COLLEGE OF ENGINEERING

DEPARTMENT OF BIOLOGICAL SYSTEMS ENGINEERING

BACHELOR OF SCIENCE IN BIOLOGICAL SYSTEMS ENGINEERING

FOR STUDENTS GRADUATING IN CALENDAR YEAR 2017

132 CREDITS REQUIRED FOR GRADUATION

FALL SEMESTER FRESHMAN 2013	**Credits**	**SPRING SEMESTER FRESHMAN 2014**	**Credits**
CHEM 1035 General Chemistry *Pre: None*	3	CHEM 1036 General Chemistry *Pre: CHEM 1035*	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1	ENGL 1106 First-Year Writing *Pre: ENGL 1105*	3
ENGL 1105 First-Year Writing *Pre: None*	3	MATH 1206 Calculus II *Pre: MATH 1205*	3
MATH 1205 Calculus I *Pre: Math Ready*	3	MATH 1224: Vector Geometry *Pre: MATH 1205; Co: MATH 1206, MATH 1114*	2
MATH 1114: Elementary Linear Algebra	2	PHYS 2305 Found of Physics I w/lab *Pre: MATH 1205; Co: MATH 1206*	4
ENGE 1024 Eng. Exploration **(C-)** *Co: MATH 1205*	2	ENGE 1114 Explor Eng Design or ENGE 1104 Explor Digital Future **(C-)** *Pre: ENGE 1024*	2
CLE (Area 2, 3, or 7)	3		
TOTAL	**17**	**TOTAL**	**17**

FALL SEMESTER SOPHOMORE 2014	**Credits**	**SPRING SEMESTER SOPHOMORE 2015**	**Credits**
BIOL 1105 Principles of Biology **OR** BIOL 1205H Honors Biology	3	BIOL 1106 Principles of Biology **OR** BIOL 1206H Honors Biology	3
MATH 2224 Multivariable Calculus *Pre: MATH 1206, MATH 1224*	3	MATH 2214 Differential Equations *Pre: MATH 1206, MATH 1114*	3
PHYS 2306 Foundations of Physics I w/lab *Pre: MATH 1206, PHYS 2305*	4	ESM 2304 Dynamics *Pre: ESM 2104, MATH 2224; Co: MATH 2214*	3
ESM 2104 Statics *Pre: MATH 1114; Co: MATH 2224*	3	BSE 3144 Engr Analysis for Bio Systems **(C-)** *Pre/Co: MATH 2214*	2 [S]
BSE 2004 Introduction to BSE **(C-)** *Pre: ENGE 1024*	2 [F,S]	CHEM Elective	3
CHEM Elective	3	CLE (Area 2, 3, or 7)	3
TOTAL	**18**	**TOTAL**	**17**

FALL SEMESTER JUNIOR 2015	**Credits**	**SPRING SEMESTER JUNIOR 2016**	**Credits**
STAT 4604 Stats Methods for Engrs *Pre: MATH 1206* **- OR-** STAT 4705 Prob & Stat for Engrs *Pre: MATH 2224*	3	BIOL 2604 General Microbiology *Pre: BIOL 1105, 1106, CHEM 1036*	3
ESM 3024 Intro to Fluid Mechanics *Pre: ESM 2304; MATH 2224*	3 [F,W, SII]	BSE 3504 Transport Processes in BSE **(C-)** *Pre: 3154, ESM 3024*	3 [S]
BSE 3134 BSE Seminar **(C-)** *Pre: 2004*	1 [F]	BSE Elective **(C-)**	3
BSE 3154 Thermodynamics of Biol Systems **(C-)** *Pre: MATH 2214; Pre/Co: Fluid Mechanics*	3 [F]	Technical Elective	3
Technical Elective	3	Technical Elective	3
CLE (Area 2, 3, or 7)	3	CLE (Area 2, 3, or 7)	1
TOTAL	**16**	**TOTAL**	**16**

