Department of Chemical and Biomolecular Engineering

Program Guide and Undergraduate Advising Handbook

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Program overview

With the advantage of a nationally ranked University, a campus culture that encourages excellence in teaching, students who are among the best in the country and faculty who comprise a top 25 graduate research program, the undergraduate chemical engineering program at Notre Dame is, in the words of a distinguished external reviewer "... among the elite". The curriculum emphasizes fundamental aspects of chemical engineering to ensure applicability of students' knowledge to the many industrial sectors (e.g., chemicals, petroleum, food products, consumer goods, electronic devices and materials, drug manufacture and delivery, medical diagnostics, financial analysis and business consulting) that employ our graduates. This training has proved excellent for law school medical school, MBA programs as well as graduate school in chemical engineering and biomedical engineering. This fundamental approach assures a long "half-life" for students' education and facilitates subsequent industry specific training and lifetime learning. Written and oral communication skills are honed in two chemical engineering labs and the capstone design course. A special course for Sophomores, *Careers for Chemical Engineers*, which has outside speakers as its main component, has recently been initiated to help students plan possible career paths starting early in their academic tenure.

Academic Advising in Chemical and Biomolecular Engineering

All of the students in the department have regular teaching and research faculty as academic advisors. Each faculty member has a relatively small number of advisees and can devote appropriate time to discussions with these students. Faculty advisors are able to provide information about the curriculum and courses in our department, advice to students about how to approach classes to be more successful, insight into career possibilities and specific information about graduate schools in chemical engineering. It is quite possible that some advisors will not know the answer to all of the subtle or perhaps bureaucratic aspects of registration – that this what this document is for. (Or, contact the department chair)

All students are encouraged to fill out the questionnaire that is found below in Appendix II and to discuss your answers with your advisor at least once a year. Most likely you will find that self-assessment and goal-setting will aid your ability to succeed at your chosen endeavors. This questionnaire is intended to get students thinking about this process.

Career Placement

The Career Center (http://careercenter.nd.edu/)) is the centralized career and placement center for students and alumni of the University of Notre Dame. Each year many companies come to campus to interview students for both permanent jobs and summer internships. All of these interviews are coordinated by the Career Center. Students have access to visiting recruiters through "GoIRISH" (https://careercenter.nd.edu/for-undergrads), which keeps track of student profiles and resumes, lists job postings by companies and is used to schedule interviews. The placement office staff offers resume and cover letter reviews, mock interviews and assistance with "customized" job searches and career exploration. The staff member who is responsible for Engineering is Laura Flynn, Laura.B.Flynn.59@nd.edu.

Undergraduate research

Students are encouraged to consider undergraduate research to enrich their educational experience. Undergraduate research is conducted as an individual arrangement between a student and a faculty member. Students should contact faculty who direct research in areas that match their interests.

There are three different designations for research.

CBE 48901. Undergraduate research. This is the course that students should sign up for as their first experience in research. Normally students will choose 1 credit (4-5 hours/wk) or 2 credits (8-10 hours/wk). This course is S/U. Up to 3 credits of 48901 may be counted in the free elective slot.

CBE 48902. Advanced undergraduate research is a three credit course on which students should expect to spend 12-15 hours per week. It can be counted as an *Engineering/technical* elective and students must produce a written report of their results at the end of the semester. This course is graded.

CBE 48903/48904, **Undergraduate thesis**. This is a two-course sequence of two credits each semester. Successful completion of **CBE 48901** or a summer research internship in the Department is a prerequisite for enrolling in **CBE 48903**. Students are required to produce a substantial written document that will be defended orally to a committee of faculty. This two-course sequence can be counted as a (3 credit) *CBE* elective.

International Programs

Chemical Engineering students can participate in a number of international study programs. In the past several years these have included the Fall Semester (Junior) London Program, the Fall Semester (Junior) Australia program in Perth (*University of Western Australia*), a full year (Junior) program in Ireland (*University College Dublin*) and Spring Semester (Junior) in Monterrey Mexico. There is also a summer engineering program in London. While all of these programs require some degree of schedule customization, it is normally possible to work this out so that students can participate without delaying graduation.

It is best to plan for international study starting at the beginning of the Sophomore year. Please contact the CBE department chair (mjm@nd.edu) to discuss schedule options for your chosen location(s). Also contact the International Study Office and/or monitor their homepage (http://www.nd.edu/international/index.shtml) to determine application procedures and deadlines.

It is also possible to participate in the Summer London Engineering Program with no disruption of the normal curriculum. The normal situation is that both courses taught there will count as engineering/technical electives. Note that this is an Engineering College program, not the summer London program that is run by the International Program office. The web page is http://www.nd.edu/~engineer/sumlon/.

Fundamentals of Engineering Exam

The Fundamentals of Engineering (FE) (See http://www.ncees.org/exams/fundamentals/) Exam is the first step for engineers to become licensed professional Engineers. Traditionally, chemical engineers did not deal with the public directly, and so did not need professional registration. Chemical engineers could do work for a company without a license. If there was a need for permits for a construction project, one of the structural engineers "signed off" on the plans. However there are two important reasons for chemical engineering graduates who expect to work in any way as an "engineer" to consider taking the FE exam when they are seniors and then to get professional registration. First is that you will most likely not spend your entire career with the same company. When you are seeking a job change, the PE license is a "transportable credential" that you will have received after your degree. Secondly, as you move through your career you may find yourself as the "front line" person who needs registration either because of job function within your company or because you have started your own firm and need the license to affirm legitimacy. Another reason to become registered is that in some states (e.g., Texas) you can certify the plans for the deck or porch you are adding to your house when you go to get a building permit!

