DEPARTMENT OF CHEMICAL ENGINEERING

Revised CHE and ACHE BS Programs

The NEW curricula apply only to students with ID numbers starting with 2009xxxxxx

December 2010

Introduction:

The department of chemical engineering recently revised its science and applied programs in order to meet new ABET and KFUPM general education requirements. The new programs are more flexible and enhance ability of the chemical engineer to meet requirements of the modern chemical industry and research.

Revision of Chemical Engineering Undergraduate Programs:

The present requirements for the Chemical Engineering Science Curriculum include several changes to satisfy recent KFUPM general education requirements that include two general studies (GS) courses, 6 credit hours of free electives and 6 credit hours of chemical engineering electives. The present program also satisfies the ABET 2008/2009 requirements summarized in the ABET statement: "*The program must demonstrate that graduates have: thorough grounding in the basic sciences including chemistry, physics, and* ***biology*** *appropriate to the objectives of the program; and sufficient knowledge in the application of these basic sciences to enable graduates to design, analyze, and control physical, chemical, and biological processes, consistent with the program educational objectives"*.

Summary of Changes:

Revised Chemical Engineering *Science* Curriculum:

The chemical engineering science curriculum has been modified to include 15 additional credit hours to satisfy the university and ABET new requirements. The following five courses are included:

1. Add two GS courses, GS XXX (6 credits).
2. Add a course on Biology, BIOL 233 (3 credits). This course is under preparation by the College of Sciences to be specially designed as three credits course under the name Principles of Biology.
3. Add two technical elective courses[1] (6 credits).

In order to accommodate these 15 credits to the science curriculum, the following changes have been made:

1. Delete Statics, CE 201 (-3 credits).
2. Delete Electric Circuits, EE 204 (-3 credits).
3. Delete Organic Chemistry II, CHEM 202 (-4 credits).
4. Delete CHE 325 and distribute its contents among other core courses through the curriculum (-2 credits).
5. Delete IAS elective (-2 credits).
6. Replace CHE203 with CHE202 (a new 2 credit hours course) (-1 credit).

The proposed changes to the BS degree in chemical engineering science are summarized in the tables 1 and 2 below.

[1] Departmental approval is required.

Table 1:
Changes to the B.S. Degree in Chemical Engineering Science

Category	Subject	Courses	Modified Credits	Change
General Education	Gen. Chemistry	CHEM 101, 102	8	
	Mathematics	MATH 101, 102, 201, 202, STAT319	17	
	Physics	PHYS 101, 102	8	
	Communication Skills	ENGL 101, 102, 214, IAS 101, 201, 301	15	
	Eng. Skills	CE201, ICS101, EE204, CISE 301	6	Rep. ICS101 with ICS103 Delete CE201 Delete EE204 (-6 credits)
	Islamic and Arabic Studies	IAS 111, 212, 322	6	
	Phys. Education	PE 101, 102	2	
Advanced Chemical Sciences	Chemistry	CHEM 201, 202, ,311, 323	11	Delete CHEM 202 (-4 credits)
	Materials Science	ME 205	3	
	Biology	BIOL 233	3	Add a course in biology (+3 credits)
Core	Introduction to Chem. Eng.	CHE 201	3	
	Thermodynamics	CHE 203, 303	5	Replace CHE203 with CHE202 (-1 credits)
	Transport Proc.	CHE 204, 300, 304	9	
	Separation Proc.	CHE 306	3	
	Chem. Eng. Computing Lab	CHE 325	0	Delete CHE325 (-2 credits)
	Chemical Engineering Labs	CHE 309, 409	4	
	Proc. Dyn. & Cont.	CHE 401	3	
	Kinetics & Reactor Design	CHE 402	3	
	Eng. Economics & Des. Principles	CHE 425	3	
	Integrated Design	CHE 495	3	
	Summer Training	CHE 399	0	
Electives	CHE Electives	2 CHE 4XX	6	
	Technical Elective	2 XE XXX	6	Add 2 Tehnical Electives (+6 credits)
	Islamic & Arabic Studies	1 IAS Elective	0	Delete IAS elective (-2 credits)
	General Studies	2 GS XXX Electives	6	Add 2 GS electives (+6 credits)
Total Credits			133	(-6-4+3-1-2+6-2+6 = 0)

Table 2a.
OLD B.S. Degree in Chemical Engineering Science

COURSE		TITLE	LT	LB	CR	COURSE		TITLE	LT	LB	CR
First Year (Preparatory)											
ENGL	001	Preparatory English I	15	5	8	ENGL	002	Preparatory English II	15	5	8
MATH	001	Preparatory Mathematics I	3	1	4	MATH	002	Preparatory Math II	3	1	4
PYP	001	Prep. Physical Sciences	2	0	2	PYP	002	Prep. Computer Sciences	0	2	1
PYP	003	University Study Skills	0	2	1	ME	003	Prep. Eng. Technology	0	2	1
PE	001	Preparatory Physical Educ I	0	2	1	PE	002	Preparatory Phys Educ II	0	2	1
			20	**10**	**16**				**18**	**12**	**15**
Total credits required in Preparatory Program: 31											
Second Year (Freshman)											
MATH	101	Calculus I	4	0	4	MATH	102	Calculus II	4	0	4
CHEM	101	General Chemistry I	3	4	4	CHEM	102	General Chemistry II	3	4	4
PHYS	101	General Physics II	3	3	4	PHYS	102	General Physics II	3	3	4
ENGL	101	English Composition I	3	0	3	ENGL	102	English Composition II	3	0	3
IAS	111	Belief and its Consequences	2	0	2	ICS	101	Computer Programming	2	3	3
PE	101	Physical Education I	0	2	1	PE	102	Physical Education II	0	2	1
			15	**9**	**18**				**15**	**12**	**19**
Third Year (Sophomore)											
CHE	201	Intro to Chem. Engg.	3	0	3	CHE	203	Chem. Engg. Thermo.	3	0	3
CHEM	201	Organic Chemistry I	3	4	4	CHE	204	Transport PhenomenaI	3	0	3
MATH	201	Calculus III	3	0	3	CHEM	202	Organic Chemistry II	3	4	4
EE	204	Fund Electric Circuits	2	3	3	MATH	202	Elementary Diff. Eq.	3	0	3
CE	201	Statics	3	0	3	ME	205	Materials Science	2	3	3
IAS	101	Practical Grammar	2	0	2	IAS	212	Professional Ethics	2	0	2
			16	**7**	**18**				**16**	**7**	**18**
Fourth Year (Junior)											
CHE	300	Transport Phenomena II	3	0	3	CHE	306	Stagewise Separations	3	0	3
CHE	303	Chem. Engg. Thermo. II	3	0	3	CHE	309	Chem. Engg Lab I	0	6	2
CHE	304	Transport Phenomena III	3	0	3	CHE	325	Chem. Engg. Comp. Lab.	1	3	2
STAT	319	Statistics for Engineers	2	3	3	CHEM	311	Physical Chemistry II	3	4	4
ENGL	214	Technical Report Writing	3	0	3	SE	301	Numerical Methods	3	0	3
IAS	201	Writing For Prof. Needs	2	0	2	IAS	322	Human Rights in Islam	2	0	2
			16	**3**	**17**				**12**	**13**	**16**
CHE 399 **SUMMER INDUSTRIAL TRAINING** (0-0-0)											
Fifth Year (Senior)											
CHE	401	Process Dynamics and Control	3	0	3	CHE	495	Integrated Design Course	1	6	3
CHE	402	Kinetics & Reactor Design	3	0	3	CHE	409	Chem. Engg. Lab II	0	6	2
CHE	425	Engg. Econ. & Design Prin.	3	0	3	CHE	4xx	Chem Engg Elective I	3	0	3
CHEM	323	Instrumental Analysis	2	4	3	CHE	4xx	Chem. Engg. Elective II	3	0	3
IAS	301	Oral Communication Skills	2	0	2	IAS	4xx	IAS Elective	2	0	2
			13	**4**	**14**				**9**	**12**	**13**

