

# CHEMICAL ENGINEERING

— ABET ACCREDITATION CRITERIA APPLY —

Chemical Engineering is a discipline that relates to numerous areas of technology. In broad terms, chemical engineers are responsible for the conception and design of processes for the purpose of production, transformation, and transport of chemicals, biochemicals, and materials. This activity begins with experimentation in the laboratory and is followed by implementation of the technology to full-scale production. The mission of the Chemical Engineering department at Stanford is to provide professional training, development, and education for the next generation of leaders in chemical sciences and engineering.

The large number of industries that depend on the synthesis and processing of chemicals and materials place the chemical engineer in great demand. In addition to traditional examples such as the chemical, energy and oil industries, opportunities in biotechnology, pharmaceuticals, electronic materials and device fabrication, and environmental engineering are increasing. The unique training of the chemical engineer becomes essential in these areas whenever processes involve the chemical or physical transformation of matter. For example, chemical engineers working in the chemical industry investigate the creation of new polymeric materials with important electrical, optical, or mechanical properties. This requires attention not only to the synthesis of the polymer, but also to the flow and forming processes necessary to create a final product. In biotechnology, chemical engineers have responsibilities in the design of production processes and facilities to use microorganisms and enzymes to synthesize new drugs. Problems in environmental engineering that engage chemical engineers include the development of processes (for example, catalytic converters and effluent treatment facilities) to minimize the release of products harmful to the environment.

To carry out these activities, the chemical engineer requires a complete and quantitative understanding of both the scientific and engineering principles underlying these technological processes. This is reflected in the curriculum of the chemical engineering department, which includes the study of applied mathematics, material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separations technologies, chemical reaction kinetics and reactor design, biochemical engineering and process design. Courses are built on a foundation in the sciences of chemistry, physics, and biology.

The individual student's mathematics and science course preparation for the chemical engineering major depends on his or her previous background in these areas. Following are six sequences or 4-year plans. Each starts at a different point but all six plans conclude with the same in-the-major depth requirements.

*Programs with the recommended engineering math (CME) courses:*

- 1A Little preparation in math and chemistry: 1A starts with MATH 19, 20, 21, and CHEM 31A & 31B.
- 1B Little preparation in math; strong chemistry: 1B starts with MATH 19, 20, 21 and CHEM 31X.
- 2 No AP math credits, but prepared to start with MATH 40 series, then move to CME math series. Strong chemistry preparation; start with CHEM 31X.
- 3 AP math credits, prepared to start with the CME math series, which is recommended instead of the MATH 50 series. Start with CHEM 31X.
- 4 Same preparation as 3, leading to a B.S. with Honors in Chemical Engineering. Honors Program by application only; 3.5 GPA required. For students interested in an in-depth research experience in addition to normal coursework.

Alternative programs with MATH 50 series courses:

- 5 No AP math credits, starting with MATH 40 series and continuing preparation with MATH 50 series.
- 6 AP math credits for MATH 40; start with MATH 50 series. Programs 5 & 6 require 5 additional units of math.

Our departmental website is at <http://chemeng.stanford.edu/> and that of our student chapter of the American Institute of Chemical Engineers is at <http://www.stanford.edu/group/aiche/>. Our faculty, staff, and students would be glad to talk with you about majoring in Chemical Engineering. If you would like more information about this major, please contact our departmental student services office in Keck Science Building, room 189 or via phone at 650-723-1302, or email Jeanne Cosby at [cosby@stanford.edu](mailto:cosby@stanford.edu).

## OBJECTIVES AND OUTCOMES FOR CHEMICAL ENGINEERING

### Objectives:

1. Principles and Skills: Provide a basic understanding of chemical engineering principles along with analytical problem-solving and communication skills necessary to succeed in diverse careers, including chemical engineering practice and academic research.
2. Preparation for Changing and Diverse Practice: Prepare students for successful practice in a field whose focus is constantly changing and growing with a long-term perspective that takes into account new tools, new means of dispersing and controlling information, new focus areas such as biotechnology and molecular engineering, and increasingly complex professional and societal expectations.
3. Preparation for Graduate Study: Prepare students for graduate study coupled with short-term and/or long-term career research in the chemical sciences and chemical engineering.
4. Preparation for Service: Prepare and develop students' skills, awareness, and background to become responsible citizens, employees, and leaders in our communities and in the field of chemical science.

### Outcomes:

- (a) A proficiency in and ability to apply knowledge of engineering, mathematics through differential equations, probability and statistics, and science including physics, chemistry, and biology.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (c) An ability to design a system, component, or process to meet desired needs
- (d) An ability to function on multi-disciplinary teams
- (e) An ability to identify, formulate, and solve engineering problems
- (f) An understanding of professional and ethical responsibility
- (g) An ability to communicate effectively
- (h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (l) Background for admission to engineering or other professional graduate programs

## REQUIREMENTS: CHEMICAL ENGINEERING PROGRAM

Course	Title	Engr. Sci.	Engr. Dsgn.	Expr.	Total	Qtr.	Year
<b>Mathematics and Science (47-53 Units)</b>							
MATH 41	Single Variable Calculus	-	-	-	5	A	Fr
MATH 42	Single Variable Calculus	-	-	-	5	A,W	Fr
CME 100	Vector Calculus for Engineers <i>For MATH alternative to CME 100, see Prog Sheet.</i>				5	A	Fr, So
CME 102	Ordinary Differential Eqs for Engineers <i>For a 2-course MATH alternative for CME 102, see Prog Sheet.</i>	-	-	-	5	W, S	Fr, So
CME 104	Linear Algebra & Partial Differential Eqs for Engineers				5	S	So/Jr
or CME 106 (1 of 2 req'd)	Intro to Probability and Statistics for Engineers				4	W	So/Jr
CHEM 31X	Chemical Principles (req'd) or 31 A & 31 B	-	-	-	4	A,W	Fr
CHEM 33	Structure and Reactivity (req'd)	-	-	-	4	W, S	Fr
CHEM 35	Organic Monofunctional Compounds (req'd)	-	-	-	4	A, S	Fr
CHEM 36	Organic Chemistry Laboratory I (req'd)	-	-	2	3	S	Fr
PHYS 41	Mechanics (req'd)	-	-	-	4	W	So
PHYS 43	Electricity & Magnetism (req'd)	-	-	-	4	S	So
<b>Technology in Society (3-5 units) (select one course from the approved list; see Figure 3-3)</b>							
<b>Engineering Fundamentals (3 courses minimum)</b>							
ENGR 20	Introduction to Chemical Engineering	2	1	-	3	S	Fr/So
ENGR 25	Biotechnology	2	1	-	3	S	Fr/So
<i>Plus one or more additional course(s) (see Handbook, Figure 3-4 for list)</i>							
<b>Engineering Depth (53-54 units; Note: Engr. Sci/Des units, that is, columns 1 &amp; 2 from Fundamentals and Depth combined, must equal a minimum of 63 units in order to meet ABET graduation requirements)</b>							
CHEME 10	The Chemical Engineering Profession	-	-	-	1	A	Sr
CHEME 100	Chem. Process Modeling, Dynamics & Control	2	1	-	3	A	Jr
CHEME 110	Equilibrium Thermodynamics (03-04: Spr)	2	1	-	3	W	Jr
CHEME 120A	Fluid Mechanics	3	1	-	4	W	Jr
CHEME 120B	Energy & Mass Transport	3	1	-	4	S	Jr
CHEME 130	Separation Processes	2	1	-	3	S	Jr
CHEME 140 or	Microelectronics Processing Technology	2	1	-	3	S	Sr
CHEME 150 or	Biochemical Engineering	2	1	-	3	A	Sr
CHEME 160 (2 of 3 req'd)	Polymer Science & Engineering	2	1	-	3	W	Sr
CHEME 170	Kinetics and Reactor Design	2	1	-	3	A	Sr
CHEME 180	Chemical Engineering Plant Design	-	3	-	3	S	Sr
CHEME 185	Chem Engr Lab ( <i>satisfies WIM</i> )*06-07 (W)	2	2	4	4	A*	Sr
BIOSCI 41	Genetics, Biochemistry, and Molecular Biology	5	-	-	5	A	So
CHEM 130	Organic Chemistry Laboratory II	4	-	4	4	A,W	So
CHEM 131	Organic Polyfunctional Compounds	-	-	-	3	A,W	Jr
CHEM 171	Physical Chemistry – Chemical Thermodynamics	3	-	-	3	A	Jr
CHEM 173	Physical Chemistry – Quantum Chemistry	3	-	-	3	W	Jr
CHEM 175	Physical Chemistry – Kinetic Theory & Statistical Mechanics	3	-	-	3	S	Jr