Undergraduate Curricula

Regular curriculum. Class of 2011 and earlier

FIRST YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 10550, Calculus I	4	MATH 10560, Calculus II	4
CHEM 10121, Gen Chem I	4	CHEM 10122, Gen Chem II	3
Arts and Letters (A&L, I)	3	Univ. Sem 1318X/FYC 13100 (A&L, III)	3
EG 10111, Intro to Engineering	3	EG 10112, Intro to Engineering	3
FYC13100 Comp/Univ. Sem. 1318X (A&L II)	3	PHYS 10310, Gen Phys I	4
	17		17

SOPHOMORE YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 20550, Calculus III	3.5	MATH 20580, Linear Algebra & ODE's	3.5
CHEM 20223,Org Chem I	3	CHEM 20224, Org Chem II	3
CHEM 21223, Organic Chem Lab I	1	Arts and Letters V	3
PHYS 10320, Gen Phys II	4	CBE 20258, Computer Mtds	3
CBE 20255, Intro to Chemical Engineering	3	CBE 20256, Thermodynamics	4
Arts and Letters IV	3		
	17.5		16.5

JUNIOR YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 30650, Diff Eqns	3	CHEM 30324, Physical Chem	3
CHEM 30333, Analytical Chem	2	CHEG 30356, Transport Phen II	3
CHEM 31333, Analytical Chem Lab	2	CBE 30338, Chem Proc Control	3
Arts and Letters VI	3	CBE 31358, Chem Eng Lab I	3
CBE 30361, Materials	3	Arts and Letters VII	3
CBE 30355, Transport Phen I	3		
	16		15

SENIOR YEAR

First Semester	Cr.	Second Semester	Cr.
CBE Elective	3	CBE 40448, Proc Design	3
CBE 41459, Chem Eng Lab II	3	Engineering/Technical Elective	3
CBE 40443, Separation Proc	3	CBE Elective	3
CBE 40445, Chem Rxn Eng	3	Engineering/Technical Elective	3
Advanced Science Elective	3	Arts and Letters VIII	3
	15		15

total:129 credits

The 8 Arts and Letters slots are for: 2 Phil, 2 Theo, 1 Hist., 1 Soc. Sci, 1 Fine Arts/Lit., FYC 13100.

A list of courses that fulfill the Advanced Science elective is available on page 16

Chemical and Biomolecular Engineering Curriculum

Class of 2012 and Beyond

Freshman

Fall semester		Spring semester	
MATH 10550, Calculus 1	4	MATH 10560, Calculus 2	4
CHEM 10171/11171	4	CHEM 10122	3
EG 10111, Intro to Eng	3	EG 10112, Intro to Eng	3
Arts & Letters 1	3	PHYS 10310, Gen Physics 1	4
University seminar/A&L 2	3	University seminar/A&L 3	3
	17		17

Sophomore

Fall semester		Spring semester	
MATH 20550, Calculus 3	3.5	MATH 20580, Linear/ODEs	3.5
CHEM 10172, Organic 1	3	CHEM 20273, Organic 2	3
CHEM 11172, Organic Lab 1	1	CBE 20266, Thermodynamics 1	3
CBE 20255, Intro to Chem. Eng.	3	CBE 20258, Computer Methods	3
PHYS 10320, Gen Physics 2	4	A&L 5	3
A&L 4	3		
	17.5		15.5

Junior

Fall semester		Spring semester	
MATH 30650, Differential Eqns.	3	CHEM 30324, Physical Chem.	3
CHEM 30333, Analytical Chem.	2	CBE 30338, Chem. Proc. Control	3
CHEM 21333, Analytical Lab.	2	CBE 30356, Transport 2	3
CBE 30355, Transport 1	3	CBE 31358, Chemical Eng. Lab	3
CBE 30367, Thermodynamics 2	3	A&L 6	3
CBE 30361, Materials	3		
	16		15

Senior

Fall semester		Spring semester	
CBE 40443, Separations	3	CBE 40448, Process Design	3
CBE 40445, Reaction Engineering	3	CBE Elective	3
CBE 41459, Chemical Eng. Lab 2	3	Tech Elective	3
CBE Elective	3	Advanced Science Elective	3
A&L 7	3	A&L 8	3
	15		15

Total 128 credits

Students planning to apply to medical school will want to take BIOS 20201, Gen Biology A, in the Fall Sophomore semester, BIOS 20202, Gen Biology B, in the Spring Sophomore semester, and the Organic Chemistry Lab 2, CHEM 21273.

Curricular Options

The only undergraduate engineering degree granted by the department is in Chemical Engineering. However, there are three curricular "options" that provide students suggested elective sequences to get a deeper background in the areas of *Materials*, *Environmental Chemical Engineering* or *Biomolecular Engineering*. There is also a *pre-med* option for students who intend to apply to medical school.

Premed option

Chemical engineering provides an excellent background for medical school. Many of the fundamental subjects have relevance and provide insight into living systems. Examples are respiration (mass transfer and thermodynamics), cell metabolism (mass transfer, chemical reaction) and organism physiology (energy and mass balances, control, mass transfer and reaction). A direct link to medicine is drug delivery that involves materials, mass transfer, thermodynamics mass balances and chemical reaction.

