Chemical, Biological & Environmental Engineering

COLLEGE OF **ENGINEERING**

http://cbee.oregonstate.edu

UNDERGRADUATE ADVISING GUIDE

CHEMICAL ENGINEERING

Our mission is to graduate students who are immediately prepared for professional practice.

Oregon State UNIVERSITY

Updated July 27, 2017

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:

Amgen
Amorphyx
ATI Specialty Metals
Bechtel
Bend Research
Boeing
Cascade Pacific Pulp
CH2M Hill
Dow Chemical
E&J Gallo Winery
Emerald Kalama Chemical
ENTEK Manufacturing
Frito-Lay
Genentech
Georgia-Pacific
Hewlett Packard
HP inc.
Inpria
Intel
KapStone Longview
Merck
Nalco
NASA
Occidental
ON Semiconductor
Petroleum Dev. Oman (PDO)
Puget Sound Naval Shipyard
Pyrotek
Qatar Petroleum
Sabic
Saudi Aramco
Selmet
Schlumberger
Siltronic
Solenis LLC
Tokyo Electric
Tosoh Quartz
US Water Services
WaferTech
Xerox

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.

About the Chemical Engineering Undergraduate Program (CHE):

Chemical engineering is the engineering discipline that focuses on the science and engineering of processes to convert raw materials into valued chemicals and products at a manufacturing scale. These include products found in everyday life such as transportation and heating fuels, plastics, pharmaceuticals, household and paper products (soaps, cosmetics, health care and cleaning products, etc.), as well as more advanced products like solar cells, computer chips, and advanced composites for jet aircraft.

Chemical engineers find employment in traditional chemical industries such as pulp and paper manufacturing and petroleum refining, high-tech industries such as semiconductor device manufacturing, biopharmaceutical production, aerospace, and emerging industries, particularly in sustainable energy.

Alumni of the Chemical Engineering program will be work-ready engineers, problem solvers, responsible professionals, and interdisciplinary collaborators. Specifically, based on the needs of the program's constituencies, within a few years of graduation chemical engineering alumni will have:

1. Obtained professional employment in a company, institute or agency within the chemical or related industries, entered a graduate program in chemical engineering or a related field or gained admission to a professional program such as medicine, law or business.
2. Created value by applying appropriate modern chemical engineering tools to the analysis, design, and control of chemical, physical, and/or biological processes, including the hazards associated with these processes.
3. Continued to develop their skills and knowledge through professional activities including FE/PE certifications, memberships in professional organizations and continuing education courses in order to fulfill their professional and ethical responsibilities though lifelong learning.
4. Demonstrated good communication skills and worked effectively in cross-functional team environments comprised of a diverse set of members with varying organizational backgrounds, positions, and geographic locations.

The chemical engineering undergraduate curriculum is designed to meet these objectives through relevant course content, hands-on laboratory and design experiences at the first year through senior levels, and structured, collaborative learning experiences. The school has a core curriculum where students from all three programs housed within the school (CHE, BIOE, ENVE) take common courses in the areas of first-year engineering, material and energy balances, thermodynamics, transport phenomena, and senior year laboratory.

Chemical engineering students have opportunities to obtain internships offered through the School of CBEE, and through the Multiple Engineering Cooperative Program (MECOP) program. Many scholarships are also available on a competitive basis for chemical engineering undergraduate students.

The chemical engineering program allows students to choose technical elective courses in a focus or emphasis area. Three suggested emphasis areas are Biochemical Processes, Environmental Processes, and Microelectronics and Material Science.

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 sequence involves 3 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.

Grade Requirements:
Students must achieve a 'C' or better in all required courses (exceptions are HHS, PAC, perspectives, synthesis classes), or the course will be considered 'missing' for a prerequisite or graduation requirement.
Pre-core GPA calculation for professional program admission: Both OSU and transfer grades are included, and in the case of repeated classes, the grade from the second take, no matter where the class was taken, will be used in the pre-core GPA calculation.