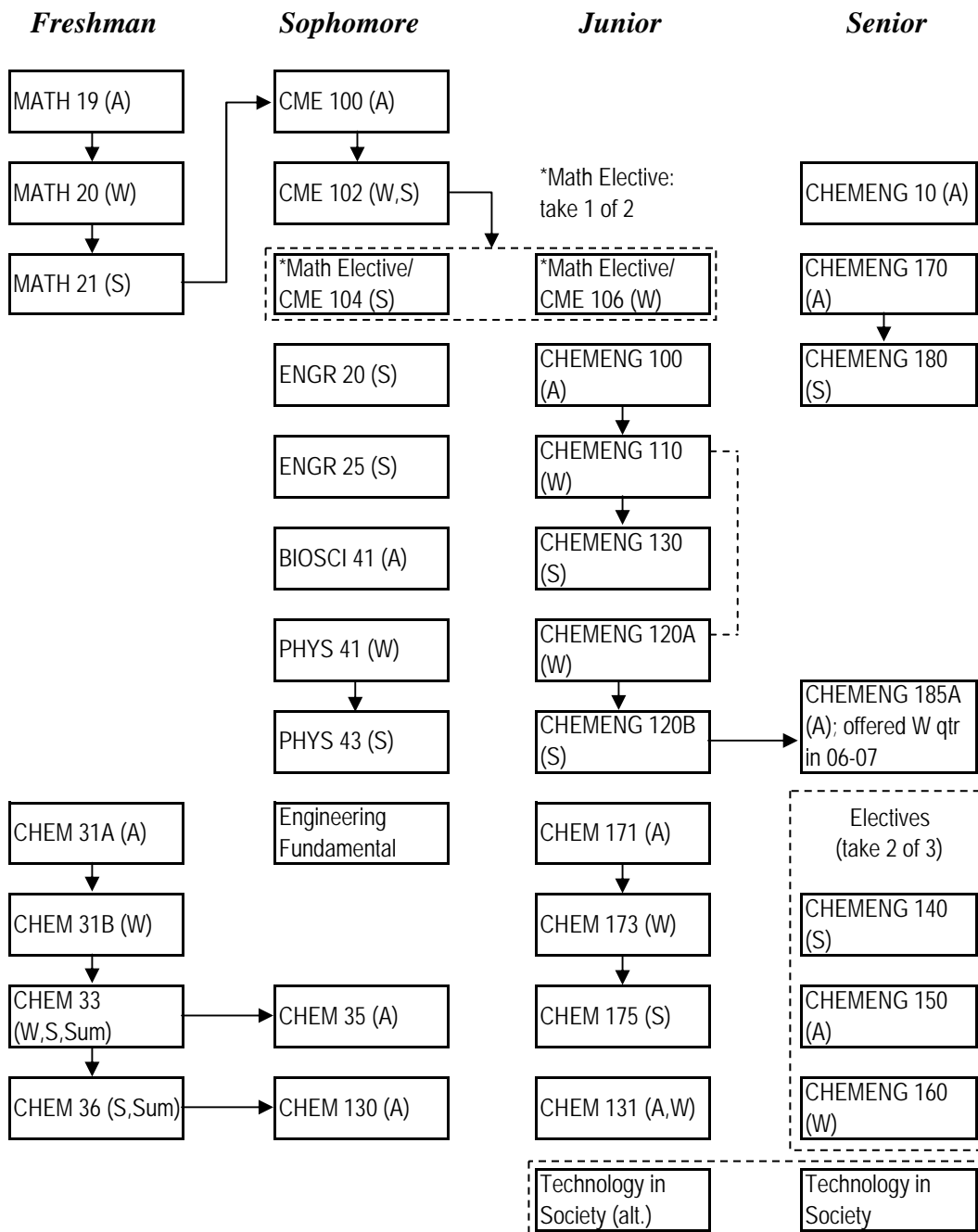
# Chemical Engineering

Typical Sequence of Courses

4-Year Plan # 1-A

MATH 19, 20, 21 series, then CME 100, 102 and ENGR math elective

Plan A = CHEM 31A and CHEM 31B (instead of CHEM 31X)



\* Solid arrows represent direct prerequisites.

\* Dashed lines represent co-requisites.

\* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, or alternate courses that may be taken at a given time.