Total credits required for degree program: 133

Table 2b.
NEW B.S. Degree in Chemical Engineering Science

COURSE		TITLE	LT	LB	CR	COURSE		TITLE	LT	LB	CR
First Year (Preparatory)											
ENGL	001	Preparatory English I	15	5	8	ENGL	002	Preparatory English II	15	5	8
MATH	001	Preparatory Mathematics I	3	1	4	MATH	002	Preparatory Math II	3	1	4
PYP	001	Prep. Physical Sciences	2	0	2	PYP	002	Prep. Computer Sciences	0	2	1
PYP	003	University Study Skills	0	2	1	ME	003	Prep. Eng. Technology	0	2	1
PE	001	Preparatory Physical Educ I	0	2	1	PE	002	Preparatory Phys Educ II	0	2	1
			20	**10**	**16**				**18**	**12**	**15**

Total credits required in Preparatory Program: 31

Second Year (Freshman)											
MATH	101	Calculus I	4	0	4	MATH	102	Calculus II	4	0	4
CHEM	101	General Chemistry I	3	4	4	CHEM	102	General Chemistry II	3	4	4
PHYS	101	General Physics I	3	3	4	PHYS	102	General Physics II	3	3	4
ENGL	101	An Intro to Academic Disc	3	0	3	ENGL	102	Introduction to Report Wr	3	0	3
ICS	103	Computer Programming in C	2	3	3	IAS	101	Practical Grammar	2	0	2
PE	101	Physical Education I	0	2	1	PE	102	Physical Education II	0	2	1
			15	**12**	**19**				**15**	**9**	**18**
Third Year (Sophomore)											
CHE	201	Principles of Chem. Engg. I	3	2	3	CHE	202	Principles of Chem. Engg. II	2	2	2
CHEM	201	Organic Chemistry I	3	4	4	CHE	204	Transport Phenomena I	3	0	3
MATH	201	Calculus III	3	0	3	BIOL	233	Principles of Biology	2	3	3
ENGL	214	Academic & Professional C	3	0	3	MATH	202	Elementary Diff. Eq.	3	0	3
IAS	111	Belief and its Consequences	2	0	2	ME	205	Materials Science	2	3	3
			14	**6**	**15**	IAS	201	Writing For Prof. Needs	2	0	2
									14	**8**	**16**
Fourth Year (Junior)											
CHE	300	Transport Phenomena II	3	0	3	CHE	306	Stagewise Separations	3	0	3
CHE	303	Chem. Engg. Thermo.	3	0	3	CHE	309	Chem. Engg Lab I	0	6	2
CHE	304	Transport Phenomena III	3	0	3	CHEM	323	Analytical Chemistry	2	4	3
CHEM	311	Physical Chemistry I	3	4	4	STAT	319	Probability & Stats. for Engrs.	2	3	3
CISE	301	Numerical Methods	3	0	3	IAS	301	Oral Communication Skills	2	0	2
IAS	212	Professional Ethics	2	0	2	GS	XXX	General Studies Elective I	3	0	3
			17	**4**	**18**				**12**	**13**	**16**

Summer Session CHE 399 Summer Training (0-0-0)

Fifth Year (Senior)											
CHE	401	Process Dynamics and Control	3	0	3	CHE	495	Integrated Design Course	1	6	3
CHE	402	Kinetics & Reactor Design	3	0	3	CHE	409	Chem. Engg. Lab II	0	6	2
CHE	425	Process Design and Economics	3	0	3	CHE	4XX	Chem Engg Elective II	3	0	3
CHE	4XX	Chem. Eng. Elective I	3	0	3	XE	XXX	Technical Elective II	3	0	3
XE	XXX	Technical Elective I	3	0	3	GS	XXX	General Studies Elective II	3	0	3
IAS	322	Human Rights in Islam	2	0	2				**10**	**12**	**14**
			17	**0**	**17**						

Total credits required for degree program: 133

Revised *Applied* Chemical Engineering Curriculum:

The following five courses have been included to the applied chemical engineering curriculum:

1. Add one GS courses, GS XXX (3 credits).
2. Add a course in Biology, BIOL 233 (3 credits). This course is under preparation by the College of Sciences to be specially designed as three credits course under the name Principles of Biology.
3. Add one chemical engineering elective course (3 credits).
4. Add one technical elective course[2] (3 credits).

In order to accommodate these 15 credits to the applied curriculum, the following changes have been made:

1. Delete Electric Circuits, EE 204 (-3 credits).
2. Delete Organic Chemistry II, CHEM 202 (-4 credits).
3. Delete CHE 325 and distribute its contents among other core courses through the curriculum (-2 credits).
4. Delete IAS elective (-2 credits).
5. Replace CHE203 with CHE202 (a new 2 credit hours course) (-1 credit).

The revised applied chemical engineering curriculum has been improved by adding one chemical engineering elective as well as a technical elective which were lacking in the old curriculum. The applied chemical engineering curriculum is very constrained because of the nine credits requirements for CO-OP. As a result, only one chemical engineering elective, one technical elective, and one GS are proposed. Adding additional credits to the applied curriculum is only feasible by increasing the maximum total credits to more than 133 or by reducing the credit hours for CHE 351 to less than 9.

