



BIORENEWABLE SYSTEMS (BRS)

ADVISING MANUAL

Agricultural and Biological Engineering Department
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Introduction

The Agricultural and Biological Engineering Department is committed to providing a stimulating, conducive, educational environment for all students.

This manual has been prepared to assist BioRenewable Systems major students plan their academic careers at Penn State. It is hoped that this manual will help you understand the requirements of the BioRenewable Systems major and provide guidance in planning and selecting coursework to meet the program and, more importantly, your personal objectives. Your personal program checklist should be kept up-to-date and periodically checked against the one in your advisor's file.

As a BioRenewable Systems major student, you will be assigned an academic advisor when you: enroll as a freshman at University Park Campus; declare BioRenewable Systems as your major; or when you transfer to University Park from another campus location, college, or university. Your advisor will assist you in selecting courses to meet the academic requirements of the BioRenewable Systems major and your personal goals. Your advisor is a resource to answer academic questions during your career at Penn State. It is hoped that your advisor will become your friend and provide useful information concerning academic and non-academic matters as the need arises. You will normally retain the same academic advisor until you graduate.

BioRenewable Systems Major Overview

The BioRenewable Systems Major is an applied major that intertwines the study of engineering technology, natural resources, and agriculture with fundamentals of business, entrepreneurship, and management. Administered through the Department of Agricultural and Biological Engineering, the BioRenewable Systems (BRS) program uniquely prepares students to solve 21st century problems and attain careers in both traditional sectors and those relating to the emerging bioeconomy. Students in this program will secure: 1) knowledge of fundamental sciences related to resources, processes, and products in biorenewable systems; 2) communication and managerial skills relevant to careers in product development, technology, sales, marketing and management; and 3) the ability to apply systems analysis skills, positioning them for effective problem solving and leadership in the agricultural and bioproducts industries.

Graduates are typically employed as sales and field representatives, financial and technical consultants, and technical service or quality assurance personnel in renewable bioproducts or related agricultural sectors such as: power and machinery systems, forest products, food production, bioprocessing, environmental systems, wood structures, bioenergy, co-product development, and agrochemicals. Graduates may continue their education in a graduate program with a science, engineering, or business orientation.

BioRenewable Systems Options

The BRS major has two options: Agricultural Systems Management (ASM) and BioProducts (BP). For the B.S. degree in BioRenewable Systems, a minimum of 120 credits is required for the BioProducts Option and minimum of 122 credits is required for the Agricultural Systems Management Option.

If you have questions about the BioRenewable Systems major, please contact the people below, or you can visit: <http://abe.psu.edu/majors> for more information.

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The following tables show the BRS program requirements. The first is a typical semester schedule for students starting at University Park. The second is for students starting at all other Penn State campus locations. It is important to note that these are examples. Many factors will determine exactly what your schedule looks like, including campus location, the level of math and English at which you start, and on placement tests, etc. The third table is a specialized course selection list and finally a checksheet arranged by category. You can use this to determine your progress through the major.

BRS—Agricultural Systems Management (ASM) Option - (122 Credits Required)

This option applies a technological approach to understanding and managing agricultural production systems to meet economical and sustainable needs. Basic study is emphasized in the agricultural and business management sciences, along with the application of the technical results of engineering research, design, and manufacturing. Graduates of this option apply their technology and management training to the diverse areas of food and fiber production; bioprocessing; and land, water, and air resources.

BRS—BioProducts Option (BP) - (120 Credits Required)

The scientific nature of biobased resources—their unique design, sustainability, and renewability—constitutes the core of this option. Building upon that foundation, students will learn techniques for converting and efficiently utilizing these materials to maximize product life cycles, while simultaneously exploring relevant marketing and management strategies. Technical electives for this option emphasize material sciences, engineering, and/or business. Career tracks are broad, ranging from traditional forest products companies to emerging sectors, including bioenergy co-products.

Tables for

BRS—Agricultural Systems Management (ASM) Option (122 Credits Required)

- **Recommended Academic Plan -- University Park**
- **Recommended Academic Plan -- Commonwealth Campuses**
- **Specialized Credits Selection List**
- **Checksheet**