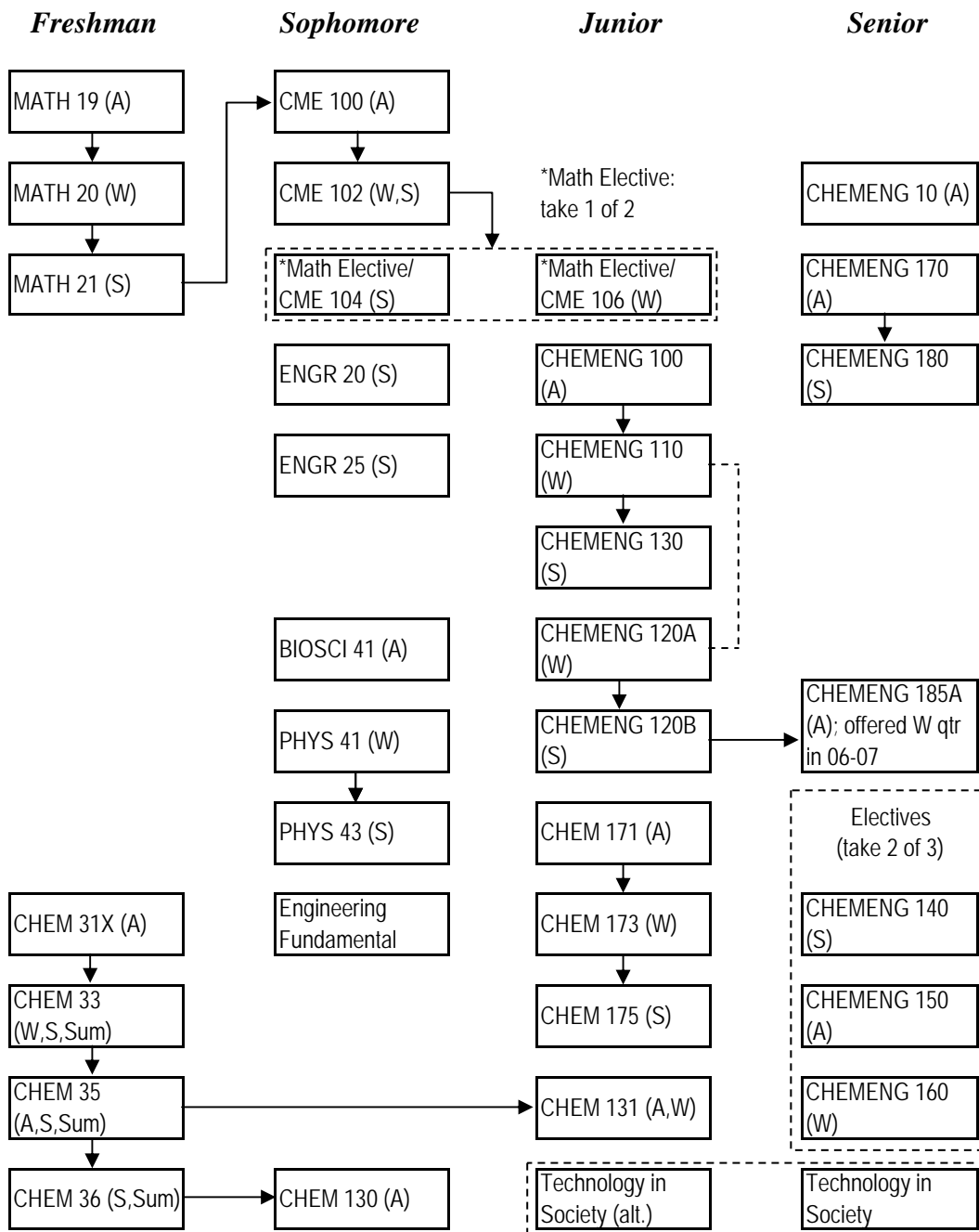
# Chemical Engineering

Typical Sequence of Courses

4-Year Plan # 1-B

MATH 19, 20, 21 series, then CME 100, 102 and ENGR math elective

Plan B = CHEM 31X (instead of CHEM 31A and CHEM 31B)



\* Solid arrows represent direct prerequisites.

\* Dashed lines represent co-requisites.

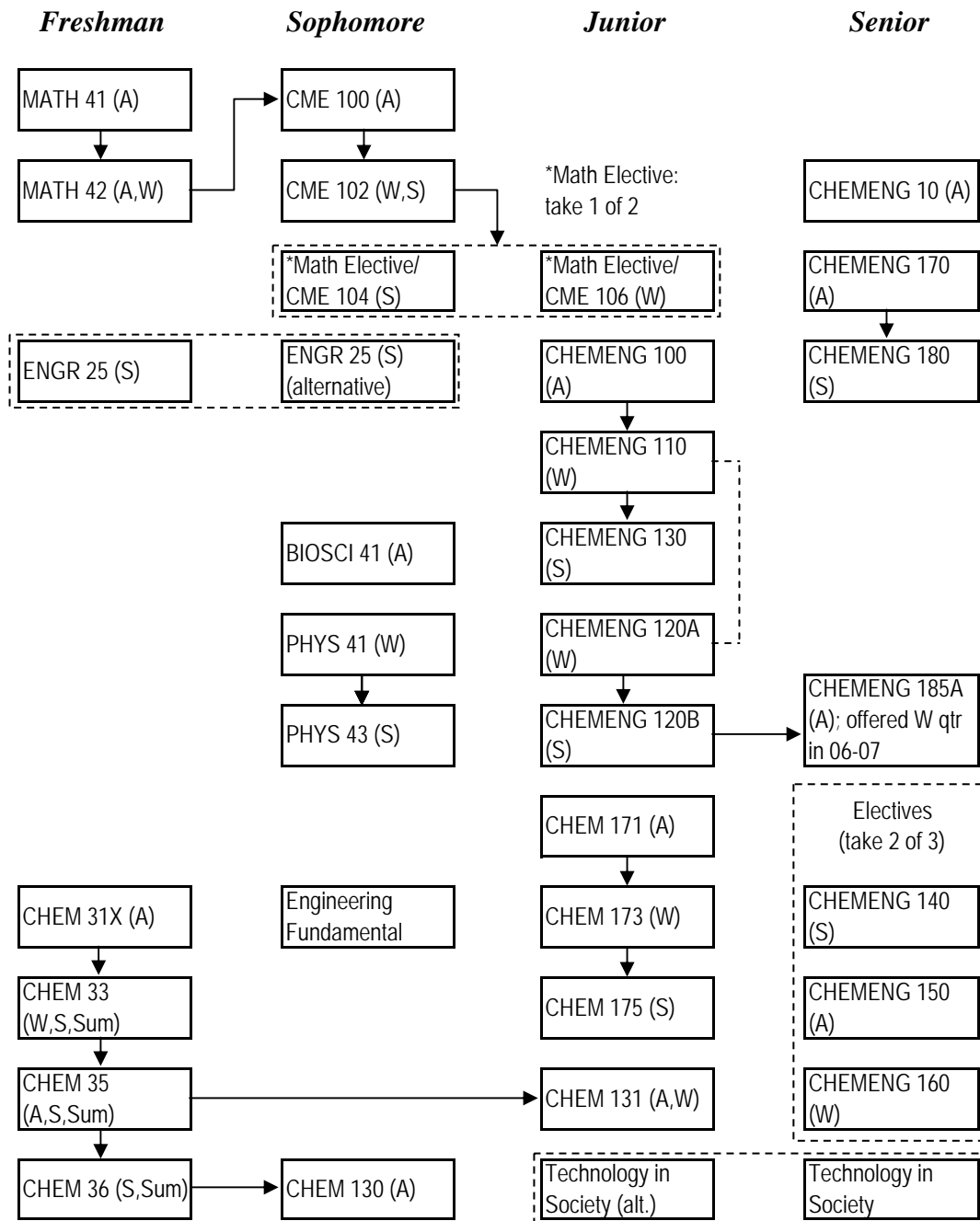
\* Dashed-line boxes indicate alternatives. These may indicate courses offered in alternate years or alternate courses to satisfy a requirement.

# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 2 — RECOMMENDED

MATH 40 series, then CME 100, 102 then CME 104 or 106



\* Solid arrows represent direct prerequisites.

\* Dashed lines represent co-requisites.

