, CE 356

\*ENGR 221 can be used towards Engineering Topics or towards Ethics, but not towards both.

Other engineering classes can also be used towards the engineering topics electives. Consult your advisor to see if a class that you are interested in is appropriate. **A petition to the Head Advisor of the Chemical Engineering Department is required to use a class outside of the list above.**

**No engineering topics course may be taken S/U.**

**Communication Skills.** The best technical work is worthless if it cannot be communicated to others for evaluation and implementation. Many engineers find that they spend more time communicating – meeting and working with colleagues, writing memos and reports, and giving presentations – than they do in technical problem solving. For that reason, the chemical engineering curricula requires courses in basic writing, technical report writing, and public speaking. CHE 414 satisfies the OSU BACC requirement for a writing intensive course (WIC) in the CHE curriculum. NO communication skills course may be taken S/U.

**Humanities and Social Sciences.** It is the University's role to prepare students to take an active, constructive part in society. To fulfill that role, it must provide engineering students with the technical knowledge and skill that they will need to function as engineers. But engineers must have more than just technical skills. Like any citizen, engineers have a great responsibility to society. To meet that responsibility, they must have a basic understanding of individual and social behavior and values and cultures of the society. For that reason, each engineering curricula requires courses in humanities and social sciences.

ABET requires that at least 24 credits of humanities and social science courses be taken. For purposes of graduation with a BS in Chemical Engineering, the satisfaction of the OSU Baccalaureate Core (BACC) plus the department's ethics course, BIOE 220, is considered to be sufficient to satisfy the ABET requirements. See the *Oregon State University Bulletin* and the *OSU Schedule of Classes* for more information on BACC requirements.

**Perspectives Courses:** A total of 5 Perspectives courses, totaling at least 15 credits, must be taken. This includes a minimum of 1 course in each of the following categories: Western Culture, Cultural Diversity, Literature and the Arts, and Social Processes and Institutions. In fulfilling the Humanities and Social Sciences requirements, a maximum of two courses may be selected from the same department. The fifth perspectives class required is Professionalism and Bioengineering Ethics (BIOE 220).

**Difference, Power, and Discrimination Course (DPD):** One DPD course, totaling at least 3 credits, must be taken. In fulfilling the Humanities and Social Sciences requirements, a maximum of two courses may be selected from the same department.

**Synthesis Courses:** Two Synthesis courses must be taken: one course in Contemporary Global Issues and one course in Science, Technology, and Society. NO COURSE listed as an OSU "synthesis" course can be used as an Advanced Chemistry or Engineering Topic elective.

Except for BIOE 220, Humanities and Social Sciences courses MAY be taken S/U. An absolute maximum of 36 credits of S/U may be taken if a student has four years of full-time study at OSU. For transfer students the maximum is 3 times the number of quarters of full-time residency at OSU.

**Fitness.** The OSU Baccalaureate Core requires that all OSU students take HHS 231 and HHS 24x, Lifetime Fitness Lab. HHS 231 and 24x MAY be taken S/U.

**Free Electives.** Each CHE student may need to take up to four credits of free electives to fill out his or her program (192 total credits). A free elective may be any OSU course. Excess credits from other course categories may be counted as Free Electives. However, Free Electives should not be considered as "throw away" courses. Your time at the University is unique in your life, in that at no other time will you have such easy access to learning. Free electives MAY be taken S/U.

## Curriculum Block Diagram for BS Program

*Curriculum Block Diagram for BS Program.* The “block diagram” flowchart showing an example of the four-year schedule for completing the Bachelor’s degree in chemical engineering can be seen on page 18. Each column represents one academic quarter. The first two years in the program are the pre-engineering program. The gray shaded courses comprise the “core” courses used to calculate a GPA used for admission to the professional program. The courses shaded in pink represent technical electives while those shaded in aqua represent classes needed to satisfy the general education requirements. The sequence of courses in the third and fourth years represents the professional program. This flowchart represents an idealized schedule, and most students’ actual schedules will differ in sequence and number of quarters required to satisfy all requirements. In particular, students interested in the MECOP program, (and/or other work opportunities) must carefully plan their schedules with the MECOP advisor to ensure timely graduation.



