

BRT CORE REQUIRED AND CORE APPROVED ELECTIVE COURSES

Course Title	Course Number	Credit Hours	Prerequisites	Technical Barrier Area*			
				PI Sci	Prod	Proc	Util
CORE REQUIRED COURSES (Min. 6 credits): BRT 501, 506B, 506C, 515, and either 592L OR BR C 507							
Fundamentals of Biorenewable Resources	BRT 501	3	Undergrad training in engineering, physical, biological discipline, degree in ag or econ	X	X	X	X
Biobased Products Seminar	BRT 506C	1	Undergrad training in engineering, physical, biological discipline, degree in ag or econ				
Bionrenewable Law and Policy	BRT/Pol S 515	3	None		X	X	X
Special Topics in Biorenewable Resources	BRT 590	var.	Permission of instructor; see Laurie Englen for section numbers				
Biorenewable Resources Laboratory	BRT 592L	1	Permission of instructor; see Laurie Englen for section numbers				
Technology-Led Entrepreneurship in Biorenewables	BRT/BR C 507	1	Graduate classification or permission of instructor				
RESEARCH							
Research	BRT 699	var.	Permission of instructor; see Laurie Englen for section numbers. Other departmental research can be substituted to meet the minimum requirements.				
CORE APPROVED ELECTIVE COURSES							
			Light blue = available via distance Ed at ISU	38	31	54	39
Modeling and Controls for Agricultural Systems	ABE/BSE 403/503	3	A E 363, Math 266		X		
Instrumentation for Agricultural and Biosystems Engineering	ABE 404/504	3	A E 363 or Cpr E 281		X	X	
Electronic Systems Integration for Ag Machinery & Prod.	ABE 510	3	A E 363 or equivalent		X	X	
Food and Bioprocess Engineering	ABE 551	3	Ch E 357 or M E 436, AE 216 or FS 351, MA 266 or 267			X	
Grain Processing and Handling	ABE/BSE 569	3	A E 216		X	X	
Forage Crop Management	Agron 334	3	Agron 114		X		
Global Change	Agron/Mteor/EnSci 404/504	3	Four courses in physical or biological sciences or engineering	X	X		X
Introduction to Plant Breeding	Agron/Hort 421	3	Agron 320 or Biol 313	X	X		
Crop Growth and Development	Agron 501	3	Agron 114, Math 140, Chem 163, Biol 101	X	X		
Climate and Crop Growth	Agron 503	3	Agron 114, Math 140		X		
Crop Physiology	Agron 516	3	Biol 330	X	X		
Principles of Cultivar Development	Agron 521	3	Agron 421, Stat 401	X			
Molecular Plant Breeding	Agron 523	3	Agron 520, 521, 524, 527	X			
Plant Genetics	Agron 527	3	Gen 410	X			
Crop Ecology and Management	Agron 531	3	Agron 501, 502 and 503, recommend 512, 514		X		
Crop Protection	Agron 533	3	Agron 514		X		
Soil and Environmental Microbiology	Agron/EnSci/Micro 585	3	Agron 154 or 402, Micro 201, 203 recommended		X		
Current Issues in Agronomy	Agron 592	3	Agron 501, 503, 511, 512, 513, 514	X			
Survey of Biochemistry	BBMB 301	3	Chem 231 or Chem 331	X			
Principles of Biochemistry	BBMB 316	3	Chem 231 or Chem 331; Biol 212	X			
Biochemistry I	BBMB 404	3	Chem 332	X			
Biochemistry II	BBMB 405	3	BBMB 404	X			
Techniques in Biochemical Research	BBMB 411	3	BBMB 404 or 501, Chem 210 or 211	X			
Comprehensive Biochemistry I	BBMB 501	4	Chem 211, 332	X			
Comprehensive Biochemistry II	BBMB 502	4	BBMB 501	X			