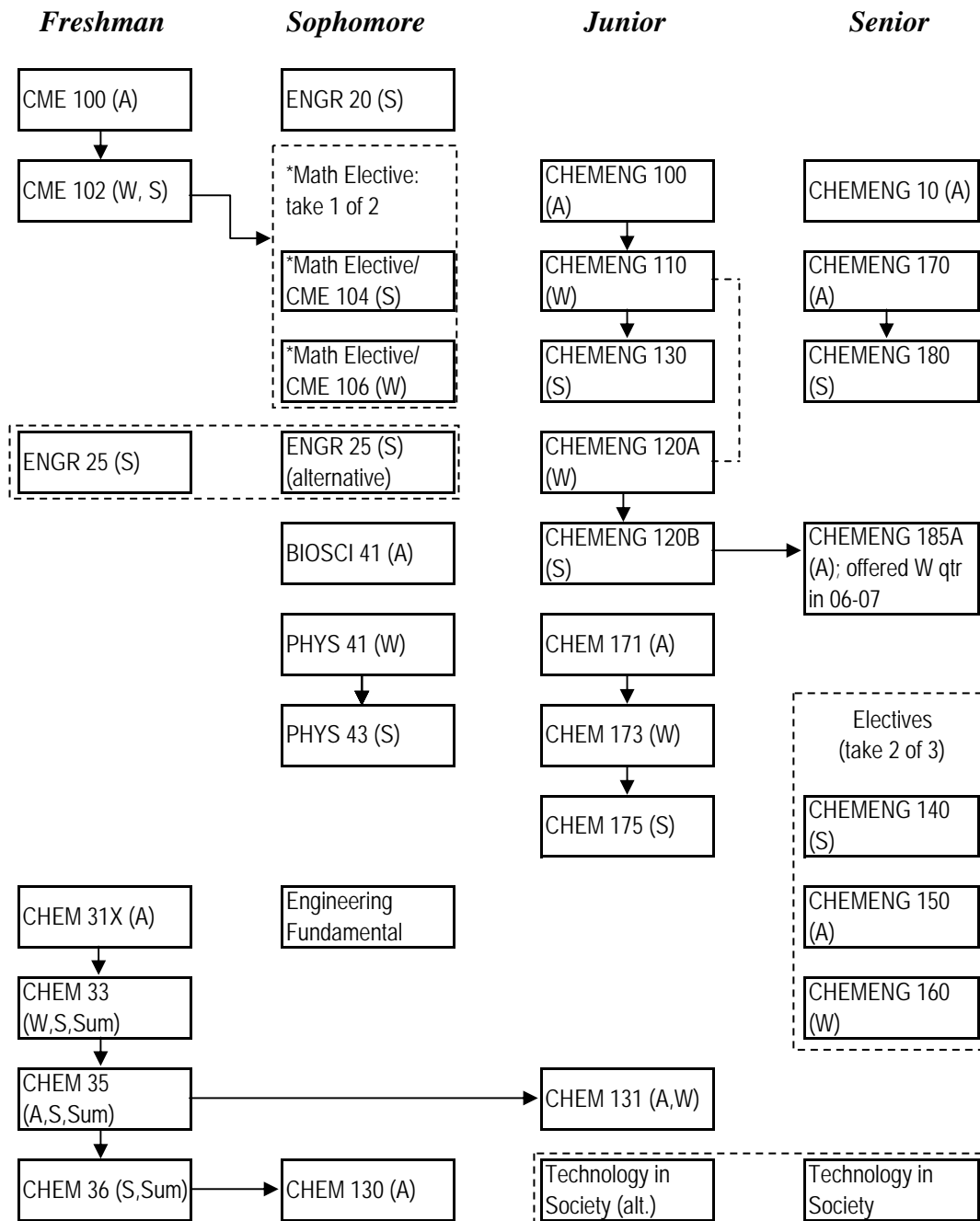
\* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, or alternate courses that may be taken at a given time.

# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 3 — RECOMMENDED

AP credit for MATH 40 series: start with CME 100, 102 instead of MATH 51 series

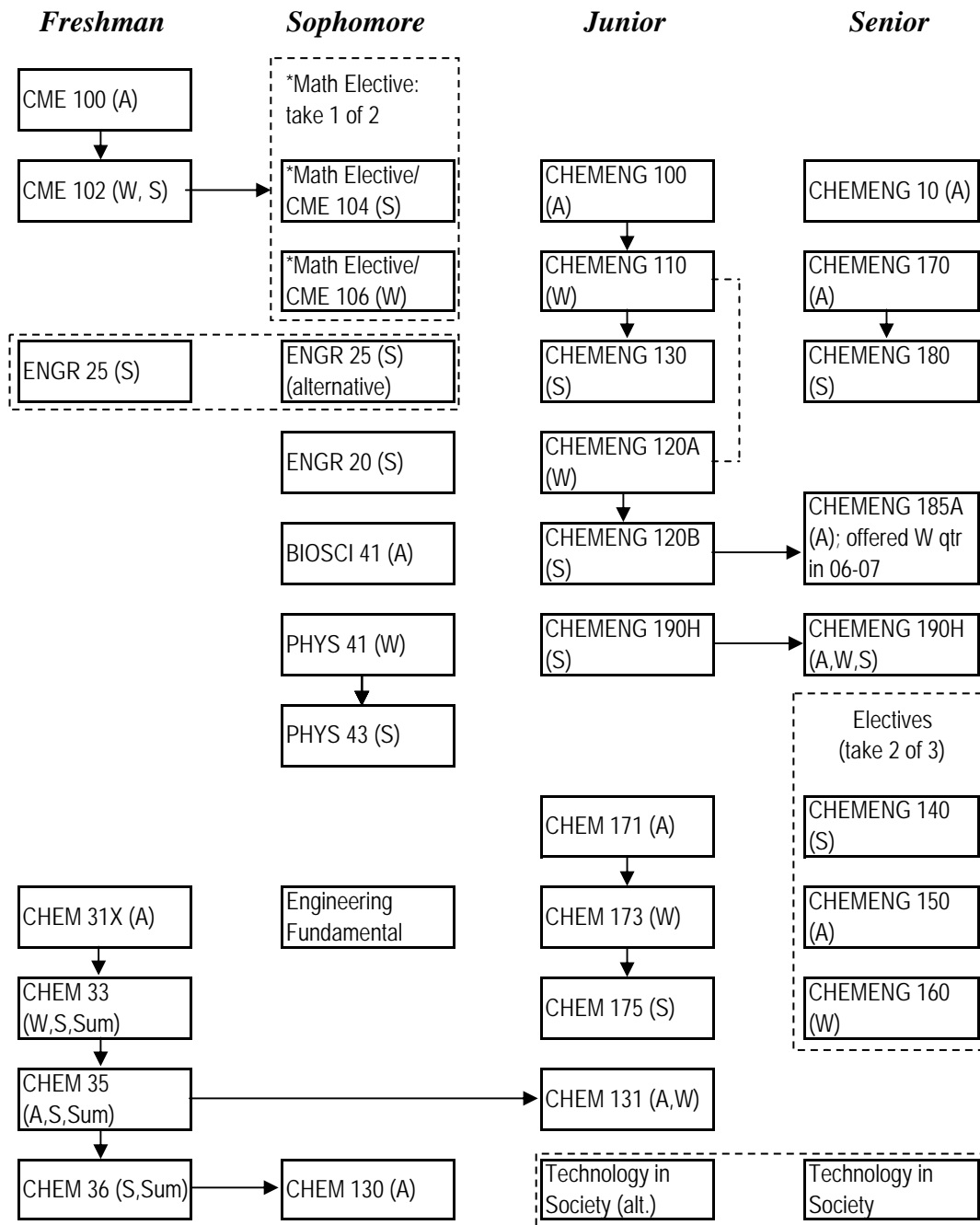


# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 4 — RECOMMENDED

AP credit for MATH 40 series: start with CME 100, 102 instead of MATH 51 series



\* Solid arrows represent direct prerequisites.

\* Dashed lines represent co-requisites.