### Options

The Options Program has been designed to offer ChE students the opportunity to focus their choices of electives in an identifiable application area of Chemical Engineering. The result is that they will obtain documented special preparation in a particular area that complements chemical engineering, without having to take more than the required 192 credit minimum to obtain a ChE BS degree. These areas correspond to strengths in the OSU ChE program. In each of these areas at least one faculty member serves as the area “Option advisor”. This faculty member provides information about the option and approves the student petition. Detailed option course sheets and block diagrams are available in the ChE main office.

To apply for an Option, a Declaration of Option Request in Chemical Engineering form must be filled out and presented to the Option advisor and the department head for signature. A copy of this petition form can be found in the appendix. To substitute a course for a listed Option course requires written approval by the Option Advisor and the Department Head of Chemical Engineering. A student must apply for an Option audit at the time they apply for a graduation audit for the Option to appear on their diploma and transcript.

**Options are now transcript visible and should be declared when you apply for graduation with the registrar’s office.**

**The codes and option advisors are:**

- ◆ **Biochemical Option - 488, Dr. Greg Rorrer**
- ◆ **Environmental Processes Option - 489, Dr. Skip Rochefort**
- ◆ **Microelectronics Processes & Material Science Option - 487, Dr. Milo Koretsky**
- ◆ **Nanotechnology Processes, Dr. Milo Koretsky**

## CHEMICAL ENGINEERING CURRICULUM (192 credits)

Cr.	First Year = 47 credits			Second Year = 50 credits			Third Year = 47 credits			Fourth Year = 48 credits			
	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	
1	Chem CH 221 (5F)	Chem CH 222 (5W)	Chem CH 223 (5S)	O Chem CH 331 (4F)	O Chem CH 332 (4W)	Tec Rpts WR 327 (3FWS)	P Chem CH 440 (3F)	P Chem CH 441 (3W)	P Chem CH 442 (3S)	CHE Lab CHE 414 (3F)	CHE Lab CHE 415 (3W)	CHE Lab CHE 416 (3S)	
2													
3													
4													
5						EE Fund ENGR 201 (3FWS)	ENGR Topics 1 (3)	Proc Dyn CHE 361 (3W)	Proc Ctrl CHE 461 (3S)	Rxn Engr CHE 443 (4F)	Design CHE 431 (3W)	Design CHE 432 (3S)	
6	Diff MTH 251 (4FWS)	Integral MTH 252 (4FWS)	Vector Calc MTH 254 (4FWS)	Mix & Pwr MTH 306 (4FWS)	Diff Eqs MTH 256 (4FWS)	COMM 11/1/14 (3FWS)	ENGR Topics 1 (3)	Proc Dyn CHE 361 (3W)	Proc Ctrl CHE 461 (3S)	Rxn Engr CHE 443 (4F)	Design CHE 431 (3W)	Design CHE 432 (3S)	
7													
8													
9							Transport I Fluids CHE 331 (4F)	Transport II Heat & Mass CHE 332 (4W)	Transport III CHE 333 Lab (3S)	Unit Ops CHE 411 (4F)	Persp 5 (3)	Synth 1 (3)	
10													
11	Orient CHE 101 (3F)	Prob Solv CHE 102 (3W)	Physics PH 211 (4SF)	Physics PH 212 (4FW)	Physics PH 213 (4WS)	Statics ENGR 211 (3FWS)	Transport I Fluids CHE 331 (4F)	Transport II Heat & Mass CHE 332 (4W)	Transport III CHE 333 Lab (3S)	Unit Ops CHE 411 (4F)	ENGR Topics 2 (3)	ENGR Topics 2 (3)	Synth 2 (3)
12													
13													
14	Eng Comp WR 121 (3FWS)	(Note c) BioSLab (4)	Life Fit HHS 231 (2FWS)	Mat Bal CHE 211 (3F)	Energy Bal CHE 212 (3W)	Process Data Anal CHE 213 (4S)	Thermo CHE 311 (3F)	PRxnEquil CHE 312 (3W)	Adv Chem 1 (3)	Adv Chem 2 (3)	ENGR Topics 3 (3)	Free electives (5)	
15													
16													
17													
18													

**Notes:**

a. **Only Persp, Syn, HHP 231, and FREE can be taken on S/U grading** (# of S/U credits are limited to 3X # of terms at OSU, up to 36 max).

b. "Shaded" courses = required for admission to professional program and contribute to "core" GPA used for admission (also 80 credits minimum completed)

c. Must satisfy the OSU-BACC "Biological Science (with lab)" requirement - see list of acceptable courses in current Schedule of Classes.