FALL SEMESTER SENIOR 2016	**Credits**	**SPRING SEMESTER SENIOR 2017**	**Credits**
ISE 2014 Engineering Economy *Pre: ENGE 1024*	2	BSE 4126 Comprehensive Design Project **(C-)** *Pre: 4125*	3 [S]
BSE 4125 Comprehensive Design Project **(C-)** *Pre: 3334 or 3524*	2 [F]	BSE Elective **(C-)**	3
BSE 4204 Instrumentation for Biosystems **(C-)** *Pre: ESM 3024, PHYS 2306*	3 [F]	Engineering Topics Elective	3
BSE Elective **(C-)**	3	CLE (Area 2, 3, or 7)	3
BSE Elective **(C-)**	3		
Engineering Topics Elective	3	CLE (Area 2, 3, or 7)	3
TOTAL	**16**	**TOTAL**	**15**

Curriculum for Liberal Education (CLE)

Consult the CLE Alphabetical Listing at: http://www.cle.prov.vt.edu/guides/alpha.html, CLE courses need to be completed prior to graduation

CLE Area 1: Writing and Discourse (6 hrs)	**ENGL 1105**	**(3)**	**ENGL 1106**	**(3)**
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		**(3)**		**(3)**
CLE Area 3: Society & Human Behavior electives (6 hrs)		**(3)**		**(3)**
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	**PHYS 2305**	**(4)**	**PHYS 2306**	**(4)**
CLE Area 5: Quantitative and Symbolic Reasoning (8 hrs)	**MATH 1205**	**(4)**	**MATH 1206**	**(4)**
CLE Area 6: Creativity & Aesthetic Experience elective (1 hr)				**(1)**
CLE Area 7: Global Issues Elective (3 hrs)				**(3)**

If a CLE course is double-counted to satisfy two different CLE areas, a free elective(s) must be taken to maintain a minimum of 132 credits.

Electives: BSE majors must take 12 hours of BSE electives, 6 hours of chemistry electives, 6 hours of engineering topics electives, and 9 hours of technical electives. Students choose from the courses listed under each respective requirement, noting that some courses are not available to all students because some courses have prerequisites and some are restricted to majors in the offering department. Courses with substantial duplication of courses previously taken will not qualify for credit. Independent study (XXX 4974) and undergraduate research (XXX 4994) courses cannot be used as electives.

Change of Major Requirements: To enter this restricted major, students must have: 1) Minimum 2.0 overall Virginia Tech GPA; 2) Minimum grade of C- or better in ENGE 1024 and ENGE 1114 or 1104; and, 3) Minimum grade of D- or better in CHEM 1035, CHEM 1045, ENGL 1105, ENGL 1106, MATH 1205, MATH 1206, and PHYS 2305. NOTE: Students who have completed all of the required coursework and have a 3.0 or higher Virginia Tech GPA are guaranteed this major. Change of Major applications are accepted prior to the beginning of fall, spring, and summer at: http://www.enge.vt.edu/undergraduate/undergraduate-changing-majors

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The BSE Department fully supports this policy. Specific expectations for satisfactory progress for BSE majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (under Academic Policies)
- Maintain overall and in-major GPAs of at least 2.0 (in-major GPA based on grades in required BSE courses and BSE electives);
- Be registered for at least one BSE-prefix course per semester, excluding BSE 2094, 2294, 2484, and 4994;
- Not take any BSE course required in the major more than twice, including attempts ending in course withdrawal; and,
- Having attempted 72 hours (including transfer, advanced placement, advanced standing, and credit by examination), passing MATH 2224 and ESM 2304.

Prerequisites: Pre-requisites for each course are listed after the course title.

- There are no hidden prerequisites in this program of study.
- Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current requirements.

Graduation Requirements: Students must pass all required courses and both the in-major and overall GPA must be at least 2.0 for graduation. A student must obtain a C- or better in all required BSE courses, which all count towards the in-major GPA, including 2004, 3134, 3144, 3154, 3504, 4125, 4126, and 4204, the 12 hours of required BSE electives, and any additional BSE electives (if taken). Only free electives and courses only offered on a Pass/Fail basis may be taken Pass/Fail. Courses on the College of Engineering list of non-degree credit may not be taken for credit towards graduation (list found at www.eng.vt.edu/forms).

Biological Systems Engineering
Electives
2017 Checksheet

Courses with substantial duplication of courses taken previously will not qualify for credit. Independent study (XXX 4974) and undergraduate research (XXX 4994) courses cannot be used as electives.