BRS—SEMESTER COURSE RECOMMENDATIONS

Recommended Academic Plan for BRS Major -- **ASM Option -- University Park**

Semester 1	Credits	Semester 2	Credits
B E 001S - First Year Seminar	1	CHEM 111 (GN) - Experimental Chemistry I	1
CHEM 110 (GN) - Chemical Principles I	3	Arts (GA)*	3
ECON 104 (GS) - Macroeconomics OR E B F 200 (GS) - Energy and Earth Sciences Economics	3	ACCTG 211 - Financial and Managerial Accounting for Decision Making	4
EDSGN 100 - Introduction to Engineering Design	3	ENGL 015 (GWS) - Rhetoric and Composition	3
MATH 110 (GQ) - Techniques of Calculus I OR MATH 140 (GQ) - Calculus with Analytic Geometry I	4	PHYS 250 (GN) - Introductory Physics I OR PHYS 211 (GN) - General Physics: Mechanics	4
Health and Physical Activity (GHA)	2	Health and Physical Activity (GHA)	1
Total Credits:	16	Total Credits:	16
Semester 3	Credits	Semester 4	Credits
AG BM 101 (GS) - Economic Principles of Agribusiness Decision Making OR ECON 102 (GS) - Microeconomics	3	B LAW 243 - Legal Environment of Business OR B A 243 - Social, Legal, and Ethical Environment of Business OR B A 241 AND B A 242	3-4
BIOL 110 (GN) - Biology: Basic Concepts and Biodiversity OR BIOL 011 AND BIOL 012 (GN) - Introductory Biology I/II	4	SOILS 101 - Introductory Soil Science	3
CAS 100A/B (GWS) - Effective Speech	3	AGRO 028 - Principles of Crop Management OR HORT 101 - Horticultural Science	3
STAT 200 (GQ) - Elementary Statistics OR STAT 240 (GQ) - Introduction to Biometry	3-4	Arts (GA)*	3
Humanities (GH)*	3	Humanities (GH)*	3
Total Credits:	16-17	Total Credits:	15-16
Semester 5	Credits	Semester 6	Credits
AG BM 106 - Agribusiness Problem Solving	3	BRS 391 (GWS) - Contextual Integration of Communication Skills for Technical Workplace	2
BRS 221 - Engineering Principles of Biorenewable Systems	3	BRS 437 - Bioproduct Marketing and Sales	4
BRS 300 - Introduction to Biorenewable Products	3	AN SC 201 - Animal Science	4
A S M 310 - Power Transmission in Agriculture	3	SELECTION	3
A S M 327 - Soil and Water Resources Management	3	SELECTION	3
Total Credits:	15	Total Credits:	16
Semester 7	Credits	Semester 8	Credits
BRS 392 (GWS) - Contextual Integration of Leadership Skills for the Technical Workplace	2	BRS 426 -Safety and Health in Agricultural and Biorenewable Industries	3
BRS 428 - Electric Power and Instrumentation	3	BRS 429W - Biorenewable Systems Analysis and Management	3
BRS 393 - Bioresources Industry Tour	1	BRS 490 - Biorenewable Systems Colloquium	1
BRS 422 - Energy Analysis in Biorenewable Systems	3	SELECTION**	3
SELECTION**	3	SELECTION**	3
SELECTION**	3		
Total Credits:	15	Total Credits:	13

*Students must take 3 credits of US Cultures (US) and 3 credits of International Cultures (IL). These requirements should be met by selecting GA and GH courses with the appropriate US/IL designation. Courses in **BOLD** require a "C" grade or better.

BRS—SEMESTER COURSE RECOMMENDATIONS

Recommended Academic Plan for BRS Major -- **ASM Option -- Commonwealth Campuses**

Semester 1	Credits	Semester 2	Credits
First Year Seminar	1	CHEM 111 (GN) - Experimental Chemistry I	1
CHEM 110 (GN) - Chemical Principles I	3	Arts (GA)*	3
ECON 104 (GS) - Macroeconomics OR E B F 200 (GS) - Energy and Earth Sciences Economics	3	ACCTG 211 - Financial and Managerial Accounting for Decision Making	4
EDSGN 100 - Introduction to Engineering Design	3	ENGL 015 (GWS) - Rhetoric and Composition	3
MATH 110 (GQ) - Techniques of Calculus I OR MATH 140 (GQ) - Calculus with Analytic Geometry I	4	PHYS 250 (GN) - Introductory Physics I OR PHYS 211 (GN) - General Physics: Mechanics	4
Health and Physical Activity (GHA)	2	Health and Physical Activity (GHA)	1
Total Credits:	16	Total Credits:	16
Semester 3	Credits	Semester 4	Credits
AG BM 101 (GS) - Economic Principles of Agribusiness Decision Making OR ECON 102 (GS) - Microeconomics	3	B LAW 243 - Legal Environment of Business OR B A 243 - Social, Legal, and Ethical Environment of Business OR B A 241 AND B A 242	3-4
BIOL 110 (GN) - Biology: Basic Concepts and Biodiversity OR BIOL 011 AND BIOL 012 (GN) - Introductory Biology I/II	4	SOILS 101 - Introductory Soil Science**	3
CAS 100A/B (GWS) - Effective Speech	3	AGRO 028 - Principles of Crop Management OR HORT 101 - Horticultural Science***	3
STAT 200 (GQ) - Elementary Statistics OR STAT 240 (GQ) - Introduction to Biometry	3-4	Arts (GA)*	3
Humanities (GH)*	3	Humanities (GH)*	3
Total Credits:	16-17	Total Credits:	15-16
Semester 5	Credits	Semester 6	Credits
AG BM 106 - Agribusiness Problem Solving	3	BRS 391 (GWS) - Contextual Integration of Communication Skills for Technical Workplace	2
BRS 221 - Engineering Principles of Biorenewable Systems	3	BRS 437 - Bioproduct Marketing and Sales	4
BRS 300 - Introduction to Biorenewable Products	3	AN SC 201 - Animal Science	4
A S M 310 - Power Transmission in Agriculture	3	SELECTION	3
A S M 327 - Soil and Water Resources Management	3	SELECTION	3
Total Credits:	15	Total Credits:	16
Semester 7	Credits	Semester 8	Credits
BRS 392 (GWS) - Contextual Integration of Leadership Skills for the Technical Workplace	2	BRS 426 -Safety and Health in Agricultural and Biorenewable Industries	3
BRS 428 - Electric Power and Instrumentation	3	BRS 429W - Biorenewable Systems Analysis and Management	3
BRS 393 - Bioresources Industry Tour	1	BRS 490 - Biorenewable Systems Colloquium	1
BRS 422 - Energy Analysis in Biorenewable Systems	3	SELECTION**	3
SELECTION**	3	SELECTION**	3
SELECTION**	3		
Total Credits:	15	Total Credits:	13

*Students must take 3 credits of US Cultures (US) and 3 credits of International Cultures (IL). These requirements should be met by selecting GA and GH courses with the appropriate US/IL designation

**SOILS 101 may be offered at DS, AA, and CL campuses and is offered through WD campus.

***HORT 101 may be offered at BK campus and is offered through WD campus. Courses in **BOLD** require a "C" grade or better.