**Technical Electives**

**Univ & College Core**

**Free electives**



## CHEMICAL ENGINEERING CURRICULUM with Biochem Processes Option (192 credits)

Cr.	Freshman = 47 credits			Sophomore = 49 credits				Junior = 48 credits			Senior = 48 credits		
	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	
1													
2	Chem CH 221 (5F)	Chem CH 222 (5W)	Chem CH 223 (5S)	O Chem CH 331 (4F)	O Chem CH 332 (4W)	Tec Rpts WR 327 (3FWS)	BIOE 320 BIO Ethics (3F)	P Chem CH 441 (3W)	P Chem CH 442 (3S)	CHE Lab CHE 414 (3F)	CHE Lab CHE 415 (3W)	CHE Lab CHE 416 (3S)	
3													
4													
5						EE Fund ENGR 201 (3FWS)	Persp 2 (3)	Proc Dyn CHE 361 (3F)	Proc Ctr CHE 461 (3W)	Rxn Engr CHE 443 (4F)	Design CHE 431 (3W)	Design CHE 432 (3S)	
6													
7													
8	Diff MTH 251 (4FWS)	Integral MTH 252 (4FWS)	Mtrx & Pwr MTH 306 (4FWS)	Vector Calc MTH 254 (4FWS)	Diff Eqs MTH 256 (4FWS)	COMM 111/114 (3FWS)	Transport I Fluids CHE 331 (4F)	Transport II Heat & Mass CHE 332 (4W)	Transport III CHE 333 Lab (3S)		Persp 4 (3)	Bioe ChemE Elective (3FWS)	
9													
10													
11	Orient CHE 101 (3F)	Prob Solv CHE 102 (3W)	Physics PH 211 (4SF)	Physics PH 212 (4FW)	Physics PH 213 (4WS)	Statics ENGR 211 (3FWS)	Thermo CHE 311 (3F)	PRxnEquil CHE 312 (3W)	Persp 3 (3)	Unit Ops CHE 411 (4F)	Persp 4 (3)	Bioe ChemE Elective (3FWS)	
12													
13													
14	Eng Comp WR 121 (3FWS)	Life Fit HHS 231 (2FWS)		Mat Bal CHE 211 (3F)	Energy Bal CHE 212 (3W)	Process Data Anal CHE 213 (4S)	Bio Chemistry BB 450 (4FW)	Bio Chemistry BB 451 (3W)	Synth 1 (3)	Bio Reactors BIOE 457 (3F)	Persp 5 (3)	CHE 417 or CH 324 WS (4)	
15		HHS 24* (1)											
16			MB 230 (4) Micro										
17				Persp 1 (3)	ENGR 221 App of Nano (3W)								
18													

- a. **Only Persp, Syn, HHP 231, and FREE can be taken on S/U grading** (# of S/U credits are limited to 3X # of terms at OSU, up to 36 max).
- b. "shaded" courses=required for admission to professional program and contribute to "core" GPA used for admission (also 80 credits minimum completed).
- c. Satisfies the OSU-BACC "Biological Science (with lab)" requirement
- d. The capstone lab project is required to be in the area of the option  
Either BIOE 320 or ENGR 221 satisfy the department Ethics Requirement/Both do not need to be taken. If both are taken, ENGR 221 can be counted as ENGR Topics.
- e.