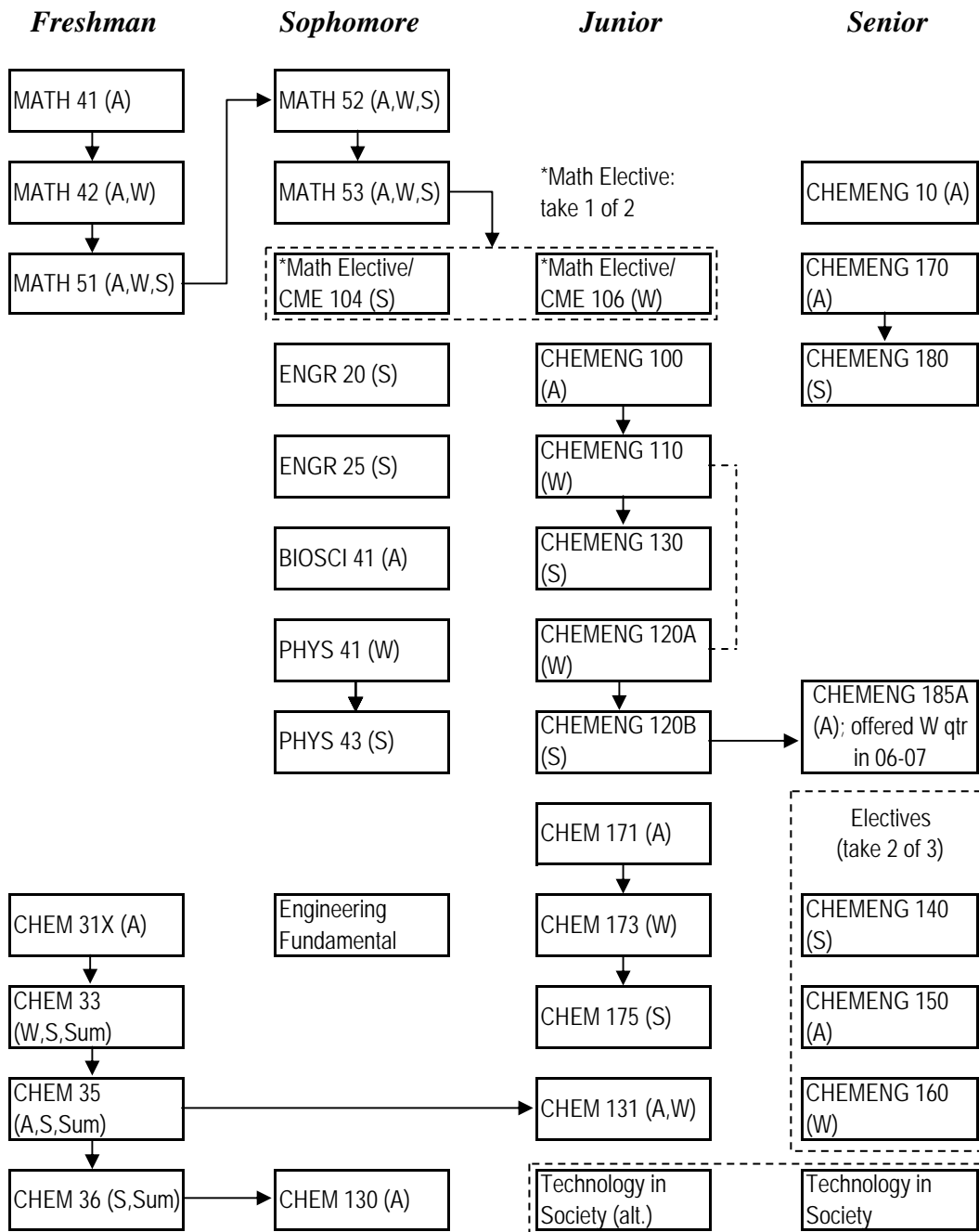
\* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, or alternate courses that may be taken at a given time.

# Chemical Engineering

Typical Sequence of Courses

4-Year Plan # 5

MATH 40 series, then Math 50 series, then CME 104 or 106



\* Solid arrows represent direct prerequisites.

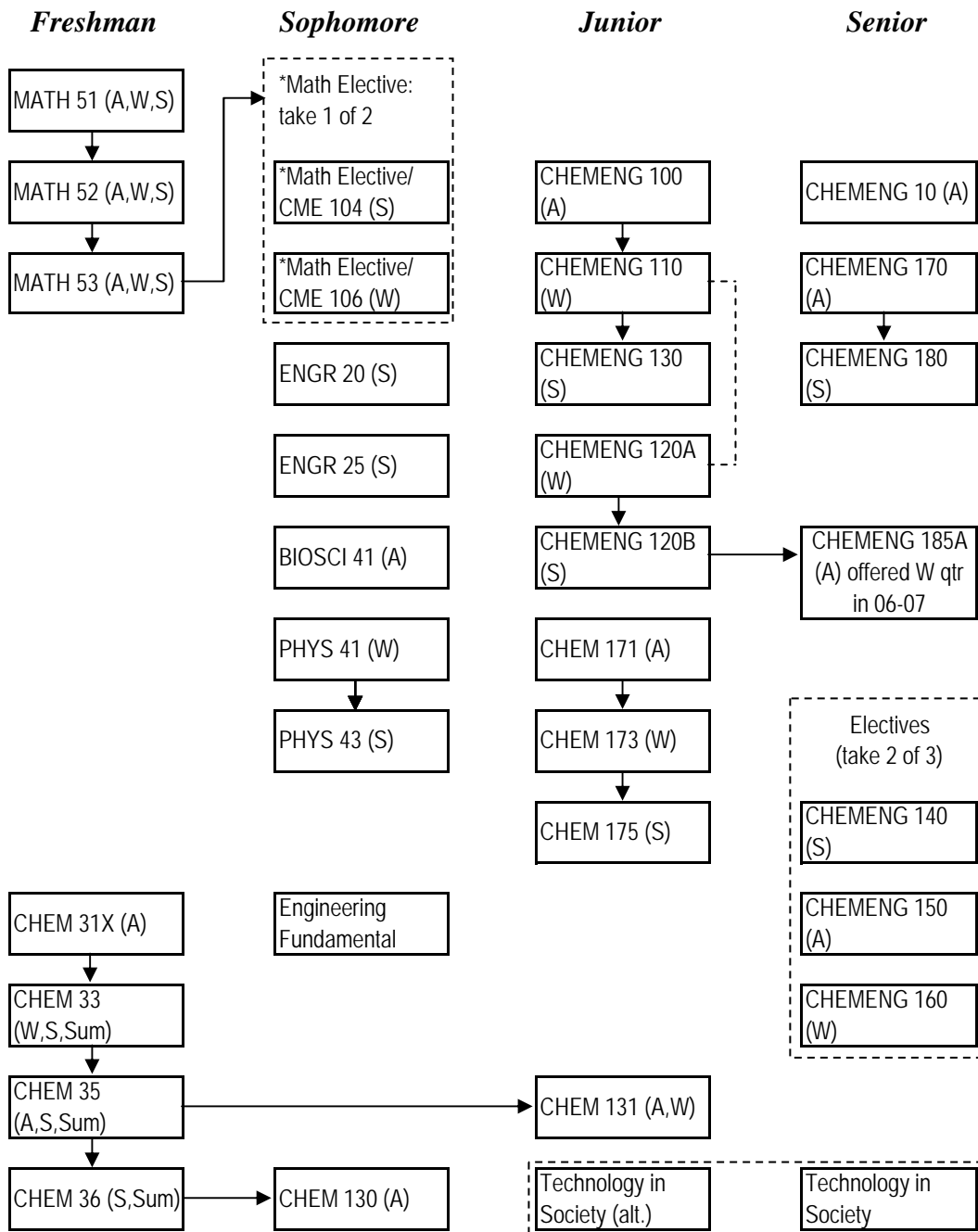
\* Dashed lines represent co-requisites.

# Chemical Engineering

Typical Sequence of Courses

4-Year Plan # 6

AP credit for MATH 40 series; Math 50 series then CME 104 or 106



\* Solid arrows represent direct prerequisites.

\* Dashed lines represent co-requisites.

\* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, or alternate courses that may be taken at a given time.