Changes to the BS degree in applied chemical engineering curriculum are summarized in tables 3 and 4 below.

[2] Departmental approval is required.

Table 3:
Proposed Changes to the B.S. Degree in Applied Chemical Engineering

Category	Subject	Courses	Modified Credits	Proposed Change
General Education	Gen. Chemistry	CHEM 101, 102	8	
	Mathematics	MATH 101, 102, 201, 202, STAT319	17	
	Physics	PHYS 101, 102	8	
	Communication Skills	ENGL 101, 102, 214, IAS 101, 201, 301	15	
	Eng. Skills	ICS 103, CISE 301, EE204	6	Rep. ICS101 with ICS103 Delete EE204 (-3 credits)
	Islamic and Arabic Studies	IAS 111, 212, 322	6	
	Phys. Education	PE 101, 102	2	
Advanced Chemical Sciences	Chemistry	CHEM 201, 311, 202, 323	11	Delete CHEM 202 (-4 credits)
	Materials Science	ME 205	3	
	Biology	BIOL233	3	Add a course in biology (+3 credits)
Core	Introduction to Chem. Eng.	CHE 201	3	
	Thermodynamics	CHE 203, 303	5	Replace CHE203 with CHE202 (-1 credits)
	Transport Proc.	CHE 204, 300, 304	9	
	Separation Proc.	CHE 306	3	
	Chem. Eng. Computing Lab	CHE 325	0	Delete CHE325 (-2 credits)
	Chemical Engineering Labs	CHE 309, 409	4	
	Proc. Dyn. & Cont.	CHE 401	3	
	Kinetics & Reactor Design	CHE 402	3	
	Eng. Economics & Des. Principles	CHE 425	3	
	Integrated Design	CHE 495	3	
	Cooperative Training	CHE 351	9	
Electives	CHE Electives	CHE 4 xx	3	Add a CHE Elective (+3 credits)
	Technical Elective	XE xxx	3	Add a technical elective (+3 credits)
	Islamic & Arabic Studies	1 IAS Elective	0	Remove IAS elective (-2 credits)
	General Studies	1 GS xxx Elective	3	Add 1 GS elective (+3 credits)
Total Credits			133	(-3-4+3-1-2+3+3+-2+3 = 0)

Table 4a.

OLD B.S. Degree in Applied Chemical Engineering

COURSE		TITLE	LT	LB	CR	COURSE		TITLE	LT	LB	CR
First Year (Preparatory)											
ENGL	001	Preparatory English I	15	5	8	ENGL	002	Preparatory English II	15	5	8
MATH	001	Preparatory Mathematics I	3	1	4	MATH	002	Preparatory Maths II	3	1	4
ME	001	Preparatory Graphics	0	2	1	ME	002	Preparatory Workshop	0	2	1
PE	001	Preparatory Physical Education I	0	2	1	PE	002	Prep Physical Education II	0	2	1
			18	10	14				18	10	14
Total credits required in Preparatory Program: 28											
Second Year (Freshman)											
MATH	101	Calculus I	4	0	4	MATH	102	Calculus II	4	0	4
CHEM	101	General Chemistry I	3	4	4	CHEM	102	General Chemistry II	3	4	4
PHYS	101	General Physics I	3	3	4	PHYS	102	General Physics II	3	3	4
ENGL	101	English Composition I	3	0	3	ENGL	102	English Composition II	3	0	3
IAS	111	Belief and its Consequences	2	0	2	ICS	101	Computer Programming	2	3	3
PE	101	Physical Education I	0	2	1	PE	102	Physical Education II	0	2	1
			15	9	18				15	12	19
Third Year (Sophomore)											
CHE	201	Intro. to Chem. Engg.	3	0	3	CHE	203	Chem. Engg. Thermo I	3	0	3
MATH	201	Calculus III	3	0	3	CHE	204	Transport Phenomena I	3	0	3
CHEM	201	Organic Chemistry I	3	4	4	MATH	202	Elem Diff Equations	3	0	3
ME	205	Materials Science	2	3	3	CHEM	202	Organic Chemistry II	3	4	4
EE	204	Fund Electric Circuits	2	3	3	ENGL	214	Technical Report Writing	3	0	3
IAS	101	Practical Grammar	2	0	2	IAS	212	Professional Ethics	2	0	2
			16	10	18				17	4	18
Fourth Year (Junior)											
CHE	300	Transport Phenomena II	3	0	3	CHE	306	Stagewise Operations	3	0	3
CHE	303	Chem. Engg .Thermo II	3	0	3	CHE	309	Chem. Engg. Laboratory I	0	6	2
CHE	304	Transport Phenomena III	3	0	3	CHE	325	Chem. Engg. Comp.Lab.	1	3	2
STAT	319	Statistics for Engineers	2	3	3	CHEM	323	Instrumental Analysis	3	0	3
CHEM	311	Physical Chemistry II	3	4	4	SE	301	Numerical Methods	3	0	3
IAS	201	Writing For Prof. Needs	2	0	2	IAS	322	Human Rights in Islam	2	0	2
			16	7	18				12	9	15
Summer Session		CHE 350 Coop Work Program			0 0 0						
Fifth Year (Senior)											
CHE	351	Cont of Coop Work	0	0	9	CHE	401	Proc. Dyn. and Control	3	0	3
						CHE	402	Kinetics & React. Design	3	0	3
						CHE	425	Engg. Econ. & Design	3	0	3
						CHE	409	Chem. Engg Laboratory II	0	6	2
						CHE	4xx	Chem. Engg. Elective	3	0	3
						IAS	4xx	IAS Elective	2	0	2
						IAS	301	Oral Communication Skills	2	0	2

Table 4b.