Medical schools have three basic course requirements for admission in addition to a Bachelor's degree. These are one year of general chemistry (sometime mistakenly called "inorganic" chemistry), one year of general biology and one year of organic chemistry. They expect that most of these courses will have accompanying labs, so students should take all of the labs that are available with these. Medical schools seem to vary widely on how rigidly they interpret the need for an entire year of study for each subject and the need for a lab with every course. It is possible to get considerable insight into this and other aspects of admission for different medical schools by going to the *USNews* website for medical school rankings (http://www.usnews.com/usnews/edu/grad/rankings/med/medindex_brief.php) and then clicking on your favorite school and following the links to admission requirements. Note that inclusion of "labs" with any one of these courses should not be an issue for chemical engineers as they have two chemical engineering labs and analytical chemistry lab. (… but it is safer to not rely on medical school admissions people understanding this!)

The chemical engineering premed option incorporates biology, BIOS 20201 and 20202, into the Sophomore year. Students also have at least one more elective for physiology, genetics or cell biology. They can take bioengineering courses for their ChEg electives. Students will want to contact the pre-professional office before Junior year to get set up with the formal application process that is administered by them. This office has information about when to take the MCAT and when medical school applications need to be submitted. They can also give students a reasonable assessment of the chances of admission at a particular school.

Some words of caution. Essentially all students will find chemical engineering a much harder major than "PreProfessional" and will consequently have a slightly, to somewhat, lower GPA in chemical engineering. (Of course chemical engineering is a much more intrinsically rich degree with greater value for a broad range of careers!). Because GPA constitutes a large part of the admission assessment criteria medical schools and many will not give particular credit to chemical engineers, students need to be sure that they weight this risk that can lower their chance of admission. Another minor point, which shows the cultural divide between chemical engineering and medical schools, is the value of *research*. Undergraduate research is a strong asset to a resume for a student applying to graduate school or working at many companies.

However, many medical schools are likely to value any clinical experience or other experience with people in health care settings more than research.

Pre-Med Option 2011 and earlier

FIRST YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 10550, Calculus I	4	MATH 10560, Calculus II	4
CHEM 10121, Gen Chem I	4	CHEM 10122, Gen Chem II	3
Arts and Letters (A&L, I)	3	Univ. Sem 1318X/FYC 13100 (A&L, III)	3
EG 10111, Intro to Engineering	3	EG 10112, Intro to Engineering	3
FYC13100 Comp/Univ. Sem. 1318X (A&L II)	3	PHYS 10310, Gen Phys I	4
	17		17

SOPHOMORE YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 20550, Calculus III	3.5	MATH 20580, Linear Algebra & ODE's	3.5
PHYS 10320, Gen Phys II	4	CBE 20256, Thermodynamics	4
CHEM 20223, Organic Chem I	3	CHEM 20224, Organic Chem II	3
CHEM 21223, Organic Chem Lab I	1	CHEM 21224, Organic Chem II Lab	1
CBE 20255, Intro Chem Eng	3	CBE 20258, Comp. Methods	3
BIOS 20201, Gen Biology A	4	BIOS 20202, Gen Biology B	4
	18.5		18.5

JUNIOR YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 30650, Diff Eqns	3	CBE 31358, Chem Eng. Lab I	3
Arts and Letters IV	3	CHEM 30324, Phys Chem	3
CBE 30355, Transport Phen I	3	CBE 30338, Chem Proc Control	3
CHEM 30333, Analytical Chem	2	CBE 30356, Transport Phen II	3
CHEM 31333, Analytical Chem Lab	2	Arts and Letters V	3
CBE 30361, Materials	3	Arts and Letters VI	3
	16		18

SENIOR YEAR

First Semester	Cr.	Second Semester	Cr.
CBE Elective[@]	3	CBE 40448, Proc Design	3
CBE 41459, Chem Eng Lab II	3	CBE Elective[@]	3
CBE 40443, Separation Proc	3	*Engineering/Technical Elective	3
CBE 40445, Chem Rxn Eng	3	[#]Advanced Science Elective	3
Arts and Letters VII	3	Arts and Letters VIII	3
	15		15

TOTAL = 136 credits

*Suggestions: BIOS, 30341, 30326, 30344 or 40435.

The 8 Arts and Letters slots are for: 2 Phil, 2 Theo, 1 Hist., 1 Soc. Sci, 1 Fine Arts/Lit. , 1 FYC 13100.

[#] Biochemistry, CHEM 40420 is recommended.

[@]Suggested CBE electives are Bioprocess Engineering, Biomedical Transport Phenomena or Biomaterials Engineering

Biomolecular Engineering option

Notre Dame is following a plan to *integrate* an understanding of Life Sciences throughout the curriculum, and to create new elective courses in fundamental topics of bioengineering that emphasize a rigorous application of engineering analysis and design principles. The goal is to train engineers who are prepared to manufacture for the public, exciting new *life-science inspired* products, just as chemical engineers have done for chemical compounds for the past century.