Agricultural Systems Management (ASM) Option -- Selection List

In consultation with an advisor, ASM option students must choose 15 specialization credits from this course list or file an appropriate petition. The first column is suggested choices for various specializations. As an alternative, students are encouraged to consider a minor, such as Agribusiness Management, Agronomy, Engineering Entrepreneurship, Animal Science, Horticulture, Forest Science, Sustainability Leadership, Off Road Equipment, or Environmental Resource Management.

Specialization	Course	Abbreviated Title	Prerequisites
Agronomy	AGRO 423	Forage Crop Mgmt	AGRO 028
	AGRO 425	Field Crop Mgmt	AGRO 028
	AGRO 438	Principles of Weed Mgmt	6 cr. in plant sciences
Agribusiness Management	AG BM 302	Food Prod Mktg	AG BM 101, AG BM 102, AG BM 106
	AG BM 308W	Strategic Decision Making in Agribusiness	AG BM 101, AG BM 102, AG BM 106
	AG BM 320	Markets and Prices	AG BM 101, AG BM 102 and AG BM 106; SCM 200 or STAT 200
	AG BM 338 (IL)	AG BM in the Global Economy	AG BM 101, AG BM 102, AG BM 106
	AG BM 407	Farm Plan and Fin Mgmt	AG BM 101, AG BM 106
	AG BM 408	Fin Decision Making for Agribusiness	AG BM 308W, B A 301
	AG BM 440	Food Product Innovation Management	AG BM 302
	AG BM 460	Managing the Food System	AG BM 320, AG BM 338
Agricultural Mechanization	A S M 320	Combustion Engines	A S M 310
	A S M 420	Principles of Off-Road Machines	Concurrent: A S M 320
	A S M 424	Sel Mgmt Ag Mach	Concurrent: A S M 320
Animal Sciences	AN SC 300	Intgratd Anml Biol	BIOL 011 and BIOL 012 or BIOL 110
	AN SC 301	Animal Nutrition	3 cr. in biochemistry or organic chemistry
	AN SC 305	Comp Anim Ntr Mgmt	AN SC 201
	AN SC 306	Swine Prod & Mgmt	AN SC 201
	AN SC 308	Sheep/Goat-Prd Mgt	AN SC 201
	AN SC 309	Beef Prod & Mgmt	AN SC 201
	AN SC 310	Dairy Mgmt	AN SC 201
	AN SC 311	Poul Prod & Mgmt	AN SC 201
	AN SC 327	Horse Prod & Mgmt	AN SC 201
	AN SC 410	Adv Dairy Herd Mgt	AN SC 310, concurrent: AN SC 400
	AN SC 420	An Ntr/Feed Tech	AN SC 301
AN SC 450	Dairy Mgmt Systems	AN SC 310, AN SC 400, AN SC 410	
Agricultural Sciences	AGECO 201	Intro Agroecology	
	AGECO 457	Principles of IPM	ENT 313, HORT 238
	BRS 411	Biobased Fiber Science	CHEM 110, BRS 300
	BRS 423	Deter Prot Bioproducts	BRS 300, concurrent: BRS 411
	ENT 202	Insect Connection	
	ENT 313	Intro Ent	3 cr. of natural science
	ENT 316	Field Crops Ent	ENT 313
	ENT 402W	Biol Anim Parasit	BIOL 110
	ENT 410	Insect Struct/Functn	BIOL 110, BIOL 220W, BIOL 230W, BIOL 240W

Agricultural Systems Management (ASM) Option—Selection List—(continued)

	E R M 300	Basic Princ Calc Env Analysis	3 cr. in BIOL, CHEM 111, MATH 110 or
	E R M 412	Resource System Analysis	BIOL 220W, E R M 300, STAT 240, MATH
	E R M 413W	Case Studies in Ecosys Mgmt	BIOL 220W, SOILS 101, concurrent: E R
	FD SC 200	Intro to Food Science	CHEM 110
	FD SC 207	Animal Products	
	FD SC 208	Animal Products Tech Lab	Concurrent: FD SC 207
	FOR 203	Field Dendrology	Concurrent: FOR 200W or W P 200W
	FOR 308	Forest Ecology	Concurrent: FOR 203
	FOR 320	Forest Fire Mgmt	FOR 308
	FOR 366	Forest Resources Measurements	STAT 240
	FOR 410	Forest Ecosys Mgmt	3 cr. in both biology and ecology
	FOR 418 (US;IL)	Agroforestry	
	FOR 421	Silviculture	FOR 308, FOR 366
	FOR 455	Rem Sens & Spa Dat	MATH 110, 3 cr. in computer science, 6
	FOR 475	Forest Soils Mgmt	FOR 308, 3 cr. in soils
	HORT 202	Plant Propagation	BIOL 027 or BIOL 100 or HORT 101
	HORT 238	Turf Orn Weed Ctrl	CHEM 110
	HORT 315	Envir Effect Hort	HORT 101, HORT 202
	HORT 412W	Post-Har Physiol	6 cr. in horticulture or other plant sciences
	HORT 433	Veg Crops	HORT 101, HORT 315
	SOILS 401	Soil Comp/Phy Prop	SOILS 101
	SOILS 402	Chem Soils Fertilzr	CHEM 112, SOILS 101
	SOILS 412W	Soil Ecol	BIOL 011, BIOL 127, or BIOL 110
	SOILS 418	Nutr Mgmt & Ag Sys	
	SOILS 450	Environmental GIS	SOILS 101
	TURF 235	Turfgrass	
	TURF 238	Turf Orn Weed Ctrl	CHEM 110
	TURF 434	Turf Edaphology	SOILS 101, TURF 235
	TURF 435	Turf Nutr	SOILS 101, TURF 235
	W F S 209	Wildl Fish Conserv	BIOL 110 or BIOL 240W
	W F S 446	WildL Fish Pop Dyn	W F S 209
Biology	BIOL 220W	Biology Pop Comm	BIOL 110
	BIOL 240W	Biol Func Dev Org	BIOL 110, CHEM 110
	BIOL 436	Pop Ecol Glob Clim	BIOL 220W