NEW B.S. Degree in Applied Chemical Engineering

COURSE		TITLE	LT	LB	CR	COURSE		TITLE	LT	LB	CR
First Year (Preparatory)											
ENGL	001	Preparatory English I	15	5	8	ENGL	002	Preparatory English II	15	5	8
MATH	001	Preparatory Mathematics I	3	1	4	MATH	002	Preparatory Math II	3	1	4
PYP	001	Prep. Physical Sciences	2	0	2	PYP	002	Prep. Computer Sciences	0	2	1
PYP	003	University Study Skills	0	2	1	ME	003	Prep. Eng. Technology	0	2	1
PE	001	Preparatory Physical Educ I	0	2	1	PE	002	Preparatory Phys Educ II	0	2	1
			20	**10**	**16**				**18**	**12**	**15**

Total credits required in Preparatory Program: 31

Second Year (Freshman)											
MATH	101	Calculus I	4	0	4	MATH	102	Calculus II	4	0	4
CHEM	101	General Chemistry I	3	4	4	CHEM	102	General Chemistry II	3	4	4
PHYS	101	General Physics I	3	3	4	PHYS	102	General Physics II	3	3	4
ENGL	101	An Intro to Academic Disc	3	0	3	ENGL	102	Introduction to Report Wr	3	0	3
ICS	103	Computer Programming in C	2	3	3	IAS	101	Practical Grammar	2	0	2
PE	101	Physical Education I	0	2	1	PE	102	Physical Education II	0	2	1
			15	**12**	**19**				**15**	**9**	**18**
Third Year (Sophomore)											
CHE	201	Principles of Chem. Engg. I	3	2	3	CHE	202	Principles of Chem. Engg. II	2	2	2
CHEM	201	Organic Chemistry I	3	4	4	CHE	204	Transport Phenomena I	3	0	3
MATH	201	Calculus III	3	0	3	BIOL	233	Principles of Biology	2	3	3
ENGL	214	Academic & Professional C	3	0	3	MATH	202	Elementary Diff. Eq.	3	0	3
IAS	111	Belief and its Consequences	2	0	2	ME	205	Materials Science	2	3	3
			14	**6**	**15**	IAS	201	Writing For Prof. Needs	2	0	2
									14	**8**	**16**
Fourth Year (Junior)											
CHE	300	Transport Phenomena II	3	0	3	CHE	306	Stagewise Separations	3	0	3
CHE	303	Chem. Engg. Thermo.	3	0	3	CHE	309	Chem. Engg Lab I	0	6	2
CHE	304	Transport Phenomena III	3	0	3	CHEM	323	Analytical Chemistry	2	4	3
CHEM	311	Physical Chemistry I	3	4	4	STAT	319	Probability & Stats. for Engrs.	2	3	3
CISE	301	Numerical Methods	3	0	3	IAS	301	Oral Communication Skills	2	0	2
IAS	212	Professional Ethics	2	0	2	GS	XXX	General Studies Elective	3	0	3
			17	**4**	**18**	CHE	401	Process Dynamics and Cont.	3	0	3
									15	**13**	**19**
Summer Session		CHE 350 Cooperative Work	0	0	0						
Fifth Year (Senior)											
CHE	352	Cont. of Cooperative Work	0	0	9	CHE	402	Kinetics & Reactor Design	3	0	3
			0	**0**	**9**	CHE	409	Chem. Engg. Lab II	0	6	2
						CHE	425	Process Design and Econ.	3	0	3
						CHE	495	Integrated Design Course	1	6	3
						CHE	4XX	Chem Engg Elective	3	0	3
						XE	XXX	Technical Elective	3	0	3
						IAS	322	Human Rights in Islam	2	0	2
									15	**12**	**19**

Total credits required for degree program: 133

Table 5. Revised Pre-Requisite and Co-Requisite Requirements

Course Title	Course Name	Revised Pre-Requisite and Co-Requisite Requirements		Comments
		Pre-Requisites	Co-Requisites	
CHE 201	Principles of Chem. Engg. I	CHEM 102 PHYS 102		
CHE 202	Principles of Chem. Engg. II	CHE 201 MATH 201 ICS 103		
CHE 203	Chemical Engineering Thermodynamics I	CHE 201 MATH 201 ICS 103		Required for OLD Curricula Only
CHE 204	Transport Phenomena I	CHE 201 (or PE201) ICS 103	MATH 202	
CHE 300	Transport Phenomena II	CHE 202 CHE 204		
CHE 303	Chemical Engineering Thermodynamics	CHE 202		
CHE 304	Transport Phenomena III	CHE 204	CHE 300	
CHE 306	Stagewise Operations	CHE 303 CHE 304		
CHE 309	Chemical Engineering Laboratory I	CHE 300 ENGL 214	CHE 304	
CHE 325	Chemical Engineering Computing Laboratory	CHE 306		Required for OLD Curricula Only
CHE 351	Applied Chemical Engineering Coop	ENGL 214 CHE 309		
CHE 399	Summer Training	ENGL 214 CHE 304		
CHE 401	Process Dynamics and Control	CHE 304 CISE 301		
CHE 402	Kinetics and Reactor Design	CHE 303 CHE 304 CHEM 311 CISE 301		
CHE 409	Chemical Engineering Laboratory II	CHE 306 CHE 309	CHE 401 CHE 402	
CHE 422	Properties of Fluids	CHE 303		
CHE 425	Process Design and Economics	CHE 306	CHE 402	
CHE 430	Separation Processes	CHE 306		
CHE 431	Membrane Processes Technology	CHE 306		

CHE 432	Principles of Heat Exchanger Design	CHE 300		
CHE 440	Catalysis & Catalytic Processes	CHE 402		
CHE 449	Biochemical Engineering	CHE 304	CHE 402	
CHE 453	Mathematical Methods in Chemical Engineering	MATH 202 CHE304		
CHE 455	Chemical Process Simulation	CHE 306		
CHE 456	Industrial Process Control	CHE 401		
CHE 461	Petroleum Refining	CHE 306		
CHE 462	Petrochemical Industries	CHE 306		
CHE 463	Polymer Technology	CHEM 311		
CHE 464	Refining and Petrochemicals Technology and Economics	CHE 306		
CHE 465	Process Integration and Optimization	CHE 306		
CHE 470	Process Air Pollution Control	CHE 304		
CHE 471	Process Water Pollution Control	CHE 304		
CHE 472	Corrosion	CHEM 311		
CHE 473	Desalination	CHE 304 CHE 303		
CHE 480	Energy Technology	CHE 304 CHE 303		
CHE 491	Materials Evaluation and Selection	ME 205		
CHE 495	Integrated Design Course	None	CHE 402 CHE 425	
CHE 498	Special Topics in Chemical Engineering I	Approval of the Department.		
CHE 499	Special Topics in Chemical Engineering I	Approval of the Department.		

Chemical Engineering

CHE

CHE 201 Principles of Chem. Engg. I (3-2-3)

The basic principles and techniques used for calculations of material balances in chemical engineering processes are introduced. Material balance for reactive and nonreactive processes is discussed. Simple chemical engineering processes and complex systems including recycle are covered. Study of behavior of ideal and real gases. Computer simulation will be used for material balance problems.