The *Biomolecular Engineering* Option fits within the fully accredited Bachelor of Science in Chemical Engineering degree. Students who complete this option, *Biomolecular Engineers*, will have a strong understanding of structure and function of biologically active molecules and how they interface with both living systems and inanimate chemical systems. The application of chemical engineering mathematics, analysis, and computation will enable graduates in this field to develop new products using molecular biology, analyze and design process systems ranging from the microscopic to macroscopic scale, and integrate their new bioproducts into existing materials. Such products include artificial skin, blood, organs, and tissues, advanced delivery systems for essential pharmaceuticals, new drugs based on knowledge obtained from the human genome, revolutionary sensors that rapidly and sensitively detect bacteria, in people and in products designed for human use and consumption. A key part of this program, that is not discernable from just the curricular sheet, will be the incorporation of life science example problems into many of the core chemical engineering courses.

Biomolecular Engineering Option

FIRST YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 10550, Calculus I	4	MATH 10560, Calculus II	4
CHEM 10121, Gen Chem	4	CHEM 10122, Intro to Cell/Mol Bio	3
Arts and Letters (A&L,I)	3	Univ. Sem 1318X/FYC 13100(A&L, III)	3
EG 10111 Intro to Engineering Sys	3	EG 10112 Intro to Engineering Sys	3
FYC 13100/Univ. Sem. 1318X (A&L II)	3	PHYS 10310, Gen Phys I	4
	17		17

SOPHOMORE YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 20550, Calculus III	3.5	MATH 20580, Linear Algebra & ODE's	3.5
CHEM 20223,Org Chem I	3	CHEM 20224, Org Chem II	3
CHEM 21223, Organic Chem Lab I	1	Arts and Letters V	3
PHYS 10320, Gen Phys II	4	CBE 20258, Computer Mtds	3
CBE 20255, Intro Chem Eng	3	CBE 20256, Thermodynamics	4
Arts and Letters IV	3		
	17.5		16.5

JUNIOR YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 30650, Diff Eqns	3	CHEM 30324, Physical Chem	3
CHEM 30333, Analytical Chem	2	CBE 30356, Transport Phen II	3
CHEM 31333, Analytical Chem Lab	2	CBE 30338, Chem Proc Control	3
BIOS 20201, General Biology	4	CBE 31358, Chem Eng Lab I	3

CBE 30361, Sci of Eng Materials	3	CHEM 40420 Biochemistry	3
CBE 30355, Transport Phen I	3	Arts and Letters VI	3
	17		18

SENIOR YEAR

First Semester	Cr.	Second Semester	Cr.
CBE 40481/60581 Biomedical Eng Transport Phen[@]	3	CBE 40448, Proc Design	3
CBE41910 Biomolecular Engineering Laboratory	3	Arts and Letters VII	3
CBE 40443, Separation Proc	3	CBE 40483 Topics in Biomol. Eng.[@]	3
CBE 40445, Chem Rxn Eng	3	Advanced Biology Elective	3
Advanced Biology Elective[+]	3	Arts and Letters VIII	3
	15		15

total:132 credits

The 8 Arts and Letters slots are for: 2 Phil, 2 Theo, 1 Hist., 1 Soc. Sci, 1 Fine Arts/Lit., ENGL 110.

[#] A list of courses that fulfill the Advanced Science elective is available in chemical engineering advising handbook

[+] Suggested biology electives are Cell biology [30341], Developmental biology[30342], Molecular biology[60531], Microbiology[30401] and Genetics[30326].

[@] Or other bioengineering electives in chemical engineering.

Materials Option

Chemical engineers are intimately connected to the development of new ceramics, polymers and catalysts and the manufacture of both commodity and specialty materials. The materials option is intended show students how molecular and macro aspects of structure control the properties and thus performance of materials.

This program is designed to offer a structured set of elective courses in materials science and engineering for students pursuing the chemical engineering undergraduate degree program. It does not require any additional credit hours. Two highlights of the program are required undergraduate thesis research (2 credit hours each semester) in the senior year, and a laboratory course (2 credit hours) in the sixth semester. In addition, the lecture course CBE 40461- Structure of Solids, is required in the seventh semester. Students intending to participate in the Certificate Program follow the course schedule indicated on the attached sheet.

The topics for the senior thesis will be made available to interested students in the sixth semester. The thesis will be a written document, and will require an oral defense before the faculty members participating in the program.

Upon successful completion of the program, at graduation, students will receive a Certificate in Materials Science and Engineering, along with the diploma for the Bachelor of Science degree in Chemical Engineering.

Program Faculty

Faculty members participating in the Certificate Program currently include:
D.A. Hill, E.J. Maginn, P.J. McGinn and E.E. Wolf.

Students interested in pursuing the Certificate Program should contact the program coordinator, Prof. P.J. McGinn.

Laboratory Course

CBE 41362 - Laboratory Techniques in Materials Science & Engineering

This course is required for all participants in the Certificate Program. The course is a two-credit laboratory class that meets once per week. It consists of lectures on the theory of the measurement method and laboratory experience in applying the techniques to selected materials. Topics to be covered may include: X-ray diffraction, Auger/XPS analysis, Image Analysis / Optical Structure Characterization, Thermal Analysis (DTA/TGA), SEM/EDS, Computer-based Structure Simulation (using Biosym or equivalent software packages), FTIR, AFM/STM, magnetic susceptibility, and polymer structure characterization.