Choose from the courses listed under each respective requirement, noting that some courses are not available to all students because some courses have prerequisites and some are restricted to majors in the offering department.

Biological Systems Engineering (BSE) Electives (12 credit hours required):

BSE 2304 Landscape Measurement and Modeling
BSE 3324 Small Watershed Hydrology
BSE 3334 NPS Pollution Assessment and Control
BSE 3524 Unit Operations in BSE
BSE 4224 Field Methods in Hydrology
BSE 4304 NPS Pollution Modeling and Management
BSE 4344 Geographic Information Systems for Engineers
BSE 4504 Bioprocess Engineering
BSE 4604 Food Process Engineering
BSE 4524 Biological Process Plant Design
BSE 4544 Protein Separation Engineering
BSE 4644 Biobased Industrial Polymers

Chemistry (CHEM) Electives (6 credit hours required):

BCHM 2024 Concepts of Biochemistry
CHEM 2114 Analytical Chemistry
CHEM 2124 Analytical Chemistry Lab
CHEM 2514 Survey of Organic Chemistry
CHEM 2535-2536 Organic Chemistry
CHEM 2565-2566 Principles of Organic Chemistry
CHEM 3615 Physical Chemistry
CHEM 4615 Physical Chemistry for the Life Sciences
CSES 4314 Water Quality
CSES 4324 Water Quality Laboratory
CSES 4734 Environmental Soil Chemistry
GEOS 4634 Environmental Geochemistry

Engineering Topics Electives (6 credit hours required):

BMES 2104; ESM 2204; all 3000 and 4000 level engineering courses, **except:** all CS courses, all 4974 and 4994 courses, BMES 4064, BSE 4394, CHE 4144(MKTG 4144), CEE 4164 and 4594, ENGE 3714, ENGR 3064, ESM 4404 and 4714, MINE 4554

Technical Electives (9 credit hours required):

All 3000 and 4000 level engineering and computer science courses, **except:** all 4974 and 4994 courses, ESM 4404, ENGE 2714 and 3714

ALS 3134 Livestock and the Environment
BIOL 1XXX laboratories and all 2000, 3000, and 4000 level courses, except 3504H
BCHM all 2000, 3000, and 4000 level courses, except 4074
BMES 2104 Intro to Biomedical Engineering
BMES 4064 Intro Medical Physiology
CHEM 1046 General Chemistry Lab and all CHEM 2000, 3000, and 4000 level courses except 4014 and 4024
CSES 3114 Soils
CSES 3124 Soils Laboratory
CSES 3644 (ENSC 3644) Plant Mat for Env Restoration
CSES 4214 Soil Fertility and Management
CSES 4224 Soil Fertility and Management Lab
CSES 4344 Crop Physiology and Ecology
CSES 4594 (CEE 4594) Soil and Groundwater Pollution
CSES 4644 Land-Based Systems for Waste Treatment
CSES 4774 (ENSC 4774) Reclamation of Disturbed Lands
CSES 4854 (ENSC 4854) Wetland Soils and Mitigation
ENGE 2344 Computer Aided Drafting
ESM 2204 Mechanics of Deformable Bodies
FIW 4514 Principles of Aquaculture
FST 3214 Meat Science
FST 4504 Food Chemistry
FST 4514 Food Analysis
FST 4524 Food Quality Assurance
FST 4604 Food Microbiology
FOR 3714 Forest Harvesting
FOR 3724 Forest Boundaries and Roads
FOR 4354 Forest Soils and Hydrology
FOR 4374 Forested Wetlands
FOR 4714 Harvesting Systems Evaluation
GEOG 4314 Spatial Analysis in Geog Info Systems
GEOG 4354 Introduction to Remote Sensing
GEOS 2104 Elements of Geology
GEOS 4804 Groundwater Hydrology
HORT 4764 Vegetable Crops
MATH all 3000 and 4000 level courses except 4044,4625,4626,4644,4654,4664,4754,4964,4974, 4984,4994
PPWS 4104 Plant Pathology
PPWS 3504 Plant Physiology and the Biotic Environment
PPWS 3514 Plant Physiology Lab
SBIO 3444 Sustainable Biomaterials and Bioenergy
UAP 4374 Land Use and Env: Planning and Policy
UAP 4384 Pollution Control Planning and Policy