<b>OPTION Courses</b>	<b>Univ &amp; College Core</b>
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# CHEMICAL ENGINEERING CURRICULUM with Environmental Processes Option (192 credits)

Name:

Advisor:

Option 489

Cr.	Freshman = 47 credits			Sophomore = 49 credits			Junior = 49 credits			Senior = 48 credits		
	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring
1												
2												
3	Chem CH 221 (5F)	Chem CH 222 (5W)	Chem CH 223 (5S)	O Chem CH 331 (4F)	O Chem CH 332 (4W)	Tec Rpts WR 327 (3FWs)	Free Electives (5)	P Chem CH 441 (3W)	P Chem CH 442 (3S)	CHE Lab CHE 414 (3F)	CHE Lab CHE 415 (3W)	CHE Lab CHE 416 (3S)
4												
5												
6												
7												
8	Diff MTH 251 (4FWs)	Integral MTH 252 (4FWs)	Mtrx & Pwr MTH 306 (4FWs)	Vector Calc MTH 254 (4FWs)	Diff Eqs MTH 256 (4FWs)	EE Fund ENGR 201 (3FWs)	Persp 2 (3)	Proc Dyn CHE 361 (3W)	Proc Ctrl CHE 461 (3S)	Rxn Engr CHE 443 (4F)	DESIGN CHE 431 (3W)	DESIGN CHE 432 (3S)
9												
10												
11	Orient CHE 101 (3F)	Prob Solv CHE 102 (3W)	Physics PH 211 (4SF)	Physics PH 212 (4FW)	Physics PH 213 (4WS)	COMM 111/114 (3FWs)	Transport I Fluids CHE 331 (4F)	Transport II CHE 332 Heat & Mass (4W)	Transport III CHE 333 Lab (3S)	Unit Ops CHE 411 (4F)	Persp 5 (3)	Synth 1 (3)
12												
13												
14	Eng Comp WR 121 (3FWs)	Life Fit HHS 231 (2FWs)	MB 230 (4) Micro	Mat Bal CHE 211 (3F)	Energy Bal CHE 212 (3W)	Statics ENGR 211 (3FWs)	Thermo CHE 311 (3F)	PRxn Equil CHE 312 (3W)	Persp 3 (3)	ENVE Elective 1 (4F)	ENVE Elective 2 (3F)	Synth 2 (3)
15												
16												
17												
18												

- Only Persp, Syn, HHP 231, and FREE can be taken on S/U grading** (# of S/U credits are limited to 3X # of terms at OSU, up to 36 max).
- "Shaded" courses=required for admission to professional program and contribute to "core" GPA used for admission (also 80 credits minimum completed)
- Satisfies the OSU-BACC "Biological Science (with lab)\*" requirement
- The capstone lab project is required to be in the area of the option
- Either BIOE 320 or ENGR 221 satisfy the department Ethics Requirement/Both do not need to be taken. If both are taken, ENGR 221 can be counted as ENGR Topics.