Prerequisites and Course Structure: A prerequisite for the course is the introductory course Science of Engineering Materials (CBE 30361). The course is limited to eight students, with participants in

the Certificate Program receiving priority. The class meets one afternoon a week, with one hour devoted to lecture and the remainder (2.5 hrs) to laboratory work. Each characterization topic is introduced over 2-3 class periods, so that 4-6 topics are covered during the semester, depending on the time demands of various experiments. Written laboratory reports are submitted one week after the completion of each topic. Students use equipment located in the research laboratories of the participating faculty members.

Additional Courses to Satisfy the Technical Elective

CBE 60565 Electrochemistry and Corrosion
CBE 60910 Selected Topics in Materials Processing
CBE 60556 Polymer Engineering

AME 50045 Mechanical Behavior of Materials
AME 50542 Engineering Analysis of Manufacturing Processes
AME 60646 Failure of Materials
GEOS 60500 ICP-MS Analytical Techniques
EE 40446 IC Fabrication Laboratory
EE 60576 Microelectronic Materials

PHYS 80501 Solid State Physics
CHEM 40443 Inorganic Chemistry
CHEM 90616 Solid State and Cluster Chemistry

DEPARTMENT OF CHEMICAL ENGINEERING
UNDERGRADUATE CURRICULUM

CERTIFICATE PROGRAM IN MATERIALS SCIENCE & ENGINEERING

(Changes from the regular undergraduate curriculum are shown in boldface type)

FIRST YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 10560, Calculus I	4	MATH 10560, Calculus II	4
CHEM 10121, Gen Chem I	4	CHEM 10122, Gen Chem II	3
Arts and Letters (A&L,I)	3	Univ. Sem 1318X/FYC 13100(A&L, III)	3
EG 10111 Intro to Engineering	3	EG 10112 Intro to Engineering	3
FYC13100/Univ. Sem. 1318X (A&L II)	3	PHYS 10310, Gen Phys I	4
	17		17

SOPHOMORE YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 20550, Calculus III	3.5	MATH 20580, Calculus IV	3.5
Arts and Letters IV	3	CHEM 20224, Org Chem II	3
PHYS 10320, Gen Phys II	3.5	CBE 20258, Computer Mtds	3
CBE 20255, Intro Chem Eng	3	CBE 20256, Thermo	4
CHEM 20223, Org Chem I	3	Arts and Letters V	3
CHEM 21223, Org Chem Lab	1		16.5
	17.5		

JUNIOR YEAR

First Semester	Cr.	Second Semester	Cr.
MATH 30650, Diff Eqns	3	CHEM 30324, Phys Chem II	3
CHEM 30333, Analytical Chem	2	CBE 30356, Transport Phen II	3
CHEM 31333, Analytical Chem Lab	2	CBE 31358, Chem Eng Lab I	3
Arts and Letters V	3	CBE **41362, Lab. MSE**	2
CBE 30361, Sci of Eng Materials	3	CBE 30338, Chem Proc Control	3
CBE 30355, Transport Phen I	3	Arts and Letters VII	3
	16		17

SENIOR YEAR

First Semester	Cr.	Second Semester	Cr.
CBE Elective	3	CBE 40448, Proc Design	3
CBE 41459, Chem Eng Lab II	3	**Tech Elective (MSE)**	**3**
CBE 40443, Separation Proc	3	CBE **48903, Research**	**2**
CBE 40445, Chem Rxn Eng	3	Elective	3
CBE **60561, Structure of Solids**	**3**	Arts and Letters VIII	**3**
CBE **48902, Research**	**2**	Advanced Science Elect@	3
	17		**17**

Total:135 credits

@ A list of courses that fulfill the Advanced Science elective is available in chemical engineering advising handbook

The 8 Arts and Letters slots are for: 2 Phil, 2 Theo, 1 Hist., 1 Soc. Sci, 1 Fine Arts/Lit. , 1 FYC 13100.

Appendix I

Brief information and definitions

Electives:

CBE Elective: any three-credit 40XXX or 60XXX CBE course that is not already required.

Engineering/Technical elective: Non-required, 20XXX+ level course in the College of Engineering or the College of Science that enhances the student's understanding of the subject. See the lists on pages 16 and 17 for many of the possible courses.

Note: CHEM 20204*, Environmental Chemistry* and CHEM 20243, *Inorganic Chemistry* count in this category.

Chemistry/Advanced Natural Science Elective: A Chemistry or other advanced natural science course that advances a student's understanding of the scientific fundamentals.

Currently available chemistry courses that satisfy this are: CHEM: 40420, 40434, & 40443. Note that CHEM 20204*, Environmental Chemistry* does not count in this category.

Other "advanced natural science" courses that can be used to satisfy this requirement are:
BIOS: 20303, 30304, 30305, 30312, 30341, 30301, 30344, 30401, 30404, 30406, 30408, 40415;
Phys: 37341, 30472, 30471.

Elective or "Free Elective" any Notre Dame course or courses totaling three credits. Advanced placement in a subject that is not required (e.g., French) is also accepted but must be verified with the Registrar's office. The following restrictions apply:

We will count three total activity credits (e.g., from various music ensembles) but not more than one such credit in a given semester. We also do not count "AP" credits for Math Courses that precede Calculus.

Courses in Mathematics, Chemistry, Biology and Physics can be used in this category only if they are included in the lists on pages 20 and 21. Non-required Chemical Engineering courses may also be used for free electives. Non-required College of Engineering courses with call numbers > 200 may also be used. See the special note for EPICS below.