Prerequisites: CHEM 102, PHYS 102

CHE 202 Principles of Chem. Engg. II (2-2-2)

The first law of thermodynamics is studied in detail. Material covered includes concepts of energy, enthalpy, heat effects, conservation of energy, mechanical work, chemical energy liberation and equations of state, behavior of gases and liquids and standard heats of reaction, formation and combustion and heat effects of industrial reactions. Thermodynamics properties of materials and methods of their estimation are presented. Study of combined mass and energy balances and applications to problems through use of enthalpy concentration charts and humidity charts. Computer simulation will be used for combined material and energy balance problems.

Prerequisites: CHE 201, MATH 201, ICS 103

CHE 204 Transport Phenomena I (3-0-3)

The course introduces principles governing fluid flow for Newtonian and non-Newtonian fluids in laminar and turbulent flows. Mass, energy, momentum balances, dimensional analysis and simulation are used as tools to analyze flows: in pipes, in packed beds, around particles and surfaces, fluidized beds and flow meters. The course also covers: hydrostatics, exact solution of Navier-Stokes equations, constitutive equations for stresses, viscous effects and boundary layer flows. Computer simulation will be used for piping and pumping problems.

Prerequisites: CHE 201 or PETE 201, ICS 103

Corequisites: MATH 202

CHE 300 Transport Phenomena II (3-0-3)

Modes of heat transfer. Differential equations of energy transport. Steady and transient heat conduction. Free and forced convection in laminar and turbulent flows. Momentum and heat transfer analogies. Boiling and condensation. Radiation heat transfer. Application to the design of process heat transfer equipment.

Prerequisite: CHE 202, CHE 204

CHE 303 Chemical Engineering Thermodynamics (3-0-3)

This course presents the theory and applications of chemical engineering thermodynamics. Topics covered include: review 1st and 2nd laws of thermodynamics, equations of state, thermodynamics of flow processes, steam power plants, thermodynamic relations, thermodynamics properties of pure fluids, vapor-liquid equilibria, phase diagrams, solution thermodynamics, thermodynamics properties of fluid mixtures, and chemical-reaction equilibria. Computer simulation to thermodynamic systems is applied in this course.

Prerequisites: CHE 202

CHE 304 Transport Phenomena III (3-0-3)

This course covers fundamentals of mass transfer, differential equations of mass transfer, steady-state and unsteady-state molecular diffusion, convective mass transfer, interface mass transfer, mass transfer theories, mass transfer equipment, absorption and humidification operations.

Prerequisite: CHE 204

Corequisite: CHE 300

CHE 306 Stagewise Operations (3-0-3)

Review vapor-liquid equilibria. Flash distillation. Column binary distillation. McCabe-Thiele and Ponchon-Savarit methods. Excat and short cut methods for multicomponent distillation. Batch distillation. Staged and packed column design. Absorption and stripping. Immiscible extraction. Computer simulation will be used to solve different type of distillation problems throughout the course.

Prerequisites: CHE 303, CHE 304

CHE 309 Chemical Engineering Laboratory I (0-6-2)

This laboratory emphasizes concepts presented in the transport phenomena courses. A safety session is given at the commencement of the course. Safe practices are strictly adhered to throughout the course. Students carry out selected experiments in fluid mechanics, heat transfer, thermodynamics and diffusional mass transfer. Data collected are analyzed and compared to applicable theories.

Prerequisites: CHE 300, ENGL 214

Corequisite: CHE 304

CHE 351 Applied Chemical Engineering Cooperative Work (0-0-9)

In this course the student will spend a period of 28 weeks of industrial employment in industry. Students are required to write a detailed formal report on their experience. Evaluation by the employer will be counted towards the grade given for this course.

Prerequisites: ENGL 214, CHE 309

CHE 399 Summer Training (0-0-0)

A period of 12 weeks of industrial employment in appropriate industries or firms. Students are evaluated on their performance, and are required to submit a report and offer a seminar about their experience before receiving a grade of Pass or Fail for the course.

Prerequisite: ENGL 214, CHE 304

CHE 401 Process Dynamics and Control (3-0-3)

The intent of this course is to present the fundamental principles in modeling and control of chemical processes. The topics covered in this course include: modeling of chemical processes, Laplace transfer and state-space models, approximation of complicated models, dynamics and simulation of different systems, feedback controllers, PID tuning, design and instrumentation of closed-loop control systems, control block diagrams, frequency response analysis, Bode and Nyquist stability criteria.

Prerequisites: CHE 304, CISE 301

CHE 402 Kinetics and Reactor Design (3-0-3)

Introduction to kinetics of reactions. Techniques for experimentally determining rate laws for simple and complex chemical reactions. Design and operation of isothermal batch and flow reactors. Nonisothermal reactor design and operation. Introduction to catalysis and catalytic reactors. Computer simulation of reaction systems will be implemented.

Prerequisites: CHE 303, CHE 304, CHEM 311, CISE 301

CHE 409 Chemical Engineering Laboratory II (0-6-2)

A laboratory to complement the theoretical derivations in stagewise operations, process dynamics and control, and kinetics and reactor design. A safety session is given at the commencement of the course. Safe practices are strictly adhered to throughout the course. Two environmental engineering reaction experiments are included. Students carry out selected experiments, analyze data collected referring to applicable theories and present their findings in formal reports.

Prerequisites: CHE 306, CHE 309

Corequisites: CHE 401, CHE 402

CHE 422 Properties of Fluids (3-0-3)

Study on several methods for the estimation of physical, thermodynamic and transport properties of fluids commonly used in industry. Study of literature sources where property information is available. Application of these properties to process design is emphasized to give the students a complete picture of the use and importance of good property estimation.

Prerequisite: CHE 303

CHE 425 Process Design and Economics (3-0-3)

Introducing the Process flow diagrams and plant layout, conceptual design and synthesis of process flow diagrams, understanding the process conditions, technical analysis of chemical processes and use of heuristics in design and analysis, and use of simulation in equipment design and process synthesis. Engineering economic analysis of chemical processes with particular emphasis on estimation of capital cost, estimation of cost of manufacturing, time value of money, depreciation, cash flow, profitability and financial analysis, methods for decision making among alternatives.

Prerequisite: CHE 306

Corequisite: CHE 402

CHE 430 Separation Processes (3-0-3)

The intent of this course is to present advances separation techniques practiced in chemical and petrochemical industry. Dynamics of the distillation column involving the column internals and column diameter calculations will be covered. Emphasis will be on the unit operations of multi-component gas absorption, humidification, evaporation, adsorption and ion exchange, reverse osmosis, permeation, dialysis, electrodialysis, and pervaporation.

Prerequisite: CHE 306

CHE 431- Membrane Processes Technology (3-0-3)

Membrane fundamentals and practical applications of membrane processes; membrane classifications, materials, properties and characterization, and preparation; transport through membranes, concentration polarization and membrane fouling, membrane permeability with special emphasis on membrane modules and process design; gas separation, pervaporation, ultrafiltration, reverse osmosis, and membrane reactors.