Agricultural Systems Management (ASM) Option—Selection List—(continued)

Business	ACCTG 311	Acctg Sys & Cntrl	ACCTG 211
	ACCTG 404	Managerial Acctg	ACCTG 211, SCM 200 or STAT 200, ECON 102
	ACCTG 471	Int. Fin Acctg I	ACCTG 211 or ACCTG 311
	B A 250	Small Business Mgmt.	3 cr. in economics
	B LAW 425	Environmental Law	B LAW 341 or B LAW 243
	B LAW 445	Intell Prop & Comp	B LAW 441
	ECON 302 (GS)	Inmd Microec Anly	ECON 102
	ECON 304 (GS)	Inmd Macroec Anly	ECON 104
	ECON 342 (GS)	Industrial Orgn	ECON 102
	E R M 402	Found. of Sustain. Business	AG BM 101 or ECON 102 or ECON 104
	ENGR 310**	Entrepreneurial Leadership	(**AEE 360, MGMT 215, or SUST 200 may be acceptable alternatives by petition. Consult with your advisor.)
	ENGR 407	Tech-based Entrepreneurship	ECON 102 or ECON 104
<i>Choose 1</i>	ECON 315	Labor Economics	ECON 102
	LER 100 (GS)	Employment Relations	
<i>Choose 1</i>	IB 303	Int'l. Business Operations	5 th semester standing
	ECON 333	International Economics	ECON 102, ECON 104 or ECON 014
	FIN 100	Introduction to Finance	3 rd semester standing
	I E 302	Engineering Economy	MATH 141
	LER 201 (GS)	Employment Law	
	LER 444	Occupat Health	LER 100
	LER 464	Com Skls Ldrs I Go	
	LER 465	Coll Dec Making	
	MGMT 100	Survey of Mgmt	
	MGMT 326	Org Beh & Design	B A 304 or MGMT 301
	MGMT 471W	Strategic Management	MGMT 301, MKTG 301, FIN 301, SCM 301
	MKTG 221	Contemp Am Mktg	3 cr. in economics
	MKTG 302	E-Commerce Mktging	B A 303 or MKTG 301
	PSYCH 100 (GS)	Introductory Psychology	
	PSYCH 281 (GS)	Indust-Org Psych	PSYCH 100
	SCM 301	Supply Chain Management	ACCTG 211, ECON 102, SCM 200 or STAT 200
Engr. Tech. Fund.	E MCH 211	Statics	Concurrent: MATH 141
	E MCH 212	Dynamics	E MCH 211, MATH 141
	E MCH 213	Strength of Materials	E MCH 211
	PHYS 212	Physics: Elec and Mag	PHYS 211, concurrent: MATH 141
<i>Choose 1</i>	MATH 111 (2)	Techniques of Calculus II	MATH 110
	MATH 141 (4)	Calculus II w/Analytic Geometry	MATH 140
	MATH 200 or higher		
	STAT 300 or higher		

Student Name:

PSU ID:

BRS—AGRICULTURAL SYSTEMS MANAGEMENT OPTION CHECKLIST									
	Credits	Sem	Grade	Alternative		Cred-	Sem	Grade	Alternative
Communications					Prescribed courses				
CAS 100A/B	3				B E 001S	1			1 st yr seminar
ENGL 015	3				Business				
BRS 391	2				ACCTG 211	4			
BRS 392	2				B LAW 243	3-4			BA 241 & 242
					AG BM 106	3		A B C	
Quantification					B R S 437	4		A B C	
MATH 110	4			MATH 140	Ag Sciences				
STAT 200	3-4			STAT 240	AGRO 028	3			HORT 101
					AN SC 201	4			
Natural Science					SOILS 101	3			
BIOL 110	4			BIOL 11 & 12	Engineering Technology				
CHEM 110	3				EDSGN 100	3		A B C	
CHEM 111	1				B R S 221	3		A B C	
PHYS 250	4			PHYS 211	B R S 300	3		A B C	
					A S M 310	3		A B C	
Art					A S M 327	3		A B C	
	3				B R S 393	1			
	3				B R S 422	3			
					B R S 428	3			
Humanities					B R S 429W	3			
	3				B R S 426	3			
	3				B R S 490	1			
Social Science									
AG BM 101	3			ECON 102	Specialization Area Selections				
ECON 104	3			E B F 200		3			
						3			
						3			
						3			
Health & PE						3			
	1					3			
	1								
	1								
Int'l Competence Course									
US Cultures Course									
COLUMN 1					COLUMN 2				
MIN. CREDIT TOTAL:	50				MIN. CREDIT	72			
					MIN. CREDIT				
					TOTAL:	122			
"C-required" courses are shown in bold with A B C in the grade column									
Selections come from department approved lists.									
Alternatives (other than those listed) require an academic exception (petition) approval.									