University requirements

(See page 22 for details)

One course in **Composition**, FYC 13100
Two courses in **Philosophy** (ND only)
Two courses in **Theology**,(ND only)
One course in **History**.
One course in **Social Science**, from departments of Anthropology, Economics, Government and International Studies, Psychology or Sociology
One course in **Literature or Fine Arts**

ROTC

Students can count one upper level ROTC course for either history or social science and three credits toward a *Free* elective.

EPICS

Credits earned doing *EPICS* projects are counted in the *Free* Elective category. However, students may petition the Department Chair for changing (only) a three credit group of these to an *Engineering* Elective. The written report for the project and a description of a student's specific role are required.

Maximum Credit load is 19/semester

Chair and Associate Dean must approve an overload. See Associate Dean's Assistant to do this.

Courses taken elsewhere

Prior approval is needed before courses taken at other Universities can be taken. Students need to get a course description from a standard course catalog or website. If the institution is not well known, he or she should provide the entire course catalog for examination by CBE faculty advisor and the Associate Dean. Advisor needs to "OK" and then Associate Dean needs to OK. Associate Dean's administrative assistant has the necessary forms.

How do the forms work?

All are available in 182 Fitzpatrick Hall.

drop/add

(Academic Course Change) Used after 7 day registration period. Students should be able to "DART" during the first 7 days of a semester.

i. Needs *administrative* signature from department offering course
ii. Signatures from Student, Advisor and Associate Dean (Uhran)
iii. Student then distributes copies to the Registrar's office and the appropriate departments.

Change of Major

(Student academic program selection)

If leaving Engineering, needs CBE Chair signature and Associate Dean Signature, then signatures of Chair and Associate Dean of new college. Form should normally be deposited with the new college office.

If entering Chemical Engineering, needs to meet with CBE Chair and devise a program of study and then will be assigned an advisor.

Symmetry prevails and form must have signatures of Chair and Associate Dean of College he or she left and then signatures of Chair and Associate Dean of Engineering college. Form should normally be deposited with the Engineering Deans' office.

Getting into "Closed" courses.

If a student desires to register for a course that is closed, she/he needs to go to the departmental office that offers the course. An assistant in this office will either place the student in the class or wait list the student or deny the request.

Advanced Placement

Students should make sure that all AP test results are noted on the academic record at the time of admission. The registrar handles this and problems should be fixed as soon as they are noted.

In general, AP credits will count in the appropriate University requirement (See above, e.g., American History) slots or in Mathematics (Calculus), Physics or Chemistry. Foreign language credits will count in the "Elective" slot. We do not count mathematics courses before Calculus anywhere.

Exceptions to this document

Although every effort is made within this document to cover all course/curriculum issues for all students, it is recognized that there is occasionally a need for *exceptions*. Examples of exceptions are course substitutions for out of sequence students and approvals for new and/or special courses. The procedure for *exceptions* is as follows. The student will discuss the issue with her/his advisor. When an agreement is reached, the student will discuss the request with the department chair. Note that the department chair must approve all exceptions. The department chair will discuss the exception as necessary with the Associate Dean. If the request will be approved a "paper trail" is generated by the student first making a request by email to the department chair (currently, mjm@nd.edu). The department chair will then send copies of the approved request to the Associate Dean for the student's official files and back to the student to confirm that the exception is officially approved.

Courses accepted as technical and engineering electives

Science Courses
(these count as a *Technical* elective)

Biology:
- 20201, 10107 General Biology (20201 Fall, 10107 Spring)
- 20303, Fundamentals of Genetics, Spring (PreReq: BIOS20201)
- 30304, General Botany (PreReq: BIOS20201, 10107)
- 30305, Evolution, Spring (PreReq: BIOS20201, 10107)
- 30312, General Ecology, Fall and Spring (PreReq: BIOS20201, 20202)
- 30341, Cellular Biology, Fall and Spring (PreReq: BIOS20201)
- 30301, Developmental Biology, Spring (PreReq: BIOS20201, 20202)
- 30344, Vertebrate Physiology, Fall (PreReq: BIOS20201, 20202)
- 30401, Microbiology, Fall (PreReq: BIOS20201, 20202)
- 30404, Vertebrate Biology, Fall (PreReq: BIOS20201, 20202)
- 30406, General Entomology, Occasionally (PreReq: BIOS202011, 20202)
- 30408, Anthropods and Human Disease, Occasionally (PreReq: BIOS20201, 20202)
- 40415, Medical and Veterinary Parasitology, Spring (PreReq: BIOS20201, 20202)

ENVG	20110, Physical Geology
	40300, Geochemistry
	40410, Geophysics GEOS
	20100, Environmental Geosciences
Mathematics:	20211, Computer Programming and Problem Solving
	30530, Introduction to Probability
	30540, Mathematical Statistics, (PreReq: MATH 30530)
	30745-30755 Real Analysis
	40480, Complex Variables
	40750, Partial Differential Equations
	40760, Differential Geometry
	40710, Computability and Logic
	40740, Topics in Mathematical Logic
Physics:	20431, General Physics III
	20455, Mechanics I
	20458, Mechanics II (PreReq: PHYS 20455)
	20464, Modern Physics I, (PreReq: PHYS 20455)
	30389, Philosophical Issues in Physics
	37341, Topics in Astronomy and Astrophysics
	30432, Lasers and Modern Optics (PreReq: PHYS 20431)
	30471, Electricity and Magnetism (PreReq: PHYS 20455)
	40403, Methods of Theoretical Physics
	40371, Medical Physics