Prerequisite: CHE 306

CHE 432 Principles of Heat Exchanger Design (3-0-3)

Description and applications of different heat exchangers in process industries. Design of double pipe heat exchanger (including extended surfaces). Detailed design procedures for shell and tube heat exchanger for single phase flow. Detailed design procedures for air coolers. Selection criteria for heat exchangers. Descriptive discussion of condensers, evaporators and reboilers, novel heat exchangers and other types of heat exchangers.

Prerequisite: CHE 300

CHE 440 Catalysis & Catalytic Processes (3-0-3)

Basic definitions and classification of catalysts, nature and mechanism of catalytic reactions, adsorption processes, catalyst preparation and catalyst characterization. Mass and heat transport effects in catalysis. Catalyst deactivation. Design principles of heterogeneous catalytic reactors such as fixed- and fluidized-bed reactors. Industrial catalytic processes with emphasis on existing processes in Saudi Arabia.

Corequisite: CHE 402

CHE 449 Biochemical Engineering (3-0-3)

Descriptive treatment of key concepts on biochemistry. The kinetics of enzyme-catalyzed reactions and its applications. Kinetics of substrate utilization, transport phenomena in microbial systems. Design and analysis of biological reactors. Analysis of multiple interacting microbial populations in applications.

Prerequisite: CHE 304

Corequisite: CHE 402

CHE 453 Mathematical Methods in Chemical Engineering (3-0-3)

This course introduces the selection, construction, solution, and interpretation of mathematical models applicable to the study of chemical engineering problems. Topics covered include: introduction to mathematical modeling, analytical solution of ordinary differential equations, special functions, analytical solution of partial differential equations, numerical solution of nonlinear algebraic systems, and numerical solution of systems of first order ODE's.

Prerequisites: MATH 202, CHE 304

CHE 455 Chemical Process Simulation (3-0-3)

The intent of this course is to emphasize the application of computer simulation and flowsheeting, optimization, and process synthesis techniques to the design and operation of chemical processes and equipment. Students will learn how to simulate various process units and processes, and what is in the black box of a simulator program. The topics covered in this course include: concepts of structure and information flow and tasks in the design and analysis of chemical processes, basic solution strategies in flowsheeting computations, computation sequence in solving set of equations, concept of flowsheet partitioning and tearing, steady-state unit operation models in simulator packages such as Aspen Plus, HYSYS and UniSim Design, selection of thermodynamics and physical property models, and heuristics for process synthesis. Each student will be assigned an individual process to simulate under steady-state conditions using available process simulators.

Prerequisite: CHE 306

CHE 456 Industrial Process Control (3-0-3)

Review of feed back control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control. Dynamic simulation of control systems using SIMULINK and other commercial software packages. Instrumentation, design case studies and tuning case studies.

Prerequisite: CHE 401

CHE 461 Petroleum Refining (3-0-3)

General review of refining processes of crude oil. Shortcut methods for practical design calculations. Design of atmospheric, vacuum, and pressure columns for petroleum fractionation, including auxiliary furnaces and condensers. Recent developments in heavy oil processing.

Prerequisite: CHE 306

CHE 462 Petrochemical Industries (3-0-3)

Process technologies used in petrochemical industries, such as thermal and catalytic cracking will be introduced. Basic, intermediate and final petrochemicals are studied. These include synthesis gas and derivatives, ethylene, propylene, butene, BTX, and their derivatives. Competing technologies will be assessed from the chemical engineering point of view.

Prerequisite: CHE 306

CHE 463 Polymer Technology (3-0-3)

Structure and physical properties of polymers. Homogeneous and heterogeneous polymerization processes. The chemical, mechanical, and engineering properties of polymers as well as polymer processing and rheology are emphasized in this course.

Prerequisite: CHEM 311

CHE 464 Refining and Petrochemicals Technology and Economics (3-0-3)

The characteristics of the industry in terms of feed stocks and products interaction, processes and technologies, and Economics are introduced. Petroleum fractionation and general review of refining processes of crude oil are introduced. Important petrochemical products are introduced with emphasis on those produced in Saudi Arabia. The basic unit processes such as hydrotreating, cracking, reforming, dehydrogenation, oxidation etc., are introduced along with their applications in the industry. The economics and cost of production is discussed whenever relevant. The course will emphasize the basic concepts and principles of the industry and will avoid unnecessary and descriptive process details. Integration of the Petrochemical and Petroleum Refining industries will be highlighted whenever applicable.

Prerequisite: CHE 306

CHE 465 Process Integration and Optimization (3-0-3)

This course presents recent advances in chemical process integration and synthesis. The course presents systematic and state-of-the-art techniques for understanding the global insights of mass and energy flows within a process and how these integrated insights can be used to optimize process performance. A variety of mathematical and visualization tools are presented. In particular, emphasis is given to fundamental integration and synthesis methodologies along with their applications to the process industries.

Prerequisite: CHE 306

CHE 470 Process Air Pollution Control (3-0-3)

Sources and effects of air pollution; air quality, atmospheric reactions and scavenging processes. Meteorological setting for dispersion of air pollutants. Theory of atmospheric dispersion modeling. Air pollution control concepts, selection, evaluation and application of control devices for emission and control from chemical and petrochemical industries.

Prerequisite: CHE 304

CHE 471 Process Water Pollution Control (3-0-3)

Water quality and pollution, industrial wastewater characterization, classification of wastewater processes. Modeling and design of biological waste treatment processes. Analyses of chemical and physical processes for wastewater treatment in process industries.

Prerequisite: CHE 304

CHE 472 Corrosion (3-0-3)

Study of corrosion mechanisms and techniques used in prevention and control. Electrochemistry and its application to corrosion. Material selection for different environments.

Prerequisite: CHEM 311

CHE 473 Desalination (3-0-3)

Description of methods of water analysis and treatment. Study of properties of water and aqueous solutions. Detailed discussion and analysis of design, maintenance, energy requirements and economics of the major processes of desalination such as distillation, reverse osmosis, and electrodialysis.

Prerequisites: CHE 304, CHE 303

CHE 480 Energy Technology (3-0-3)

Statistics on global energy use, supply and demand of energy, energy generation from fossil and non-fossil fuels. Energy transportation and storage, energy from low-calorific value fuels, energy conservation and economics, and energy management.