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	231/261 (5)	Chemistry for CH/CHE Majors I
CH	232/262 (5)	Chemistry for CH/CHE Majors II
CH	233/263 (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(7)

Engineering Topics
(ABET requirement; 72 credits)

Required Engr & ChE. Courses (68 credits)

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

Engineering Topics cont.

CBEE	212 (3)	Energy Balances
CBEE	213 (4)	Process Data Analysis
CHE	311 (3)	Thermodynamics I
CHE	312 (3)	Thermodynamics II
CHE	331 (4)	Transport I
CHE	332 (3)	Transport II
CHE	333 (3)	Transport III
CHE	334 (2)	Transport Phenomena Laboratory
CHE	361 (3)	Process Dynamics
CHE	411 (4)	Mass Transfer Ops I
● CBEE	414 (3)	Chemical Engineering Lab I
CHE	415 (3)	Chemical Engineering Lab II
CBEE	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)

CHE	320	Safety, Engineering Ethics, Professionalism	(3)

Fitness (3 credits)

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

Free Electives (4 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.

* 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. These courses are meant to allow a student to explore an interest in more depth than is required by their major. 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 231/361, 232/262 and 233/263, 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
SOIL	205	(4)	Soils: Sustainable Ecosystems
SUS	102	(4)	Introduction to Environmental Science and Sustainability
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. .

Acceptable Advanced Chemistry Electives

CHE	417 (S)	Lab	(4)	Instrumentation in Chemical, Biological and Environmental Engineering
CH	324	Lab	(4)	Quantitative Analysis
CH	337 (FS)	Lab	(3)	Organic Chemistry Lab
CH	411 (F)		(3)	Inorganic Chemistry
CH	412(W)		(3)	Inorganic Chemistry
CH	413(S)		(3)	Solid State Chemistry
CH	418(W)		(3)	Nuclear Chemistry
CH	435(F)		(3)	Structure Determination by Spectroscopic Methods
CH	445(W)		(3)	Physical Chemistry of Materials
CH	450(F)		(3)	Introductory Quantum Chemistry
CH	453		(3)	Chemical Thermodynamics
OEAS	540(W)		(3)	The Biogeochemical Earth (formerly Chemical Oceanography)
ATS	413(F)		(3)	Atmospheric Chemistry
WSE	321(F)		(3)	Chemistry of Renewable Materials

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 course, required or elective, 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	499 (WS)	(3)	Selected Topics
CHE	444 (W)	(4)	Thin Film Materials Processing
CHE	445 (FS)	(4)	Polymer Engineering and Science
CHE	514 (W)	(4)	Fluid Flow
CHE	520 (S)	(4)	Mass Transfer
CHE	525 (F)	(4)	Chemical Engineering Analysis
CHE	537 (W)	(4)	Thermodynamics
CHE	540 (W)	(4)	Chemical Reactors
CHE	450 (WS)	(3)	Conventional & Alternative Energy Systems
CHE	451 (S)	(3)	Solar Technologies
BIOE	351 (alt. S)	(4)	Biomaterials
BIOE	457 (F)	(4)	Bioreactors I
BIOE	459 (alt. S)	(3)	Cell Engineering
BIOE	462 (W)	(4)	BioSeparations
ENVE	322 (W)	(4)	Environmental Engineering Fundamentals
ENVE	421 (F)	(4)	Water and Wastewater Characterization
ENVE	422 (W)	(4)	Environmental Engineering Design
ENVE	425 (S)	(3)	Air Pollution Control
ENVE	431 (W)	(4)	Fate and Transport of Chemicals in Environmental Systems
ENVE	456 (S)	(4)	Sustainable Water Resources and Development
CE	412 (FS)	(3)	Hydrology
ECE	415 (S)	(3)	Material Science of Nanotechnology
ECE	416 (F)	(3)	Electronic Materials and Devices
ECE	417 (W)	(3)	Basic Semiconductor Devices
ECE	418 (S)	(3)	Semiconductor Processing
ENGR	221 (F)	(3)	Applications of Nanotechnology
MATS	321 (FWS)	(4)	Materials Science
MATS	322 (FWS)	(3)	Mechanical Properties of Materials
IE	355 (FS)	(4)	Statistical Quality Control
IE	356 (WS)	(4)	Experimental Design For Industrial Processes