OPTION Courses  
Univ & College Core

## CHEMICAL ENGINEERING CURRICULUM with Nanotechnology Option (192 credits)

Cr.	Freshman = 47 credits			Sophomore = 50 credits			Junior = 48 credits			Senior = 47 credits		
	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring
1												
2	Chem CH 221 (5F)	Chem CH 222 (5W)	Chem CH 223 (5S)	O Chem CH 331 (4F)	O Chem CH 332 (4W)	EE Fund ENGR 201 (3FWS)	Perisp 1 (3)	P Chem CH 441 (3W)	P Chem CH 442 (3S)	CHE Lab CHE 414 (3F)	CHE Lab CHE 415 (3W)	CHE Lab CHE 416 (3S)
3												
4												
5												
6												
7	Diff MTH 251 (4FWS)	Integral MTH 252 (4FWS)	Mtrx & Pwr MTH 306 (4FWS)	Vector Calc MTH 254 (4FWS)	COMM 111/114 (3FWS)	Diff Eqs MTH 256 (4FWS)	Nano Elective 1 (3)	Proc CtrI CHE 361 (3W)	Proc CtrI CHE 461 (3S)	Rxn Engr CHE 443 (4F)	Design CHE 431 (3W)	Design CHE 432 (3S)
8												
9												
10												
11	Orient CHE 101 (3F)	Prob Solv CHE 102 (3W)	Physics PH 211 (4SF)	Physics PH 212 (4FW)	Physics PH 213 (4WS)	Statics ENGR 211 (3FWS)	Transport I Fluids CHE 331 (4F)	Transport II Heat & Mass CHE 332 (4W)	Transport III CHE 333 Lab (3S)	Unit Ops CHE 411 (4F)	Perisp 5 (3)	Synth 2 (3)
12												
13												
14	Eng Comp WR 121 (3FWS)	Life Fit HHS 231 (2FWS)		Mat Bal CHE 211 (3F)	Energy Bal CHE 212 (3W)	Mat & Eng Bal in Nano CHE 214 (4S)	Thermo CHE 311 (3F)	PRxnEquil CHE 312 (3W)	Tec Rpts WR 327 (3FWS)	Perisp 3 (3)	Thin Films CHE 444 (4W)	CHE 417 (4S)
15		HHS 24* (1)			ENGR 221 <sup>e</sup> App of Nano (3W)	Free Electives (3)	Engr Ethics BIOE 320 <sup>e</sup> (3FW)	Perisp 2 (3)	Process Data Anal CHE 213 (4S)	Perisp 4 (3)		Free Elec (2)
16												
17												
18												

a. Only Perisp, Syn, HHP 231, and FREE can be taken on S/U grading (# of S/U credits are limited to 3X # of terms at OSU, up to 36 max).

b. "Shaded" courses = required for admission to professional program and contribute to "core" GPA used for admission (also 80 credits minimum completed)

c. Satisfies the OSU-BACC "Biological Science (with lab)" requirement

d. The capstone lab project is required to be in the area of the option

e. If ENGR 221 is used for Ethics requirements, students must choose another Tech elective. If both are taken, ENGR 221 can be counted as an ENGR Topic.

OPTION Courses	Univ & College Core
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## Options - Course Requirements

### Biochemical Processes - 488

#### Option Advisor-Greg Rorrer

BIOE	457	F	(3)	Bioreactors
BB	450	FW	(4)	General Biochemistry
BB	451	WS	(3)	General Biochemistry
CH	324	WS	(4)	Quantitative Analysis OR
CHE	417	S	(4)	Instrumentation

*Select three additional courses from the following*

BIOE	458	W	(3)	Cell Culture & Tissue Engineering
BIOE	459	S	(3)	Cell Engineering
BIOE	460	S	(3)	Metabolic Engineering
BIOE	462	F	(3)	Bioproduct Recovery
BIOE	451	W	(3)	Biomaterials
**CHE	416	S	(3)	Chemical Engineering Lab

**Total = 23**

### Environmental Processes - 489

#### Option Advisor-Jeff Nason

CH	324	WS	(4)	Quantitative Analysis OR
CHE	417	S	(4)	Instrumentation
ENVE	322	W	(4)	Fundamentals of ENVE Engr
ENVE	431	W	(4)	Fate and Transport of Chemicals in Environmental Systems

*Select three additional courses from the following:*

ENVE	421	F	(4)	Water / Wastewater Characterization
ENVE	422	W	(4)	Environmental Engineering Design
ENVE	425	S	(3)	Air Pollution Control
ENVE	456	S	(3)	Sustainable Water Resources
BB	350	S	(4)	Elementary Biochemistry
CE	412	S	(3)	Hydrology
CH	422	W	(3)	Analytical Chemistry
TOX	430	F	(3)	Chemical Behavior in the Environment
*CHE	416	S	(3)	Chemical Engineering Lab

**Total = 21**

**\*\*CAPSTONE PROJECT MUST BE IN OPTION AREA**

### Microelectronics Processes and Materials Science - 487

#### Option Advisor-Milo Koretsky

ChE	444	W	(4)	Thin Film Materials
ChE	445	W	(4)	Polymer Engineering and Sci.
CH	324	WS	(4)	Quantitative Analysis OR
CHE	417	S	(4)	Instrumentation