Prerequisites: CHE 304, CHE 303

CHE 491 Materials Evaluation and Selection (3-0-3)

This course is designed to acquaint students with the theoretical reasoning and experimental methods used in evaluating both crystalline and non-crystalline materials covering metallic, polymeric and ceramic materials. The principles involved in their selection based on

mechanical properties, resistance to degradation, and wear, and special properties are illustrated in the practical examples from process industries.

Prerequisite: ME 205

CHE 495 Integrated Design Course (1-6-3)

Development of general engineering skills and judgment needed in the solution of open-ended problems from a technical-economic viewpoint are the major goals of this course. The design of a project from conception to implementation including preliminary feasibility study, preparation of process, flow diagram, process design, pre-construction cost estimate, equipment sizing (design), selection of materials of construction, and analysis of project.

Applications will be in areas such as petroleum, petrochemicals, emerging chemical industries and water desalination. Design topics will be assigned to teams of students.

Corequisite: CHE 402, CHE 425

CHE 498 Special Topics in Chemical Engineering I (3-0-3)

Selected topics from the broad area of chemical engineering. The specific contents of the course is published one semester in advance.

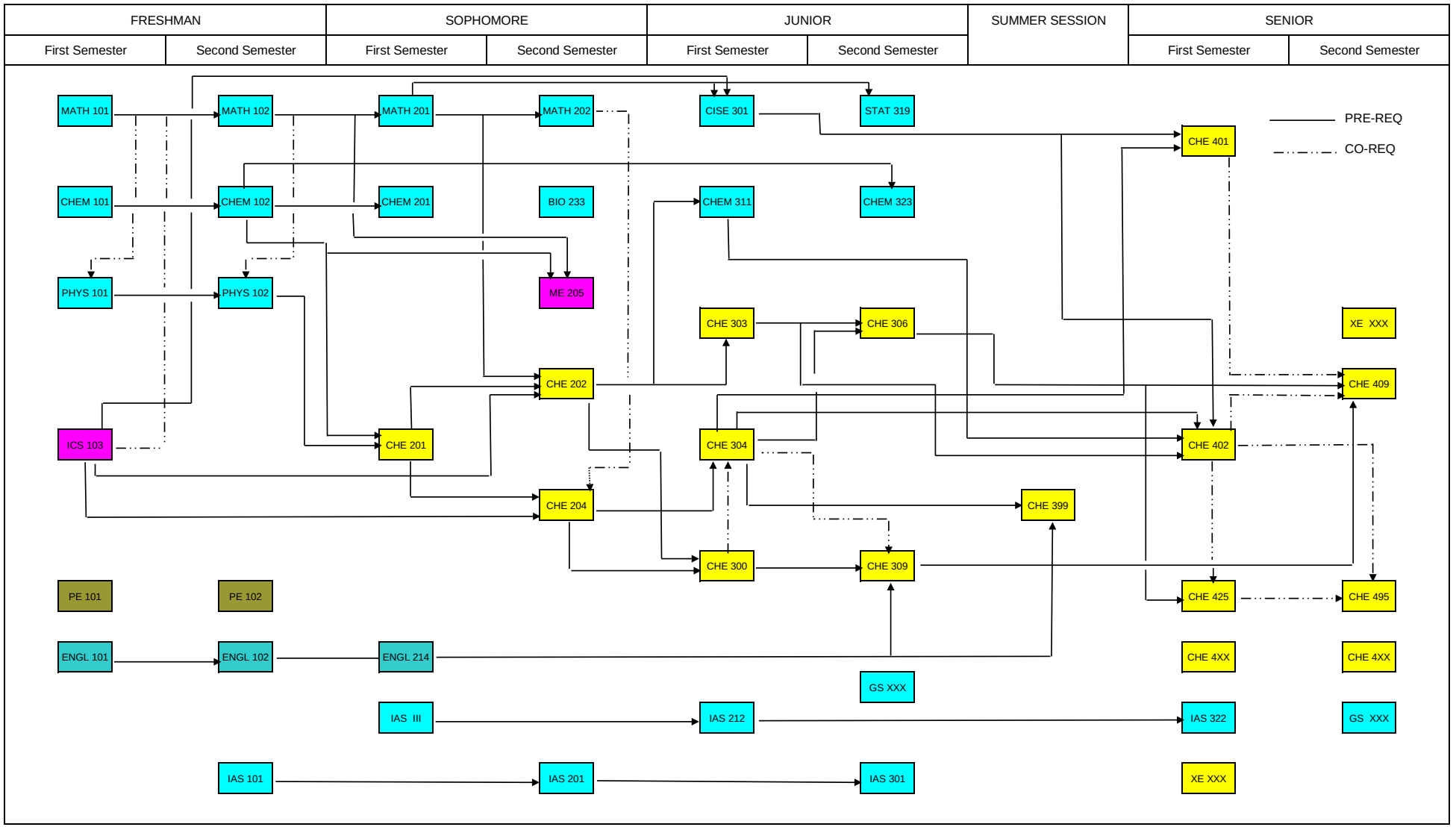
Prerequisite: Departmental Approval

CHE 499 Special Topics in Chemical Engineering II (3-0-3)