# Chemical Engineering

4-Year Plan # 1-A

Plan A = CHEM 31A and CHEM 31B (instead of CHEM 31X)

MATH 19, 20, 21 series, then CME 100, 102 and ENGR math elective

	<i>Fall</i>			<i>Winter</i>			<i>Spring</i>					
	Math/ Sci.	Engr.	Other	Math/ Sci.	Engr.	Other	Math/ Sci.	Engr.	Other			
<i>Freshman</i>	MATH 19	3	-	-	MATH 20	3	-	-	MATH 21	4	-	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	GER	-	-	3	Writing	-	-	4	CHEM 33	4	-	-
	CHEM 31A*	4	-	-	CHEM 31B*	4	-	-	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>7</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>7</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>11</i>	<i>0</i>	<i>5</i>
<b>Total</b>	<b>15</b>			<b>Total</b>	<b>16</b>			<b>Total</b>	<b>16</b>			
<i>Sophomore</i>	CME 100	5	-	-	CME 102	5	-	-	ENGR 20	-	3	-
	BIOSCI 41	-	5	-	Engr. Fund.	-	3	-	ENGR 25 ***	-	3	-
	CHEM 35	4	-	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	CHEM 130	4	-	-	Writing	-	-	4	ENGR math elec	5	-	-
	<i>Subtotals</i>	<i>13</i>	<i>5</i>	<i>0</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>6</i>	<i>0</i>
<b>Total</b>	<b>18</b>			<b>Total</b>	<b>16</b>			<b>Total</b>	<b>15</b>			
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEMENG 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEMENG 171	-	3	-	CHEMENG 173	-	3	-	CHEMENG 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	TIS ** (alt.)	-	-	-	ENGR math elec	-	-	-				
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>
<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>			
<i>Senior</i>	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-	CHEMENG elec	-	-	-
	CHEMENG 170	-	3	-	GER	-	-	4	CHEMENG 180	-	3	-
	CHEMENG 185 <sup>o</sup>	-	4	-	GER	-	-	5	GER	-	-	5
	CHEMENG 10	-	1	-	TIS ** (alt.)	-	-	-	GER	-	-	5
	TIS course**	-	-	4								
	<i>Subtotals</i>	<i>0</i>	<i>11</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>10</i>
<b>Total</b>	<b>15</b>			<b>Total</b>	<b>12</b>			<b>Total</b>	<b>13</b>			

AP Math Units: 0  
 UG Math & Science Units: 56  
 Total Engineering Units: 60  
 Total Other Units: 64

# Chemical Engineering

4-Year Plan # 1-B

Plan B = CHEM 31X (instead of CHEM 31A and CHEM 31B)  
MATH 19, 20, 21 series, then CME 100, 102 and ENGR math elective

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Math/				Math/				Math/			
	Class	Sci.	Engr.	Other	Class	Sci.	Engr.	Other	Class	Sci.	Engr.	Other
<i>Freshman</i>	MATH 19	3	-	-	MATH 20	3	-	-	MATH 21	4	-	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	GER	-	-	3	Writing	-	-	4	CHEM 35	4	-	-
	CHEM 31X	4	-	-	CHEM 33	4	-	-	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>7</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>7</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>11</i>	<i>0</i>	<i>5</i>
<b>Total</b>	<b>15</b>			<b>Total</b>	<b>16</b>			<b>Total</b>	<b>16</b>			
<i>Sophomore</i>	CME 100	5	-	-	CME 102	5	-	-	ENGR 20	-	3	-
	BIOSCI 41	-	5	-	Engr. Fund.	-	3	-	ENGR 25 ***	-	3	-
	CHEM 130	-	4	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	Writing	-	-	4	GER	-	-	3	ENGR math elec	5	-	-
	<i>Subtotals</i>	<i>5</i>	<i>9</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>3</i>	<i>Subtotals</i>	<i>9</i>	<i>6</i>	<i>0</i>
<b>Total</b>	<b>18</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>			
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	TIS ** (alt)	-	-	-	ENGR math elec	-	-	-	Elective	-	-	-
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>
<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>			
<i>Senior</i>	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-	CHEMENG elec	-	-	-
	CHEMENG 170	-	3	-	GER	-	-	5	CHEMENG 180	-	3	-
	CHEMENG 185°	-	4	-	GER	-	-	3	GER	-	-	5
	CHEMENG 10	-	1	-	Elective	-	-	3	Elective	-	-	4
	TIS course**	-	-	4	TIS ** (alt)	-	-	-				
	<i>Subtotals</i>	<i>0</i>	<i>11</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>11</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>
<b>Total</b>	<b>15</b>			<b>Total</b>	<b>14</b>			<b>Total</b>	<b>12</b>			

AP Math Units: 0  
UG Math & Science Units: 48  
Total Engineering Units: 64

# Chemical Engineering

4-Year Plan #2 — RECOMMENDED  
MATH 40 series, then CME 100, 102 then CME 104 or 106

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other
<i>Freshman</i>	MATH 41	5	-	-	MATH 42	5	-	-	ENGR 25	-	3	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	CHEM 31X	4			CHEM 33	4	-	-	CHEM 35	4		
	GER	-	-	3	Writing	-	-	4	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>7</i>	<i>3</i>	<i>5</i>
	<b>Total</b>			<b>17</b>	<b>Total</b>			<b>18</b>	<b>Total</b>			<b>15</b>
<i>Sophomore</i>	CME 100	5	-	-	CME 102	5	-	-	ENGR 20	-	3	-
	BIOSCI 41	-	5	-	Engr. Fund.		3	-	ENGR 25 ***	-	-	-
	CHEM 130	-	4	-	PHYSICS 41	4		-	PHYSICS 43	4	-	-
	Writing	-	-	4	GER	-	-	3	ENGR math elec	5	-	-
									Elective	-	-	3
<i>Subtotals</i>	<i>5</i>	<i>9</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>3</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>3</i>	
	<b>Total</b>			<b>18</b>	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>15</b>
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	TIS ** (alt.)	-	-	-	ENGR math elec	-	-	-				
<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	
	<b>Total</b>			<b>14</b>	<b>Total</b>			<b>15</b>	<b>Total</b>			<b>15</b>
<i>Senior</i>	CHEMENG elec	-	-	-	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-
	CHEMENG 170	-	3	-	GER	-	-	5	CHEMENG 180	-	3	
	CHEMENG 185	-	4	-	GER	-	-	4	Elective	-	-	5
	CHEMENG 10	-	1	-	TIS ** (alt.)	-	-	-	Elective	-	-	3
	TIS Course**	-	-	4								
<i>Subtotals</i>	<i>0</i>	<i>8</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>	<i>Subtotals</i>	<i>0</i>	<i>6</i>	<i>8</i>	
	<b>Total</b>			<b>12</b>	<b>Total</b>			<b>12</b>	<b>Total</b>			<b>14</b>

AP Math Units: 0  
UG Math & Science Units: 48

# Chemical Engineering

4-Year Plan #3 — RECOMMENDED

CME 100, 102 then CME 104 or 106

(AP credit for MATH 40 series: start with CME 100, 102 instead of MATH 51 series)

	<i>Fall</i>			<i>Winter</i>				<i>Spring</i>				
	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	
<i>Freshman</i>	CME 100	5	-	-	CME 102	5	-	-	ENGR 25***	-	3	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	CHEM 31X	4	-	-	CHEM 33	4	-	-	CHEM 35	4	-	-
					Writing	-	-	4	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>5</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>7</i>	<i>3</i>	<i>5</i>
	<b>Total</b>	<b>14</b>			<b>Total</b>	<b>18</b>			<b>Total</b>	<b>15</b>		
<i>Sophomore</i>	BIOSCI 41	-	5	-	CME math elec	4	-	-	CME math elec	-	-	-
	CHEM 130	-	4	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	Writing	-	-	4	Engr. Fund	-	3	-	ENGR 20	-	3	-
	GER	-	-	3	GER	-	-	4	ENGR 25 ***	-	-	-
									GER	-	-	5
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>7</i>	<i>Subtotals</i>	<i>8</i>	<i>3</i>	<i>4</i>	<i>Subtotals</i>	<i>4</i>	<i>3</i>	<i>5</i>
	<b>Total</b>	<b>16</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>12</b>		
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>
	<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>		
<i>Senior</i>	CHEMENG elec	-	-	-	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-
	CHEMENG 170	-	3	-	GER	-	-	5	CHEMENG 180	-	3	-
	CHEMENG 185 <sup>o</sup>	-	4	-	Elective	-	-	4	Elective	-	-	3
	CHEMENG 10	-	1	-					Elective	-	-	3
TIS course**	-	-	4					TIS**(alternative)	-	-	-	
	<i>Subtotals</i>	<i>0</i>	<i>8</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>	<i>Subtotals</i>	<i>0</i>	<i>6</i>	<i>6</i>
	<b>Total</b>	<b>12</b>			<b>Total</b>	<b>12</b>			<b>Total</b>	<b>12</b>		

