Chemical Engineering (BS): Biomanufacturing Sciences (14CHEBMF)

Semester Display Effective Date: 1.2013

FRESHMAN YEAR

Fall Semester	Credit		Spring Semester	Credit
CH 101 Chemistry, A Molecular Science[4]	3		CH 201 Chemistry – Quantitative Sci.[1]	3
CH 102 General Chemistry Lab[4]	1		CH 202 Quantitative Chem Lab	1
E 101 Introduction to Engr & Prob Solv[1]	1		MA 241 Calculus II[4]	4
E 115 Intro to Computing Environ	1		PY 205 Physics for Engr & Sc I[4]	3
ENG 101 Academic Writing and Research[1]	4		PY 206 Physics for Engineer & Scientists I Lab	1
MA 141 Calculus I[4]	4		EC 205 Economics (**or** EC 201 **or** ARE 201)*	3
HES_*** Health & Exercise Studies Course	1		HES_*** Health & Exercise Studies Course	1
	15			**16**

SOPHOMORE YEAR

Fall Semester	Credit		Spring Semester	Credit
BEC 220 Intro Biomanufacturing	1		BIO 183 Intro Biology: Cellular & Molecular	4
CH 221 Organic Chemistry I[5]	3		CH 223 Organic Chemistry II[5]	3
CH 222 Organic Chemistry I Lab[5]	1		CH 224 Organic Chemistry II Lab[5]	1
CHE 205 Chemical Proc Prin[1]	4		CHE 225 Chemical Proc Systems[1]	3
MA 242 Calculus III[1]	4		MA 341 Applied Differential Eq[1]	3
PY 208 Physics Engr & Scientists II	3		GEP Requirement*	3
PY 209 Physics for Engineer & Scientists II Lab	1			
	17			**17**

JUNIOR YEAR

Fall Semester	Credit		Spring Semester	Credit
BCH 451 Intro Biochemistry	4		BBS 426 Industrial Microbiology & Bioman Lab	2
BEC 363 Found. of Recomb Microorg for Biomanuf.	2		BEC 330 Prin & Applications of Biosparations	2
	2		CHE 312 Transport Processes II	3
BEC 463 Ferm. of Recomb Microorg	3		CHE 316 Thermo of Chem & Phase Eq	3
CHE 311 Transport Processes I[1]	3		Free Elective	3
CHE 315 Chem Process Thermo[1]	3		GEP Requirement*	3
GEP Requirement*				
	17			**16**

SENIOR YEAR

Fall Semester	Credit		Spring Semester	Credit
BEC 436 Downstream Proc of Biomaterials	2		Biomanufacturing Elective[2]	2
BEC 480 Large Scale Fermentation OR	2		CHE 435 Proc System Analy & Control	3
BEC 485 Large Scale Recovery & Purification			CHE 451 CHE Design II	3
CHE 395 Professional Dev Seminar	1		Bioethics Course (GEP IP Req*)[3]	3
CHE 447 Bioreactor Engineering	3		GEP Requirement*	2-3
CHE 450 CHE Design I	3			
GEP Requirement*	3			**13-14**
	14			

Minimum Credit Hours Required for Graduation*[I,J,K]:	125

Major/Program requirements and footnotes:

[1] Minimum grade of (C-) required.
[2] The Biomanufacturing elective course must be selected from the following list: BEC 440, 462, 463, 475, 480, 483, 485, 488, 497, 541. NOTE: Course selected from the choice of either BEC 480/485 cannot be used to satisfy this requirement (i.e. counted twice).
[3] The bioethics course must be selected from: IDS 201, 303; STS 302, 304, 320; STS(PHI) 325
[4] Grade of C (2.0) or higher required.

[5] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

***General Education Program (GEP) requirements and GEP Footnotes:**
To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied.
University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

A. Mathematical Sciences (6 credit hours – one course with MA or ST prefix)
Choose from the University approved GEP Mathematical Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:
B. Natural Sciences (7 credit hours – include one laboratory course or course with a lab)
Choose from the University approved GEP Natural Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:
C. Humanities (6 credit hours selected from two different disciplines/course prefixes)
Choose from the University approved GEP Humanities course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:
D. Social Sciences (3 credit hours selected from two different disciplines/course prefixes)
Choose from the University approved GEP Social Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement: **EC 205, EC 201, or ARE 201**
E. Health & Exercise Studies (2 credit hours – at least one 100-level Health & Exercise Studies Course)
Choose from the University approved GEP Health & Exercise Studies course list.
F. Additional Breadth - (3 credit hours to be selected from the following checked University approved GEP course lists)
X Humanities/Social Sciences/Visual and Performing Arts or ___ Mathematical Sciences/Natural Sciences/Engineering
G. Interdisciplinary Perspectives (5-6 credit hours)
2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Biotech Minor Group E requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.
H. Introduction to Writing (4 credit hours satisfied by completing ENG 101 with a C- or better)

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. U.S. Diversity(USD)
Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:
J. Global Knowledge(GK)
Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:
K. Foreign Language proficiency - Proficiency at the FL_102 level is required for graduation.