The following classes CANNOT be taken as an ET elective: ENGR 248, ENGR 350, CE 356
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, CHE 320, 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 4 Perspectives courses, totaling at least 12 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 Perspectives requirements, a maximum of two courses may be selected from the same department.

Difference, Power, and Discrimination Course (DPD): One DPD course, totaling at least 3 credits, must be taken.

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. The two synthesis courses must be from different departments.

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 or a PAC class, 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.

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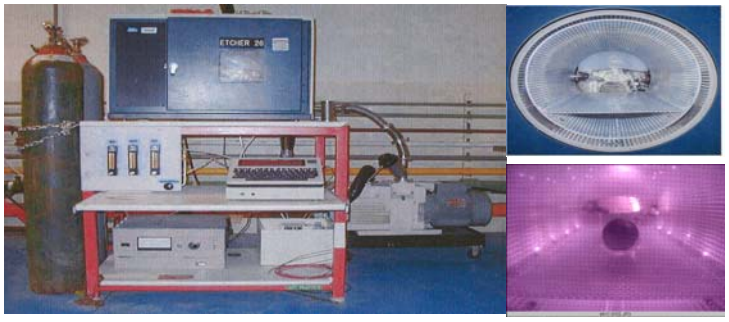
Curriculum Block Diagram for BS Program

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 the next page. 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.



Emphasis

- **Students in the chemical engineering program at Oregon State are encouraged to take technical elective courses that concentrate around one area of study. On page 12, there is an outline of the general topics that can be covered, but a students are encouraged to customize your classes to make an emphasis that is relevant to you.**

CHEMICAL ENGINEERING CURRICULUM (192 credits) - Revised 7/27/2017

Cr.	First Year = 47 credits			Second Year = 49 credits			Third Year = 49 credits			Fourth Year = 47 credits		
	Fall	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**
1	Chemistry CH 231 (4FW)	Chemistry CH 232 (4WS)	Chemistry CH 233 (4S)	O Chem CH 331 (4FW)	O Chem CH 332 (4WS)	Tec Rpts WR 327 (3FWS)	P Chem CH 440 (3F)	P Chem CH 441 (3W)	P Chem CH 442 (3S)	CHE Lab CBEE 414 (3F)	CHE Lab CHE 415 (3W)	ENGR Topics 3 (4S)
2												
3												
4						EE Fund ENGR 201 (3FWS)	ENGR Topics 1 (3 or 4)	Proc Dyn CHE 361 (3W)	Proc Ctrl CHE 461 (3S)	Rxn Engr CHE 443 (4F)	Design CHE 431 (3W)	Design CHE 432 (3S)
5	CH Lab 261 (1)	CH Lab 262 (1)	CH Lab 263 (1)	Diff Eqs MTH 256 (4FWS)	Mtrx & Pwr MTH 306 (4FWS)							
6	Diff MTH 251 (4FWS)	Integral MTH 252 (4FWS)	Vector Calc MTH 254 (4FWS)			HHS 231 (2FWS) Life Fit	Transport 1 Fluids CHE 331 (4F)	Transport II Heat CHE 332 (3W)	Transport III Mass CHE 333 (3S)		Diff., Power, Discrimination (3)	Synth 1 (3)
7												
8						HHS 24* (1)				Unit Ops CHE 411 (4F)		
9				Physics PH 212 (4FWS)	Physics PH 213 (4WS)				Transport Lab CHE 334 (2S)		ENGR Topics 2 (4)	Synth 2 (3)
10	Orient CBEE 101 (3F)	Prob Solv CBEE 102 (3W)	Physics PH 211 (4FWS)			Statics ENGR 211 (3FWS)						
11							Thermo I CHE 311 (3F)	Thermo II CHE 312 (3W)	Persp 3 (3)	Adv Chem 2 (3)		
12												
13	Eng Comp WR 121 (3FWS)	BioSLab[c] (4)	COMM 111/114 (3FWS)	Mat Bal CBEE 211 (3F)	Energy Bal CBEE 212 (3W)	Process Data Anal CBEE 213 (4S)					Free Elective (4)	
14							Engr Ethics CHE 320[d] (3F)	Persp 2 (3)				
15									Adv Chem 1 w/ lab (4)	Persp 4 (3)		
16					Persp 1 (3)							
17												
18												