AP Math Units: 10  
 UG Math & Science Units: 37  
 Total Engineering Units: 64

## Chemical Engineering WITH HONORS

4-Year Plan # 4 — RECOMMENDED

CME 100, 102 then CME 104 or 106

(AP credit for MATH 40 series: start with CME 100, 102 instead of MATH 51 series)

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other
<i>Freshman</i>	CME 100	5	-	-	CME 102	5	-	-	ENGR 25***	-	3	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	CHEM 31X	4	-	-	CHEM 33	4	-	-	CHEM 35	4	-	-
					Writing	-	-	4	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>5</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>7</i>	<i>3</i>	<i>5</i>
	<b>Total</b>	<b>14</b>			<b>Total</b>	<b>18</b>			<b>Total</b>	<b>15</b>		
<i>Sophomore</i>	BIOSCI 41	-	5	-	CME math elec	-	-	-	CME math elec	5	-	-
	CHEM 130	-	4	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	Writing	-	-	4	Engr. Fund	-	3	-	ENGR 20	-	3	-
	GER	-	-	4	GER	-	-	5	ENGR 25 ***	-	-	-
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>8</i>	<i>Subtotals</i>	<i>4</i>	<i>3</i>	<i>5</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>0</i>
	<b>Total</b>	<b>17</b>			<b>Total</b>	<b>12</b>			<b>Total</b>	<b>12</b>		
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
TIS ** (alt.)				GER	-	-	3	CHEMENG 190H	-	3		
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>8</i>	<i>Subtotals</i>	<i>0</i>	<i>13</i>	<i>5</i>
	<b>Total</b>	<b>14</b>			<b>Total</b>	<b>18</b>			<b>Total</b>	<b>18</b>		
<i>Senior</i>	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-	CHEMENG elec	-	-	-
	CHEMENG 170	-	3	-	GER	-	-	5	CHEMENG 180	-	3	
	CHEMENG 185°	-	4	-	TIS course **	-	-	4	Elective	-	-	5
	CHEMENG 10	-	1	-	CHEMENG 190H	-	3	-	Elective	-	-	4
CHEMENG 190H	-	3	-					TIS** (alt.)				
	<i>Subtotals</i>	<i>0</i>	<i>14</i>	<i>0</i>	<i>Subtotals</i>	<i>0</i>	<i>6</i>	<i>9</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>
	<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>12</b>		

AP Math Units: 10

UG Math & Science Units: 38

Total Engineering Units: 73

Total Other Units: 10

*Notes:*

# Chemical Engineering

4-Year Plan # 5

MATH 40 series, then MATH 51, 52, and 53, followed by CME 104 or 106

	<i>Fall</i>			<i>Winter</i>			<i>Spring</i>					
	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	Class	Math/ Sci.	Engr.	Other	
<i>Freshman</i>	MATH 41	5	-	-	MATH 42	5	-	-	MATH 51	5	-	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	CHEM 31X	4	-	-	CHEM 33	4	-	-	CHEM 35	4	-	-
	GER	-	-	3	Writing	-	-	4	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>12</i>	<i>0</i>	<i>5</i>
<b>Total</b>	<b>17</b>			<b>Total</b>	<b>18</b>			<b>Total</b>	<b>17</b>			
<i>Sophomore</i>	MATH 52	5	-	-	MATH 53	5	-	-	ENGR math elec	5	-	-
	BIOSCI 41	-	5	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	CHEM 130	-	4	-	Engr. Fund	-	3	-	ENGR 20	-	3	-
	Writing	-	-	4	GER	-	-	4	ENGR 25 ***	-	3	-
	<i>Subtotals</i>	<i>5</i>	<i>9</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>6</i>	<i>0</i>
<b>Total</b>	<b>18</b>			<b>Total</b>	<b>16</b>			<b>Total</b>	<b>15</b>			
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	TIS ** (alt.)	-	-	-	ENGR math elec	-	-	-				
<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	
<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>			
<i>Senior</i>	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-	CHEMENG elec	-	-	-
	CHEMENG 170	-	3	-	GER	-	-	5	CHEMENG 180	-	3	-
	CHEMENG 185 <sup>o</sup>	-	4	-	GER	-	-	5	Elective	-	-	4
	CHEMENG 10	-	1	-	TIS ** (alt.)	-	-	-	Elective	-	-	5
	TIS course**	-	-	4								
<i>Subtotals</i>	<i>0</i>	<i>11</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>10</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>9</i>	
<b>Total</b>	<b>15</b>			<b>Total</b>	<b>13</b>			<b>Total</b>	<b>12</b>			

AP Math Units: 0  
 UG Math & Science Units: 53  
 Total Engineering Units: 64  
 Total Other Units: 68

# Chemical Engineering

4-Year Plan # 6

MATH 50 series (51, 52, & 53) and then CME 104 or CME 106

(AP credit for Math 40 series)

	<i>Fall</i>				<i>Winter</i>				<i>Spring</i>			
	Math/ Sci.	Engr.	Other		Math/ Sci.	Engr.	Other		Math/ Sci.	Engr.	Other	
<i>Freshman</i>	MATH 51	5	-	-	MATH 52	5	-	-	MATH 53	5	-	-
	IHUM	-	-	5	IHUM	-	-	5	IHUM	-	-	5
	CHEM 31X	4	-	-	CHEM 33	4	-	-	CHEM 35	4	-	-
	GER	-	-	3	Writing	-	-	4	CHEM 36	3	-	-
	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>8</i>	<i>Subtotals</i>	<i>9</i>	<i>0</i>	<i>9</i>	<i>Subtotals</i>	<i>12</i>	<i>0</i>	<i>5</i>
<b>Total</b>	<b>17</b>			<b>Total</b>	<b>18</b>			<b>Total</b>	<b>17</b>			
<i>Sophomore</i>	BIOSCI 41	-	5	-	CME 104	5	-	-	ENGR math elec	5	-	-
	CHEM 130	-	4	-	PHYSICS 41	4	-	-	PHYSICS 43	4	-	-
	Writing	-	-	4	Engr. Fundamenta	-	3	-	ENGR 20	-	3	-
					ENGR math elec	-	-	-	ENGR 25 ***	-	3	-
	<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>4</i>	<i>Subtotals</i>	<i>9</i>	<i>3</i>	<i>0</i>	<i>Subtotals</i>	<i>9</i>	<i>6</i>	<i>0</i>
<b>Total</b>	<b>13</b>			<b>Total</b>	<b>12</b>			<b>Total</b>	<b>15</b>			
<i>Junior</i>	CHEMENG 100	-	3	-	CHEMENG 110	-	3	-	CHEMENG 130	-	3	-
	CHEM 131	-	3	-	CHEMENG 120A	-	4	-	CHEMENG 120B	-	4	-
	CHEM 171	-	3	-	CHEM 173	-	3	-	CHEM 175	-	3	-
	Language	-	-	5	Language	-	-	5	Language	-	-	5
	TIS ** (alt.)	-	-	-	GER	-	-	-				
<i>Subtotals</i>	<i>0</i>	<i>9</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	<i>Subtotals</i>	<i>0</i>	<i>10</i>	<i>5</i>	
<b>Total</b>	<b>14</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>15</b>			
<i>Senior</i>	CHEMENG elec	-	-	-	CHEMENG elec	-	3	-	CHEMENG elec	-	3	-
	CHEMENG 170	-	3	-	GER	-	-	4	CHEMENG 180	-	3	-
	CHEMENG 185 <sup>o</sup>	-	4	-	GER	-	-	5	GER	-	-	3
	CHEMENG 10	-	1	-	Elective	-	-	3	Elective	-	-	3
	TIS course**	-	-	4	TIS ** (alt.)	-	-	-				
<i>Subtotals</i>	<i>0</i>	<i>8</i>	<i>4</i>	<i>Subtotals</i>	<i>0</i>	<i>3</i>	<i>12</i>	<i>Subtotals</i>	<i>0</i>	<i>6</i>	<i>6</i>	
<b>Total</b>	<b>12</b>			<b>Total</b>	<b>15</b>			<b>Total</b>	<b>12</b>			