Tables for

BRS—BioProducts (BP) Option
(120 Credits Required)

- **Recommended Academic Plan -- University Park**
- **Recommended Academic Plan -- Commonwealth Campuses**
- **Specialized Credits Selection List**
- **Checksheet**

BRS—SEMESTER COURSE RECOMMENDATIONS

Recommended Academic Plan for BRS Major -- BP Option -- University Park

Semester 1	Credits	Semester 2	Credits
B E 001S - First Year Seminar	1	CHEM 111 (GN) - Experimental Chemistry I	1
CHEM 110 (GN) - Chemical Principles I	3	Arts (GA)*	3
ECON 104 (GS) - Macroeconomics OR E B F 200 (GS) - Energy and Earth Sciences Economics	3	ACCTG 211 - Financial and Managerial Accounting for Decision Making	4
EDSGN 100 - Introduction to Engineering Design	3	ENGL 015 (GWS) - Rhetoric and Composition	3
MATH 110 (GQ) - Techniques of Calculus I OR MATH 140 (GQ) - Calculus with Analytic Geometry I	4	PHYS 250 (GN) - Introductory Physics I OR PHYS 211 (GN) - General Physics: Mechanics	4
Health and Physical Activity (GHA)	2	Health and Physical Activity (GHA)	1
Total Credits:	16	Total Credits:	16
Semester 3	Credits	Semester 4	Credits
AG BM 101 (GS) - Economic Principles of Agribusiness Decision Making OR ECON 102 (GS) - Microeconomics	3	B LAW 243 - Legal Environment of Business OR B A 243 - Social, Legal, and Ethical Environment of Business OR B A 241 AND B A 242	3-4
BIOL 110 (GN) - Biology: Basic Concepts and Biodiversity OR BIOL 011 AND BIOL 012 (GN) - Introductory Biology I/II	4	SELECTION	3
CAS 100A/B (GWS) - Effective Speech	3	SELECTION	3
STAT 200 (GQ) - Elementary Statistics OR STAT 240 (GQ) - Introduction to Biometry	3-4	Arts (GA)*	3
Humanities (GH)*	3	Humanities (GH)*	3
Total Credits:	16-17	Total Credits:	15-16
Semester 5	Credits	Semester 6	Credits
AG BM 106 - Agribusiness Problem Solving	3	BRS 391 (GWS) - Contextual Integration of Communication Skills for Technical Workplace	2
BRS 221 - Engineering Principles of Biorenewable Systems	3	BRS 437 - Bioproduct Marketing and Sales	4
BRS 300 - Introduction to Biorenewable Products	3	BRS 417 - Wood Products Manufacturing Systems and Processes	4
ENGR 310** - Entrepreneurial Leadership	3	BRS 411 - Biobased Fiber Science	4
SELECTION	3		
Total Credits:	15	Total Credits:	14
Semester 7	Credits	Semester 8	Credits
E R M 402 - Foundations of Sustainable Business	3	BRS 426 - Safety and Health in Agricultural and Biorenewable Industries	3
BRS 392 (GWS) - Contextual Integration of Leader-	2	BRS 429W - Biorenewable Systems Analysis and	3
BRS 428 - Electric Power and Instrumentation	3	BRS 490 - Biorenewable Systems Colloquium	1
BRS 393 - Bioresources Industry Tour	1	BRS 423 - Deterioration and Protection of Bioproducts	3
BRS 422 - Energy Analysis in Biorenewable Systems	3	SELECTION**	3
SELECTION**	3		
Total Credits:	15	Total Credits:	13

*Students must take 3 credits of US Cultures (US) and 3 credits of International Cultures (IL). These requirements should be met by selecting GA and GH courses with the appropriate US/IL designation. Courses in **BOLD** require a "C" grade or better.

**AEE 360, MGMT 215, or SUST 200 may be acceptable alternatives by petition. Consult with your advisor.

BRS—SEMESTER COURSE RECOMMENDATIONS

Recommended Academic Plan for BRS Major -- **BP Option** -- Commonwealth Campuses