Notes:

a. **Only Persp, Syn, HHS 231, HHS 24* or PAC, and FREE can be taken with S/U grading** (# of S/U credits are limited to 3X # of terms at OSU, up to 36 max).

b. "Gray 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.

d. CHE 320 satisfies the department Ethics Requirement.

Technical Electives

Univ & College Core

Academic Concentrations in Chemical Engineering at Oregon State University

Students pursuing a chemical engineering degree at Oregon State University in the School of Chemical, Biological, and Environmental Engineering are encouraged to take technical elective courses that concentrate academic preparation in a focus or emphasis area. You must take at least five elective classes, including two Advanced Chemistry courses (minimum 7 credits, one course must have a lab component) and three or four Engineering Topics courses (minimum 11 credits). Three emphasis areas are suggested below, but students are encouraged to develop their own as well. Students are responsible for managing their course selections, which includes completing prerequisites and being aware of when course are offered. Course capacities may be limited.

Biochemical Processes			
Course	**Title (abbrev)**	**Term(s)**	**Cr**
Advanced Chemistry (select CHE 417 or CH 324, and BB 450 & 451)			
CHE 417	Instrumentation (lab)	S	4
CH 324	Quantitative Analysis (lab)	FWS	4
BB 450,451*	General Biochemistry	FW,WS	4,3
Engineering Topics (select 3)			
BIOE 457	Bioreactors	F	3
BIOE 459	Cell Engineering	F	3
BIOE 462	Bioseparations	W	3
BIOE 351	Biomaterials	S	3
BIOE 440, BIOE 445	Bioconjugation, Surface Analysis	S	3
CBEE 416	Process Engineering Project	S	3

Environmental Processes			
Advanced Chemistry (select CHE 417 or CH 324 & one non-lab)			
CHE 417	Instrumentation (lab)	S	4
CH 324	Quantitative Analysis (lab)	FWS	4
CH 422	Analytical Chemistry	W	4
BB 350	Elementary Biochemistry	S	4
TOX 430	Chem Behav in the Environ	F	3
Engineering Topics (select 3)			
CE 412	Hydrology	FS	3
CBEE 416	Process Engineering Project	S	3
ENVE 322*	Fundamentals of Env Eng	W	4
ENVE 421	Water/Wastewater Char	F	4
ENVE 422	Environmental Eng Design	W	4
ENVE 425	Air Pollution Control	S	3
ENVE 431	Fate & Transport in the Env	W	4
ENVE 456	Sustainable Water Res	S	3