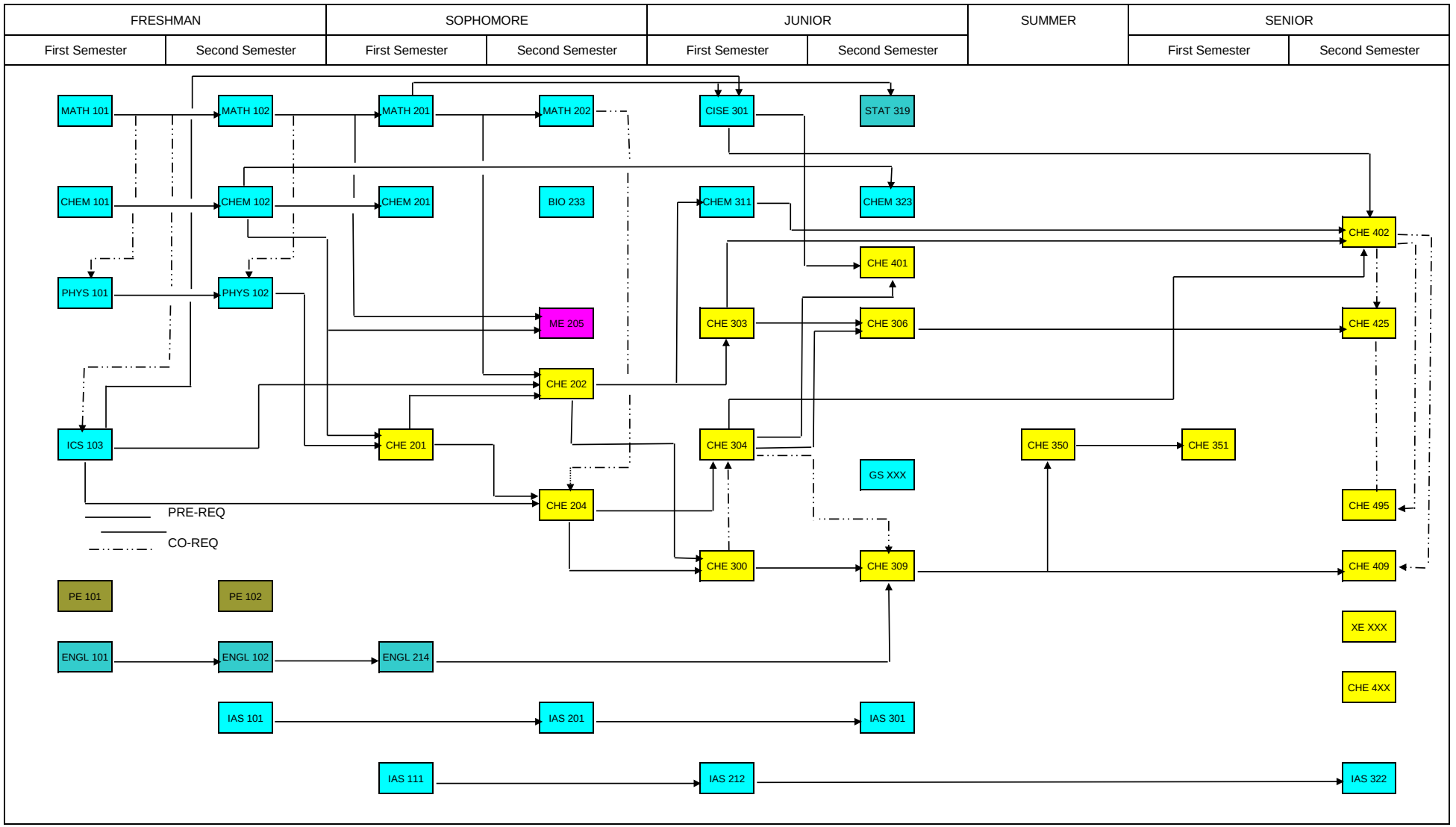
Selected topics from the broad area of chemical engineering. The specific contents of the course is published one semester in advance.

Prerequisite: Departmental Approval

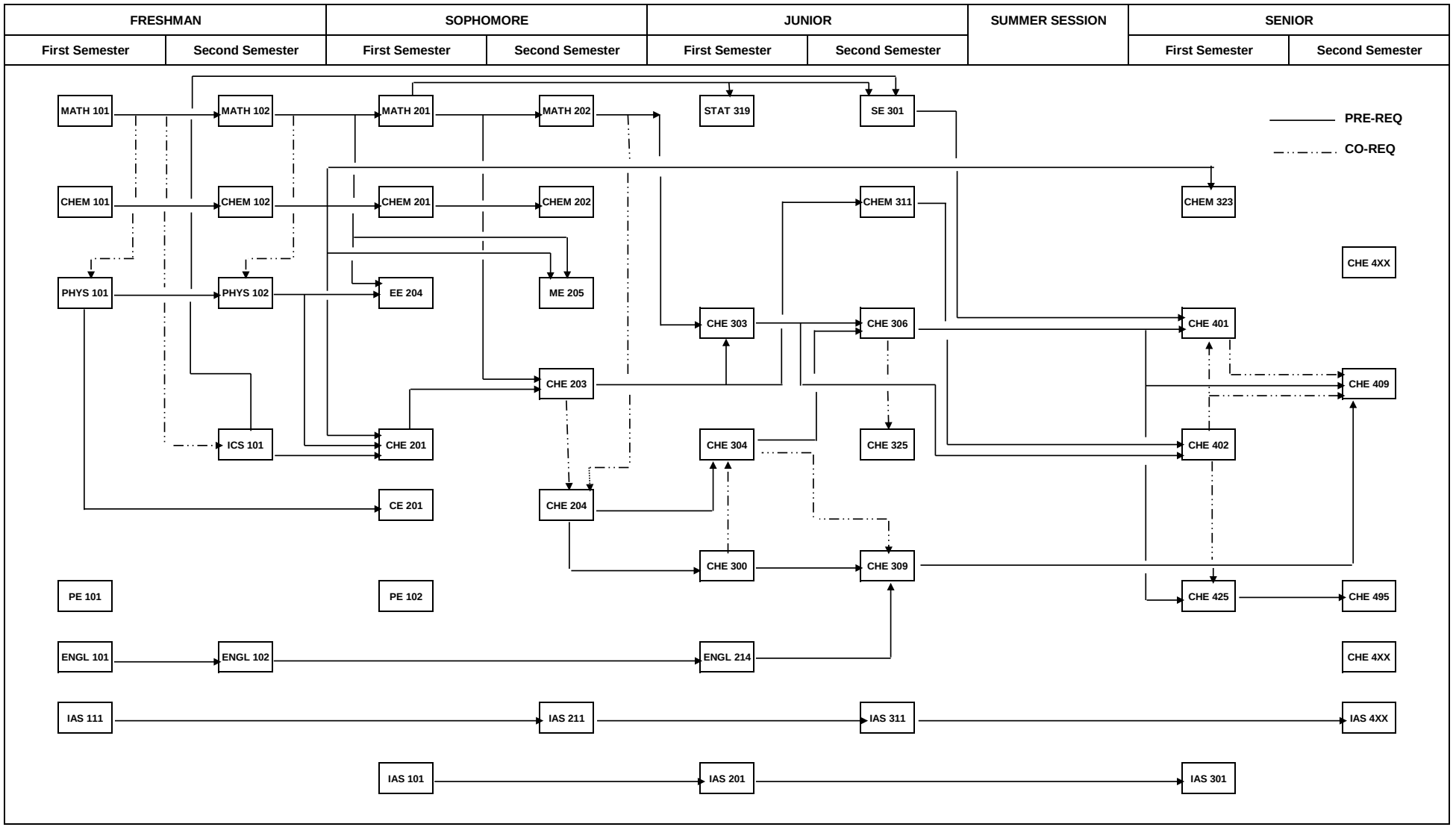
NEW CHEMICAL ENGINEERING SCIENCE CURRICULUM



NEW APPLIED CHEMICAL ENGINEERING CURRICULUM



OLD CHEMICAL ENGINEERING SCIENCE CURRICULUM



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