<u>(non-CBE) Engineering Courses</u>
(these count as *Engineering*/*Technical* electives)

AME: 20221, 20222 Mechanics I and II.
20241, Solid Mechanics (PreReq: AME 20221)
20211, Introduction to Aeronautics
50561, Statistical Quality Methods
50542, Engineering Analysis of Manufacturing Processes(PreReq: AME 20241)

CE: 20131, Concepts in Civil Engineering Analysis
20110, Stochastic Concepts in Engineering Planning and Design
34200, Structural Mechanics I (PreReq: CE/AME 20170/20241)
43020, Environmental Chemistry
40620, Transportation Engineering
40120, Numerical Methods in Engineering
40455 Water Distribution and Wastewater Collection
40560, Groundwater Hydrology
30510, Introduction to Geotechnical Engineering
40560, Legal, Ethical and Business Relations in Engineering
30320, Introduction to water chemistry and treatment

CSE: 20110, Discrete Mathematics
20211, Fundamentals of Computing I
20221, Logic, Design and Sequential Circuits
20232, Advanced Programming
20033, Functional Programming (PreReq: CSE 20232)
30331, Data Structures (PreReq: CSE 20110)
40131, Programming Languages

EE: 20224, Introduction to Electrical Engineering
20234, Electric Circuits I (PreReq: EE 20224)
20242, Electronics I (PreReq: EE 20224)
30347, Semiconductors I: Fundamentals (PHYS 20431)
34348, Electromagnetic Fields and Waves I (PreReq: EE 20234, PHYS 20431)

EG 40421, Integrated Engineering and Business Fundamentals
40422, Advanced Integrated Engineering and Business Topics (EG 40421)

Registration Notes for College of Engineering Faculty Advisors

1. BACCALAUREATE DEGREE REQUIREMENTS

Each student must satisfy the curricular requirements published in the "Bulletin of Information Undergraduate Programs" and meet all additional requirements (including a minimum of 60 credits at Notre Dame) of Article 15 of the Academic Code in order to earn a Bachelor of Science degree in the College of Engineering. These include the University (Arts/Letters) Core, Engineering Core and Program Core.

University Core:

a) Composition – FYC 13100

b) University Seminar* -- An intensive writing course required in First Year. It is offered in a variety of subjects in the humanities. 1318X are the numbers in different departments.

c) Philosophy* -- two courses. These courses must be taken at Notre Dame.

d) Theology* -- two courses.. These courses must be taken at Notre Dame.

e) History* -- one course from the offerings of the History Department.

f) Social Science* -- one course from the offerings of the Anthropology, Economics, Government and International Studies, Psychology or Sociology Departments.

g) Literature or Fine Arts* -- one course.

1) Fine Arts. From the offerings of the Art, Art History and Design Department; from the three (3) credit course offerings of the Music Department, and from the introductory theater courses offered by the Film, Television and Theater Department. Studio courses are permitted except for skill courses like piano lessons, etc. See separate list for more detail.

2) Literature. Literature courses offered by the English Department, the Classical and Oriental Languages Department, the German and Russian Languages Department, and the Romance Languages Department are acceptable.

Only First Year Students may take 10XXX Level Courses.

+*RLST is the prefix for theology courses offered at St. Mary's College*

**The University Seminar Course, XXX 180 taken in First Year of Study, may replace any one of the University Core Courses except ENGL 110 or the second Theology and Philosophy courses.*

2. ROTC COURSES

A maximum of 6 credit hours of upper level ROTC courses may be accepted as credit toward College of Engineering degree requirements. Requirements for which ROTC courses may be substituted are determined by the Department except that not more than 3

credits of ROTC can be substituted for History or Social Science. Only ROTC students are eligible for this substitution (ROTC courses taken by non-ROTC students are not creditable toward the degree requirement). Thus, the student must complete the ROTC program of choice to exercise this option.

3. CREDIT HOUR LOADS

a. Maximum credit load per semester =19

The permission of the student's Department Chair and Dean of the student's College is required for taking an overload.

ROTC courses, marching band, glee club, choral, music lessons, etc., are not included in the credit-hour load calculation.

Maximum credit hours must be changed in the student's Dean's office (see Assistant to Associate Dean) before a student can enroll in more than 19 "countable" credit hours. This will only be done at the beginning of each semester.

****Subject to the approval of the Chair of the department in which the student is enrolled.*

b. Minimum credit load per semester =12

The minimum number of credits that a student must be registered for, and still remain a full time student, is 12.

c. Summer session load

The annual load for a student during the summer session is 8 credits. The permission of the Dean of the College is required to exceed this number.

4. PASS-FAIL OPTION

Each JUNIOR and SENIOR may take one ELECTIVE, NON-MAJOR course per semester on a Pass-Fail (P/F) basis. For the College of Engineering, those courses will include:

a) Free elective (if not offered by the student's department).

b) Technical electives (if not offered by the student's department).

but exclude courses in the University Core.

Students must enroll in the course first, then request a change to pass/fail status in the Dean's office (see Assistant to Associate Dean of Academic Affairs) during the first seven days of each semester. A grade of "P" does not affect the GPA; a grade of "F" is counted in the GPA.