*Select three additional courses from the following:*

CHE	214	S	(4)	Mat & Energy Bal in Nanotech
CHE	417	S	(4)	Instrumentation
BIOE	450	S	(4)	Biomechanics
BIOE	451	W	(3)	Biomaterials
ENGR	221	W	(3)	The Science Engineering and Social Impact of Nanotechnology
CH	411	F	(3)	Inorganic Chemistry
CH	421	F	(3)	Analytical Chemistry
CH	422	W	(3)	Analytical Chemistry
CH	445	W	(3)	Physical Chemistry of Materials
CH	448	W	(3)	Surface Chemistry
ECE	317	F	(3)	Electronic Materials and Devices
ECE	417	F	(3)	Basic Semiconductor Devices
ECE	418	S	(3)	Semiconductor Processing
ENGR	321	FW	(3)	Materials Science
ENGR	322	WS	(4)	Mechanical Properties of Materials
IE	355	F	(4)	Statistical Quality Control
IE	356	W	(4)	Experimental Design for Industrial Processes
**CHE	416	S	(3)	Chemical Engineering Lab

**Total = 21**

## Options - Course Requirements

### Nanotechnology Processes - 636

Option Advisor-Milo Koretsky

CHE	214	S	4	Material & Energy Balances in Nanotechnology
**CHE	416	S	3	Chemical Engineering Lab
ENGR	221	W	3	The Science, Engineering and Social Impact of Nanotechnology
CHE	417	S	4	Instrumentation
CHE	444	W	4	Thin Films Materials Processing

*Select one additional course from the following:*

BIOE	451	W	3	Biomaterials
CH	445	W	3	Physical Chemistry of Materials
CH	448	W	3	Surface Chemistry
CHE	445	W	4	Polymer Engineering and Science
ECE	317	F	3	Electronic Materials & Devices
ECE	418	S	3	Semiconductor Processing
ECE	499	S	3	Material Science of Nanotechnology
ENGR	321	FW	3	Materials Science
IE	355	F	4	Statistical Quality Control
IE	356	W	4	Experimental Design for Industrial Processes

**\*\*CAPSTONE PROJECT MUST BE IN OPTION AREA**

**Total = 21**

### Micro-energy and Chemical System (MECS) Processes—350

Option Advisor-Goran Jovanovic

The course requirements for this Option are being developed.

# Curriculum Check List Chemical Engineering

Student's Name: \_\_\_\_\_

Form completed by: \_\_\_\_\_

Declared Option: \_\_\_\_\_

Date: \_\_\_\_\_

### Required ChE Courses (62 credits)

ChE 101 (3) \_\_\_\_\_  
 ChE 102 (3) \_\_\_\_\_  
 ChE 211 (3) \_\_\_\_\_  
 ChE 212 (3) \_\_\_\_\_  
 ChE 213 (4) \_\_\_\_\_  
 ChE 311 (3) \_\_\_\_\_  
 ChE 312 (3) \_\_\_\_\_  
 ChE 331 (4) \_\_\_\_\_  
 ChE 332 (4) \_\_\_\_\_  
 ChE 333 (3) \_\_\_\_\_  
 ChE 361 (3) \_\_\_\_\_  
 ChE 411 (4) \_\_\_\_\_  
 ChE 414 (3) \_\_\_\_\_  
 \*ChE 415 (3) \_\_\_\_\_  
 ChE 416 (3) \_\_\_\_\_  
 ChE 431 (3) \_\_\_\_\_  
 ChE 432 (3) \_\_\_\_\_  
 ChE 443 (4) \_\_\_\_\_  
 ChE 461 (3) \_\_\_\_\_

### Mathematics (20 credits)

MTH 251 (4) \_\_\_\_\_  
 MTH 252 (4) \_\_\_\_\_  
 MTH 306 (4) \_\_\_\_\_  
 MTH 254 (4) \_\_\_\_\_  
 MTH 256 (4) \_\_\_\_\_

### Basic Science (27 credits)

CH 221 (5) \_\_\_\_\_  
 CH 222 (5) \_\_\_\_\_  
 CH 223 (5) \_\_\_\_\_  
 PH 211 (4) \_\_\_\_\_  
 PH 212 (4) \_\_\_\_\_  
 PH 213 (4) \_\_\_\_\_