Semester 1	Credits	Semester 2	Credits
First Year Seminar	1	CHEM 111 (GN) - Experimental Chemistry I	1
CHEM 110 (GN) - Chemical Principles I	3	Arts (GA)*	3
ECON 104 (GS) - Macroeconomics OR E B F 200 (GS) - Energy and Earth Sciences Economics	3	ACCTG 211 - Financial and Managerial Accounting for Decision Making	4
EDSGN 100 - Introduction to Engineering Design	3	ENGL 015 (GWS) - Rhetoric and Composition	3
MATH 110 (GQ) - Techniques of Calculus I OR MATH 140 (GQ) - Calculus with Analytic Geometry I	4	PHYS 250 (GN) - Introductory Physics I OR PHYS 211 (GN) - General Physics: Mechanics	4
Health and Physical Activity (GHA)	2	Health and Physical Activity (GHA)	1
Total Credits:	16	Total Credits:	16
Semester 3	Credits	Semester 4	Credits
AG BM 101 (GS) - Economic Principles of Agribusiness Decision Making OR ECON 102 (GS) - Microeconomics	3	B LAW 243 - Legal Environment of Business OR B A 243 - Social, Legal, and Ethical Environment of Business OR B A 241 AND B A 242	3-4
BIOL 110 (GN) - Biology: Basic Concepts and Biodiversity OR BIOL 011 AND BIOL 012 (GN) - Introductory Biology I/II	4	SELECTION	3
CAS 100A/B (GWS) - Effective Speech	3	SELECTION	3
STAT 200 (GQ) - Elementary Statistics OR STAT 240	3-4	Arts (GA)*	3
Humanities (GH)*	3	Humanities (GH)*	3
Total Credits:	16-17	Total Credits:	15-16
Semester 5	Credits	Semester 6	Credits
AG BM 106 - Agribusiness Problem Solving	3	BRS 391 (GWS) - Contextual Integration of Communi-	2
BRS 221 - Engineering Principles of Biorenewable Systems	3	BRS 437 - Bioproduct Marketing and Sales	4
BRS 300 - Introduction to Biorenewable Products	3	BRS 417 - Wood Products Manufacturing Systems and	4
ENGR 310** - Entrepreneurial Leadership	3	BRS 411 - Biobased Fiber Science	4
SELECTION	3		
Total Credits:	15	Total Credits:	14
Semester 7	Credits	Semester 8	Credits
E R M 402 - Foundations of Sustainable Business	3	BRS 426 -Safety and Health in Agricultural and Biorenewable Industries	3
BRS 392 (GWS) - Contextual Integration of Leadership Skills for the Technical Workplace	2	BRS 429W - Biorenewable Systems Analysis and Management	3
BRS 428 - Electric Power and Instrumentation	3	BRS 490 - Biorenewable Systems Colloquium	1
BRS 393 - Bioresources Industry Tour	1	BRS 423 - Deterioration and Protection of Bioprod-	3
BRS 422 - Energy Analysis in Biorenewable Systems	3	SELECTION**	3
SELECTION**	3		
Total Credits:	15	Total Credits:	13

*Students must take 3 credits of US Cultures (US) and 3 credits of International Cultures (IL). These requirements should be met by selecting GA and GH courses with the appropriate US/IL designation. Courses in **BOLD** require a "C" grade or better.

**AEE 360, MGMT 215, or SUST 200 may be acceptable alternatives by petition. Consult with your advisor.

Bioproducts (BP) Option -- Selection List

In consultation with an advisor, BP option students must choose 15 specialization credits from this course list or file an appropriate petition. The first column is suggested choices for various specializations. As an alternative, students are encouraged to consider a minor, such as Biology, Business Logistics, Chemistry, Economics, Energy Business and Finance, Engineering Entrepreneurship Engineering Leadership Development, Environmental and Renewable Resource Economics, Forest Science, Labor Studies and Employment Relations, Leadership Development, Physics, Polymer Science, Statistics, or Sustainability Leadership.

Specialization	Course	Abbreviated Title	Prerequisites
Business	ACCTG 311	Acctg Sys & Cntrl	ACCTG 211
	ACCTG 404	Managerial Acctg	ACCTG 211, SCM 200 or STAT 200, ECON 102
	ACCTG 471	Int Fin Acctg I	ACCTG 211 or ACCTG 311
	B A 250	Small Business Management	3 cr. in economics
	B LAW 425	Environmental Law	B LAW 341 or B LAW 243
	B LAW 445	Intell Prop & Comp	B LAW 441
	ECON 302(GS)	Inmd Microec Anly	ECON 102
	ECON 304(GS)	Inmd Macroec Anly	ECON 104
	ECON 342(GS)	Industrial Orgn	ECON 102
<i>Choose 1</i>	ECON 315	Labor Economics	ECON 102
	LER 100(GS)	Employment Relations	
<i>Choose 1</i>	IB 303	International Business Operations	5 th semester standing
	ECON 333	International Economics	ECON 102, ECON 104 or ECON 014
	FIN 100	Introduction to Finance	3 rd semester standing
	I E 302	Engineering Economy	MATH 141
	LER 201(GS)	Employment Law	
	LER 444	Occupat Health	LER 100
	LER 464	Com Skls Ldrs I Go	
	LER 465	Coll Dec Making	
	MGMT 100	Survey of Mgmt	
	MGMT 326	Org Beh & Design	B A 304 or MGMT 301
	MGMT 471W	Strategic Management	MGMT 301, MKTG 301, FIN 301, SCM 301
	MKTG 221	Contemp Am Mktg	3 cr. in economics
	MKTG 302	E-Commerce Mktgng	B A 303 or MKTG 301
	PSYCH 100(GS)	Introductory Psychology	
	PSYCH 281(GS)	Indust-Org Psych	PSYCH 100
	SCM 301	Supply Chain Management	ACCTG 211, ECON 102, SCM 200 or STAT 200
Chemistry	BMB 211	Elementary Biochemistry	CHEM 110; CHEM 202 or CHEM 210
	BMB 200 and higher		
	CHEM 112	Chemical Principles II	CHEM 110
	CHEM 113 (1)	Continuation of CHEM 111	CHEM 110, concurrent: CHEM 112
<i>Choose 1</i>	CHEM 202	Fundamentals of Organic Chemistry I	CHEM 101 OR CHEM 110 OR CHEM 106
	CHEM 210	Organic Chemistry I	CHEM 112
<i>Choose 1</i>	CHEM 203	Fundamentals of Organic Chemistry II	CHEM 202
	CHEM 212	Organic Chemistry II	CHEM 210
	CHEM 227	Analytical Chemistry	CHEM 113 and MATH 140