5. PREREQUISITES

Students cannot enroll in a given course unless they have passed or are enrolled in the prerequisite courses. For valid reasons a student may be permitted to enroll in a course for which he or she does not have the stated prerequisite by using a "Course Registration Exemption Form". Valid reasons include having taken an equivalent course elsewhere (transferred courses do not satisfy the DART system for prerequisite purposes). An F grade in a prerequisite is not a valid reason.

Inasmuch as accreditation requires that "....computer work (be integrated) into course work wherever appropriate throughout the academic program," a working knowledge of some procedure-oriented language must be considered a prerequisite for any engineering course at the sophomore level or above. This means that students enrolling in sophomore-level engineering courses must have taken EG 10111-10112 or equivalent.

6. COURSES TAKEN ELSEWHERE

Enrolled Notre Dame Students who plan to take courses at schools other than Notre Dame MUST obtain approval of the courses at the Office of the DEAN OF ENGINEERING if they plan to transfer the credits toward a Notre Dame degree. Some schools will not admit a student without our approval, and Notre Dame will not accept credits earned elsewhere without prior approval. Chemical Engineering students must have approval of their departmental advisor prior to approval by the engineering associate dean. As a policy, University degree requirements, particularly philosophy and theology, must be taken at Notre Dame (or St. Mary's).

7. INTERNATIONAL STUDIES

Students participating in Notre Dame's Overseas programs must work with their advisors and have full approval from the International Studies Office and the Dean's Office. Courses and participation in St. Mary's Overseas programs are not part of the co-ex program with Notre Dame and students must obtain specific approvals for use of these courses in their program. In most cases approval will be denied. The University does not encourage students to participate in non-Notre Dame programs. At the present time, we have opportunities in London during the summer and fall semester, Australia in the fall and possibilities in Ireland and Mexico.

(see page 2 above for more detailed information about options for chemical engineers)

8. FIVE-YEAR PROGRAMS

The College of Engineering offers dual degree programs with Arts and Letters and Business.

The dual degree five-year program between the College of Arts and Letters and the College of Engineering enables the student to acquire the bachelor of arts from the College of Arts

and Letters and the bachelor of science degree in a chosen field of engineering. The decision to enter the program ordinarily should be made during the first year of studies, although students can also enter the program at a later stage.

The dual degree five-year program in the College of Business Administration and the College of Engineering enables the student to earn the Bachelor of Science in the chosen field of engineering and the master of business administration. This program is open only to those currently enrolled Notre Dame students who have completed three years of an engineering degree program. Students interested in making application for the M.B.A./engineering program should apply to the M.B.A. program during their junior year. To facilitate the application process, students should take the Graduate Management Admission Test (GMAT) either in June following their sophomore year or in October during the fall semester of their junior year.

In all cases of two degrees, the student must work closely with the primary advisor in engineering and the Dean's Office in both Colleges.

9. MISCELLANEOUS

a) ADVANCED PLACEMENT CREDIT is not credited toward degree requirements if the course for which credit is granted is lower than the initial course required in the degree program. For example, Advanced credits in MATH 10350/360 are not counted toward engineering degree requirements. Advanced Placement credits cannot be applied before entering the College of Engineering. (See Undergraduate Bulletin of Information.)

b) HONOR CODE. Students who enter Notre Dame agree to abide by the Honor Code. (See Academic Manual.)

c) AUDITED courses are not recorded on the permanent record of undergraduate students.

d) UNDER-PERFORMING STUDENTS. If a student is struggling with an engineering curriculum, he or she is much better advised to take a slower pace rather than try to catch up with overloads and out-of-sequence courses.

e) Deviations or exceptions to program requirements must be approved by the Dean's Office and must be documented for the student's file in the departmental office and the Dean's Office where the student's complete file is kept.

While each department assumes responsibility for its own students, the Dean's Office remains available to assist in cases of difficulty.

Appendix II

Advising/Career Development Questions

Career Development

1. What are your career plans for the period immediately after you graduate from Notre Dame?

2. What are your career plans for the longer term (i.e. 5-10 years) after graduation?

3. What strengths do you possess which will contribute to success at these endeavors?

4. What current limitations have you identified about yourself that could hurt your chances of success in the long or short term?

5. What plans do you have to eliminate these limitations?

6. What activities do you have planned for this semester that will contribute to success at your long or short term career plans?

7. List your academic goals for this semester.

Overall knowledge

1. Rate your depth of understanding of chemical engineering: (Poor, Fair, Good, Very Good, Excellent)

2. Rate your ability to apply chemical engineering principles to new problems: (Poor, Fair, Good, Very Good, Excellent)

3. Rate your ability to develop or create solutions, of any kind, to situations/problems you have not previously seen.

4. Rate your overall understanding of the US and world economy: (Poor, Fair, Good, Very Good, Excellent

Nuts and Bolts

1. Rate your skills at written communication: (Poor, Fair, Good, Very Good, Excellent)

2. Rate your skills at conversational communication: (Poor, Fair, Good, Very Good, Excellent)

3. Rate your oral presentation skills: (Poor, Fair, Good, Very Good, Excellent)

4. Rate your ability to work with other people towards a common goal: (Poor, Fair, Good, Very Good, Excellent)

Other comments

If you would like to provide other relevant information, please do so here.