### Basic Sci./Math, Biological Science Elective (4 credits) (might be constrained by OPTION)

( ) \_\_\_\_\_

### Communication Skills (9 credits)

WR 121 (3) \_\_\_\_\_  
 WR 327 (3) \_\_\_\_\_  
 COMM 111/114 (3) \_\_\_\_\_

### Required ENGR Courses (6 credits)

ENGR 201 (3) \_\_\_\_\_  
 ENGR 211 (3) \_\_\_\_\_

### Fitness (3 credits)

HHS 231 (2) \_\_\_\_\_  
 HHS 24 x (1) \_\_\_\_\_

### Advanced Chemistry (17 credits)

\*\*CH 331 (4) \_\_\_\_\_  
 \*\*CH 332 (4) \_\_\_\_\_  
 \*\*\*CH 440 (3) \_\_\_\_\_  
 CH 441 (3) \_\_\_\_\_  
 CH 442 (3) \_\_\_\_\_

### Humanities and Social Sciences (24 credits)

#### Perspectives

Western Culture ( ) \_\_\_\_\_  
 Cultural Diversity ( ) \_\_\_\_\_  
 Literature & Arts ( ) \_\_\_\_\_  
 Soc. Proc. & Inst. ( ) \_\_\_\_\_  
 Diff., Power, Disc. ( ) \_\_\_\_\_  
 Persp. Elective ( ) \_\_\_\_\_  
 BIOE 320 or ENGR 221 (3) \_\_\_\_\_

### \*\*\*\*Restricted Electives or Options (15-18 credits)

( ) \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 ( ) \_\_\_\_\_

#### Synthesis

Cont. Global Issues \_\_\_\_\_  
 Sci., Tech. & Soc. \_\_\_\_\_

### Free Electives ( 5 credits )

( ) \_\_\_\_\_

\* Lab project must be in the area of the Option

\*\* The entire organic chemistry sequence CH 334, 335, 336 can be used in place of the entire sequence CH 331, 332.

\*\*\* Not required for students who get an Option.

\*\*\*\*9 credits must be upper division engineering topics; 6 credits must be Advanced Chemistry / 3 with a lab.

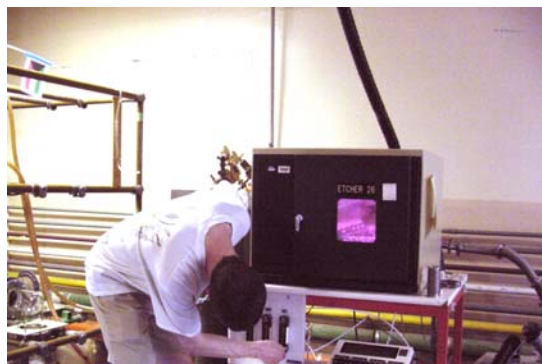
*Our Mission is to graduate students immediately prepared for professional practice.*

## MECOP

Each Summer, the MECOP program places over 250 students from most of the college's engineering programs in internships at approximately 70 companies in the Northwest. Chemical Engineering has participated in the program since 1992 and has sent interns to: Armstrong, Axiom Electronics, Boeing, Freightliner, Hewlett Packard, Intel, Kodak, LSI Logic, Merix, Norpac, Oremet, Planar Systems, Praegitzer, Siltronic, Tektronix, and Wah Chang.

Students who are accepted into the internship program complete their professional school requirements over three years instead of two. See below for the recommended schedule for the ChE core courses. The remainder of the schedule each term should be filled with technical electives, option requirements and university requirements.

	Fall	Winter	Spring
Jr.	CHE 311 CHE 331 ENGR 407	CHE 312 CHE 332	INTERNSHIP
Sr. I	CHE 443 CHE 411 ENGR 407 CHE 414	CHE 361 CH 441 CHE 415	CH 442 CHE 333 CHE 416 CHE 461
Sr. II	INTERNSHIP	CHE 431	CHE 432



*Our Mission is to graduate students immediately prepared for professional practice.*