AP Math Units: 10

UG Math & Science Units: 48

## INSTRUCTIONS FOR DECLARING MAJOR IN CHEMICAL ENGINEERING (BS: CHEM E)

1. Log on to Axess and request to major in Chemical Engineering.
2. Print your unofficial Stanford transcript off of Axess.
3. Download a Chemical Engineering Program Sheet from the School of Engineering web site: <http://ughb.stanford.edu> and complete it electronically. Fill in your grades for courses already taken or in progress. Enter “AP” instead of a course grade for any course waived due to AP credit. (AP units for math, science, or fundamentals must be approved by the SoE Dean’s office in 201 Terman; see Darlene Lazar).
4. Save the electronic file for your records. Print your Program Sheet.
5. Bring your unofficial transcript and completed Program Sheet to Jeanne Cosby, Student Services Manager, in Keck Science Building, room 189. She is most available during daily drop-in hours, 2 to 3:45pm.

REV 08/06



**Stanford University's School of Engineering**  
**Chemical Engineering**  
**2006-2007 Sample Program Sheet**  
**— ABET Accreditation Criteria Apply —**

Name: \_\_\_\_\_ SU ID: \_\_\_\_\_  
 Local Address: \_\_\_\_\_ Local Phone: \_\_\_\_\_  
 \_\_\_\_\_ Email: \_\_\_\_\_  
 \_\_\_\_\_ Date B.S. expected: \_\_\_\_\_

**Mathematics and Science Requirement (45 units minimum; delete courses not taken)**

Dept	Course	Title	Units				Grade	✓ if Transfer	Transfer/AP Approval	
			Engr Sci	Engr Des	Experiment	Total			Initials	Date
<b>Mathematics</b>										
MATH	41	Calculus (req'd)				5				
MATH	42	Calculus (req'd)				5				
CME	100	Vector Calculus for Engineers (req'd; Note 1)				5				
CME	102	ODE for Engineers (req'd; Note 1)				5				
CME 104 or CME 106 (Req'd)		Linear Algebra & Partial Differential Equations				5				
		Intro. to Probability & Statistics for Engrs				4				
<i>Mathematics Unit Total</i>						<b>29</b>				
<b>Science</b>										
PHYSICS	41	Mechanics (req'd)			0	4				
PHYSICS	43	Electricity & Magnetism (req'd)			0	4				
CHEM	31X	Chemical Principles (req'd) <i>or</i> CHEM 31A,B			0	4				
CHEM	33	Structure and Reactivity (req'd)			0	4				
CHEM	35	Organic Mono Compounds (req'd)			0	4				
CHEM	36	Organic Chemistry Laboratory I (req'd)			2	3				
<i>Science Unit Total</i>						<b>23</b>				
<i>Mathematics and Science Unit Total</i>										<b>(47 units minimum)</b>

**Technology in Society Requirement (1 course required; see UGHB Fig. 3-3 for SoE approved list)**

STS										
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**NOTES**

- \* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
  - \* This form is available as an Excel file at <http://ughb.stanford.edu/>. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
  - \* All courses listed on this form must be taken for a letter grade if offered by the instructor.
  - \* Minimum Combined Grade Point Average for all courses in Engineering Topics (Engineering Science and Engineering Design courses) is 2.0.
  - \* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at <http://ughb.stanford.edu/transfer.html>.
  - \* All courses listed on this form must only be included under one category; no double-counting. Delete courses not taken.
- (1) CME 100, 102 strongly recommended; however MATH 51 may be substituted for CME 100; MATH 52 and 53 may be substituted for CME 102.

*program sheet continues on page 2*

## Chemical Engineering Program Sheet (continued)

**Engineering Topics (Engineering Science + Engineering Design; add first two columns; see Note 4)**

Dept	Course	Title	Units				Grade	✓ if Transfer	Transfer/AP Approval	
			Engr Sci	Engr Des	Experiment	Total			Initials	Date
<b>Engineering Fundamentals (3 courses required)</b>										
ENGR	25	Introduction to Biotechnology	2	1	0	3				
ENGR	20	Introduction to Chemical Engineering	2	1	0	3				
ENGR										
<i>Engineering Fundamentals Unit Total</i>										
<b>Engineering Depth (Delete courses not taken)</b>										
BIOSCI	41	Genetics and Biochemistry	5	0	0	5				
CHEMENG	10	The Chemical Engineering Profession	0	0	0	1				
CHEMENG	100	Chem. Proc. Modeling, Dyn. & Control	3	0	0	3				
CHEMENG	110	Equilibrium Thermodynamics	3	0	0	3				
CHEMENG	120A	Fluid Mechanics	3	1	0	4				
CHEMENG	120B	Energy and Mass Transport	3	1	0	4				
CHEMENG	130	Separation Processes	2	1	0	3				
CHEMENG	140	Microelectronics Process Tech (see note 2)	2	1	0	3				
CHEMENG	150	Biochemical Engineering (see note 2)	2	1	0	3				
CHEMENG	160	Polymer Science & Engineering (see note 2)	2	1	0	3				
CHEMENG	170	Kinetics and Reactor Design	2	1	0	3				
CHEMENG	180	Chemical Engineering Plant Design	0	3	0	3				
CHEMENG	185	Chemical Engineering Lab (see note 3)	2	2	4	4				
CHEM	130	Organic Chemistry Laboratory II	4	1	4	5				
CHEM	131	Organic Polyfunctional Compounds	2	0	1	3				
CHEM	171	Physical Chemistry - Chem. Thermo.	3	0	0	3				
CHEM	173	Physical Chemistry - Quantum Chem.	3	0	0	3				
CHEM	175	Physical Chem - Kin. Th. & Stat. Mech.	3	0	0	3				
<i>Engr Science/Engr Design/Experiment/Depth Unit Totals</i>			43	15	11	54				

### Program Totals (ABET Requirements)

<i>Mathematics and Science</i>		<i>(47 units minimum)</i>
<i>Engineering Topics (Engr Science + Engr Design)</i>		<i>(63 units minimum)</i>
<i>Experimentation</i>		<i>(8 units minimum)</i>

### Program Approvals

**Advisor**

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Signature: \_\_\_\_\_

**Student Services**

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Signature: \_\_\_\_\_

**Departmental**

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Signature: \_\_\_\_\_

**School of Engineering**

Printed Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Signature: \_\_\_\_\_

**NOTES (continued from page 1)**

- (2) Two out of the three of CHEMENG 140, 150, and 160 must be taken.
- (3) Fulfills the "Writing in the Major" requirement for Freshmen and Transfer students entering Fall 96 or later.
- (4) Engr. Science and Design units from Fundamentals and Depth (columns 1 and 2 combined) must equal a minimum of 63 units to satisfy ABET requirements for graduation.