Microelectronics and Material Science			
Course	**Title (abbrev)**	**Term(s)**	**Cr**
Advanced Chemistry (select CHE 417 or CH 324 & one non-lab)			
CHE 417	Instrumentation (lab)	S	4
CH 324	Quantitative Analysis (lab)	FWS	4
CH 411	Inorganic Chemistry	FW	3
CH 421	Analytical Chemistry	F	3
CH 422	Analytical Chemistry	W	3
Engineering Topics (select 3)			
BIOE 451	Biomaterials	S	3
CBEE 416	Process Engineering Project	S	3
CHE 444	Thin Film Materials	W	4
CHE 499	Electrochemical Energy Systems	S	3
CHE 445	Polymer Eng and Science	FS	4
CHE 450	Energy Systems	W	3
CHE 451	Solar Technologies	S	3
ECE 415	Mat Science of Nanotech	S	3
ECE 416	Electronic Mat and Dev	F	4
ECE 417	Basic Semiconductor	W	4
ECE 418	Semiconductor Process	S	4
IE 355	Statistical Quality Control	F	4
IE 356	Experimental Design	W	4
MATS 321	Material Science	FWS	4
MATS 322	Material Properties	WS	3
ENGR 221	Sci., Engr., Social Impact of Nanotechnology	F	3

*Prerequisite for majority of emphasis classes

Curriculum Check List
Chemical Engineering (192 cr)

Student's Name: _____ Form completed by: _____

Declared Option: _____ Date: _____

Required ChE Courses (60 credits)

CBEE	101	(3)	
CBEE	102	(3)	
CBEE	211	(3)	
CBEE	212	(3)	
CBEE	213	(4)	
ChE	311	(3)	
ChE	312	(3)	
ChE	331	(4)	
ChE	332	(3)	
ChE	333	(3)	
ChE	361	(3)	
ChE	411	(4)	
CBEE	414	(3)	
ChE	415	(3)	
ChE	431	(3)	
ChE	432	(3)	
ChE	443	(4)	
ChE	461	(3)	
ChE	**334**	**(2)**	

Required ENGR Courses (6 credits)

ENGR	201	(3)	
ENGR	211	(3)	

Advanced Chemistry (17 credits)

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

**Restricted Electives (18 credits)

		( )	
		( )	
		( )	
		( )	
		( )	
CBEE 416	op-tional	(3)	

Free Electives (4 credits)

		( )	

Mathematics (20 credits)

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

Basic Science (27 credits)

CH	231/261	(5)	
CH	232/262	(5)	
CH	233/263	(5)	
PH	211	(4)	
PH	212	(4)	
PH	213	(4)	

Biological Science Elective (4 credits)

		( )	

Communication Skills (9 credits)

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

Fitness (3 credits)

HHS	231	(2)	
HHS	24 x	(1)	

Humanities and Social Sciences (24 credits)

Perspectives

Western Culture	( )	
Cultural Diversity	( )	
Literature & Arts	( )	
Soc. Proc. & Inst.	( )	
Diff., Power, Disc.	( )	
Persp. Elective	( )	
CHE 320	(3)	

Synthesis

Cont. Global Issues

Sci., Tech. & Soc.	

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

****11 credits must be upper division engineering topics; 7 credits must be Advanced Chemistry /one chemistry class with a lab**

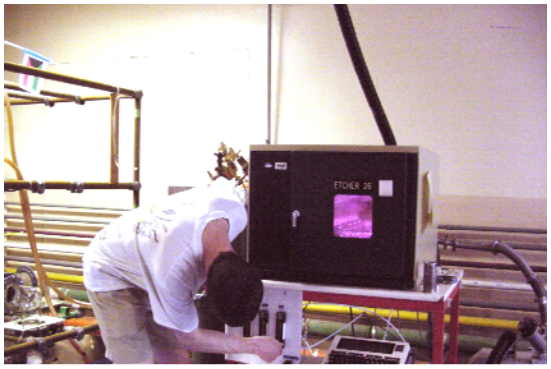
Our Mission is to graduate students immediately prepared for professional practice.

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.

CHE MECOP	FALL	WINTER	SPRING
Junior	CHE 311 CHE 320 CHE 331 CH 440 ENGR 407	CHE 312 CHE 332 CHE 333	INTERNSHIP
Senior I	CHE 443 CHE 411 CBEE 414	CH 441 CHE 415 CHE 361	CH 442 CHE 334 CBEE 416 CHE 461
Senior II	INTERNSHIP	CHE 431	CHE 432



May 24, 2016