BioProducts (BP) Option—Selection List—(continued)

Biology and Plants	AGECO 201	Introductory Agroecology	
	AGRO 028	Principles of Crop Management	
<i>Choose 1</i>	BIOL 127	Introduction to Plant Biology	
	BIOL 240W (4)	Biology: Function and Development of Organisms	BIOL 110, CHEM 110
<i>Choose 1</i>	BIOL 230W (4)	Biology: Molecules and Cells	BIOL 110, CHEM 110
	BMB 251/ MICRB 251	Molecular and Cell Biology	CHEM 112
	BIOL 407	Plant Developmental Anatomy	BIOL 240W
	BIOL 424	Seeds of Change: The Uses of Plants	BIOL 110; BIOL 220W, BIOL 230W or BIOL 240W
	BIOL 441	Plant Physiology	BIOL 230W, BIOL 240W
	BIOL 459	Plant Tissue Culture and Biotechnology	BIOL 230W; or BMB 251, BMB 252
	HORT 101	Horticultural Science	
	FOR 203	Field Dendrology	Concurrent: FOR 200W or W P 200W and W P 203
	FOR 308	Forest Ecology	Concurrent: FOR 203
	FOR 366	Forest Resources Measurements	STAT 240
	FOR 410	Forest Ecosys Mgmt	3 cr. in both biology and ecology
	FOR 418 (US;IL)	Agroforestry	
	FOR 421	Silviculture	FOR 308, FOR 366
	PPATH 405	Microbe-Plant Interactions	BIOL 110
	PLANT 461	Emerging Issues in Plant Sciences	AGRO 028 or HORT 101; AGECO 201 or BIOL 127 or HORT 202; ENT 313 and SOILS 101
Materials Science/ Polymers	MATSE 101	Energy and the Environment	
	MATSE 112	Applied Materials Chemistry for Engineers	CHEM 110
	MATSE 201	Introduction to Materials Science	CHEM 112; MATH 231
	MATSE 202	Introduction to Polymer Materials	CHEM 202, MATH 231
	MATSE 441	Polymeric Materials I	CHEM 210, MATH 231
	MATSE 443	Introduction to the Materials Science of Polymers	CHEM 210, MATH 231
	MATSE 447	Rheology and Processing of Polymers	MATSE 443
	MATSE 448	Polymer Processing Technology	MATSE 447 or CHE 302A
	MATSE 473	Polymeric Materials Laboratory—Synthesis (1)	MATSE 443
	MATSE 474	Polymeric Materials Laboratory—Characterization (1)	MATSE 443
	E MCH 315	Mechanical Responses of Materials	E MCH 213 or E MCH 210
	E MCH 471	Engineering Composite Materials	E MCH 213 or E MCH 210; E MCH 315, E SC 414M, or MATSE 201
	E SC 484	Biologically Inspired Nanomaterials	PHYS 214, MATH 230

BioProducts (BP) Option—Selection List—(continued)

Engineering Technology Fundamentals			
	E MCH 211	Statics	Concurrent: MATH 141
	E MCH 212	Dynamics	E MCH 211, MATH 141
	E MCH 213	Strength of Materials	E MCH 211
	PHYS 212	Physics: Elec and Mag	PHYS 211, concurrent: MATH 141
	MATH 034	The Mathematics of Money	
<i>Choose 1</i>	MATH 111 (2)	Techniques of Calculus II	MATH 110
	MATH 141 (4)	Calculus II with Analytic Geometry	MATH 140
	MATH 200 or higher		
	STAT 300 or higher		

Student Name:

PSU ID:

BRS—BIOPRODUCTS OPTION CHECKLIST									
	Credits	Sem	Grade	Alternative		Credits	Sem	Grade	Alternative
Communications					Prescribed courses				
CAS 100A/B	3				B E 001S	1			1 st yr seminar
ENGL 015	3				Business				
BRS 391	2				ACCTG 211	4			
BRS 392	2				B LAW 243	3-4			BA 241 & 242
					AG BM 106	3		A B C	
Quantification					B R S 437	4		A B C	
MATH 110	4			MATH 140	Option Courses				
STAT 200	3-4			STAT 240	B R S 411	4			
					B R S 423	3			
Natural Science					W P 417	4			
BIOL 110	4			BIOL 11 & 12	ENGR 310**	3		A B C	
CHEM 110	3				E R M 402	3		A B C	
CHEM 111	1								
PHYS 250	4			PHYS 211	Engineering Technology				
					EDSGN 100	3		A B C	
Art					B R S 221	3		A B C	
	3				B R S 300	3		A B C	
	3				B R S 393	1			
					B R S 422	3			
Humanities					B R S 426	3			
	3				B R S 428	3			
	3				B R S 429W	3			
					B R S 490	1			
Social Science									
AG BM 101	3			ECON 102	Specialization Area Selections				
ECON 104	3			E B F 200		3			
						3			
						3			
						3			
Health & PE						3			
	1								
	1								
	1								
Int'l Competence Course									
US Cultures Course									
COLUMN 1					COLUMN 2				
MIN. CREDIT TOTAL:	50				MIN. CREDIT TOTAL:	70			
					MIN. CREDIT TOTAL:	120			
"C-required" courses are shown in bold with A B C in the grade column									
Selections come from department approved lists.									
Alternatives (other than those listed) require an academic exception (petition) approval.									
**AEE 360, MGMT 215, or SUST 200 may be acceptable alternatives by petition. Consult with your advisor.									

Minors

Opportunities exist for BRS majors to develop areas of interest in a minor through the selection of course-work available to meet program requirements. Early planning with an advisor may allow you to add depth and breadth to your college career and help you to attain additional personal and academic goals. (Note: A grade of C or better must be earned in courses applying to a minor). Minors should be chosen before the sixth semester begins and are done by the student in eLion. Several minors fit well into the BRS curriculum. With careful course selection, some minors can be obtained without taking any additional courses. Minors you may want to consider are included in the following table:

Selected Minors to Complement a BRS Major

	Minor
Technology	Off-Road Equipment
	Science, Technology, and Society
	Geographic Information Systems
Agricultural Sciences and Environment	Agronomy
	Watersheds and Water Resources
	Mushroom Science and Technology
	Animal Science
	Horticulture
	Energy, Environmental & Mineral Economics
	Environmental and Renewable Resource Economics
	Forest Science
	Environmental Resource Management
Business and Leadership	Agricultural Business Management
	Legal Environment of Business Biology
	Labor and Industrial Relations
	Business (offered by Liberal Arts)
	Dispute Management Resolution
	Economics
	Global Business Strategies for the Earth, Energy & Material Industries
	Engineering Entrepreneurship
	Information Systems and Statistical Analysis
	Operations Management
	Management Information Systems
	Industrial Health and Safety
	Insurance
	Real Estate
Science	Biochemistry and Molecular Biology
	Microbiology
	Biology

Opportunities for International Experiences

One of the characteristics of a world-class graduate in a technical field is knowledge and appreciation for the international challenges and opportunities now and anticipated in future years. Probably the best way to gain global experiences is through participation in an international activity while you are still a student. Fortunately there are numerous opportunities for gaining international experiences and perspectives through activities such as study abroad programs (for a semester or academic year), international co-ops and internships, alternative Spring Break tours, technical study tours, PSU course/international tour combinations, and May study tours.

Financial Support for International Activities

Some study abroad programs offer financial support to each student who is accepted into the program. There are scholarships available through the College of Agricultural Sciences specifically for students who are gaining international experiences. The deadline dates to apply for awards from College of Agricultural Sciences for programs are typically:

Summer semester:	March 15
Fall Semester:	April 15
Spring Semester:	September 30 of previous year
Spring Break Study Tour:	December 15 of previous year

Students who apply after the above deadline dates might be considered for awards, depending on whether all the funds have been awarded or not. For additional information, exact deadline dates, application forms, or any questions regarding studying abroad, please contact the International Programs Office at 106 Agricultural Administration Building, 814-863-0249, or visit their website: <http://agsci.psu.edu/international/undergraduates>.

The Penn State Office of Global Programs also offers scholarships to study abroad and has an Education Abroad Fair every year. Visit <http://gpglobalea.gp.psu.edu/> for more information.

Global Engineering Education

The mission of Global Engineering Education Programs is to provide opportunities for College of Engineering students, faculty, and staff to participate in international educational experiences and help them to become World Class Engineers. The website contains a searchable database of study abroad programs for engineering majors and others, checklists for how to prepare for international experiences, information about program deadlines and application procedures, and useful resources for going abroad. Please take a look at <http://www.engr.psu.edu/international>.

Agricultural Systems Management Club

The Agricultural Systems Management Club exists for you, the student. It is organized so that you will have an opportunity to meet on an informal basis individuals who have similar interests. Club meetings are every two weeks during the semester. Club activities have included speaker programs, picnics and banquets, fund raisers, and trips. Social activities have included; a fall and spring picnic, hay-ride, and trap shoot. Fund raising activities have included: Christmas wreath sales, lawn mower clinics, yard clean-up, picnic table sales, and tractor overhaul. The Club normally supports college and university functions and is involved in college phone-a-thons, Ag Hill Festival, and Open House events.

The ASM Club offers many opportunities to develop leadership skills by having officers and student-organized events. The club provides national and international leadership opportunities and involvement through its participation in the National Council of Student Mechanization Branches of the American Society of Agricultural and Biological Engineers. The club has supported student travel to the International Summer and Winter Meetings and has had several members hold office in the national organization.

The key to the club's success and to your satisfaction is your involvement in planning and organizing of club activities. You are encouraged to become involved in the Agricultural Systems Management Club and make the club function be of benefit to you. While the Agricultural Systems Management Club is not the largest group on campus, it is a strong group that works together to be heard. The potential of the Agricultural Systems Management Club is limited only by your level of involvement. Commit some time to get involved and make the club your organization, meeting your needs.

The ASM Club website can be found at: <http://abe.psu.edu/students/clubs-and-organizations/agricultural-systems-management-club>.

Penn State Pullers

The Penn State Pullers compete in a ¼ scale tractor pulling contest sponsored by ASABE (The American Society of Agricultural and Biological Engineers). Students design and build ¼ scale tractors to compete nationally with other universities. The four main judging categories are: written design report, team presentation, individual tractor design, and performance competition. The performance competition is a multi-stage tractor pull using a progressive weight sled.

The Penn State pullers website can be found at: <http://pennstatepullers.weebly.com/>.

Scholarships

Students are eligible for scholarships awarded through the College of Agricultural Sciences. The scholarship application for the academic year is usually available until April 30th of that year. Those who are selected to receive a College and/or Department scholarship will be notified via mail in July. Please note they will only notify students who have been selected as a scholarship recipient. Please visit <http://agsci.psu.edu/students/scholarships> for more information. The scholarships from the Agricultural and Biological Engineering Department for which students are eligible are listed at that website.