Genetic Engineering	BBMB/GDCB/MCDB 520	3	Gen 411 or BBMB 405	X	X	X	
Plant Biochemistry	BBMB 607	2	BBMB 405 or BBMB 502	X			
Carbohydrate Chemistry	BBMB 622	2	BBMB 404 or 501	X			
Mechanisms of Enzymatic Catalysis	BBMB 642	2	BBMB 404, BBMB 420 or BBMB 501	X		X	
Principles of Plant Physiology	Biol 330	3	Biol 313 or Gen 320; Biol 314 or BBMB 301; Chem 231 or Chem 332; Phys 106 or Phys 111	X			
Principles of Plant Physiology Lab	Biol 330L	1	(Curr) 330	X			
Plants and People	Biol 355	3	Biol 211 and Biol 211L				X
Plant Anatomy	Biol 454	4	Biol 212L	X			
Bioprocessing and Bioproducts	BRT 511	3	AE 216 or equivalent, Math 160 or 165, one of Chem 167 or higher, Biol 101 or higher or BRT 501			X	X
International Law and Policy	BRT/Pol S 516	3	None		X	X	X
Biorenewables Supply Chain Management	BRT/SCM 513X	3	Graduate standing or qualified undergraduates with instructor permission		X	X	X
Thermochemical Processing of Biomass	BRT/ME 535	3	Undergraduate course work in thermodynamics and transport phenomena			X	X
Introduction to Bioplastics & Biocomposites	BRT/TSM/ABE/MSE 546X	3	CHEM 163 and MATH 151, or permission of instructor	X		X	X
Engineering Analysis of Biological Systems	BSE/EnSci 480/580	3	BSE 216; MATH 266; BIOL 211 or BIOL 212; M E 231	X			X
Civil Engineering	C E 326	3	Chem 177 or 178, Math 166, credit or enrolled in EM 378				X
Environmental Engineering Chemistry	C E 520	3	Chem 177, 178, Math 166			X	X
Environmental Biotechnology	C E 521	3	C E 326			X	X
Water Pollution Control Processes	C E/EnSci 522	3	C E 521			X	
Separations	Ch E 358	3	Ch E 310 and 357			X	
Chemical Engineering Thermodynamics	Ch E 381	3	Ch E 310, Math 267, Phys 222, Chem 325			X	
Chemical Reaction Engineering	Ch E 382	3	Ch E 310, 381 and 357			X	
Biochemical Engineering	Ch E 515	3	Ch E 357, 382, Chem 331			X	
Process and Plant Design	Ch E 430	4	Ch E 358 and 382			X	
Polymeric Biomaterials	Ch E 542	3	Chem 331 or a polymers class				X
Polymers and Polymer Engineering	Ch E 547	3	Ch E 382 and Chem 331 or Mat E 351				X
Bioseparations	Ch E 562	3	Ch E 357			X	
Advanced Chemical Reactor Design	Ch E 587	3	Ch E 382			X	
Metabolic Engineering	Ch E 625	3	Ch E 382, Chem 331			X	
Catalysis and Catalytic Processes	Ch E 688	3	Ch E 382			X	
Bioinorganic Chemistry	Chem/BBMB 503	2	Chem 402 or BBMB 405			X	
Instrumental Methods of Chemical Analysis	Chem 316	2	Chem 211, 211L & Math 166, concurrent Chem 316L, Phys 222			X	
Organic Chemistry I	CHEM 331	3	CHEM 178 OR CHEM 201. ENROLLMENT IN CHEM 331L HIGHLY RECOMMENDED			X	
Organic Chemistry II	CHEM 332	3	CHEM 331. ENROLLMENT IN CHEM 332L HIGHLY RECOMMENDED			X	
Advanced Inorganic Chemistry	CHEM 502	3	CHEM 402. RECOMMENDED: CHEM 331			X	
Advanced Quantitative Analysis	Chem 511	3	Chem 316 and 316L			X	
Analytical Molecular and Atomic Spectroscopy	Chem 513	3	Chem 316, 316L, 324 and 322L			X	
Analytical Separations	Chem 516	3	Chem 316, 316L, 324 and 322L			X	

Physical Organic Chemistry	Chem 537	3	Chem 332			X	
Physical Organic Chemistry II	Chem 538	3	Chem 537			X	
Spectrometric Identification of Organic Compounds	Chem 572	3	Chem 332			X	
Rural, Urban and Regional Economics	Econ 376	3	Econ 101				X
Firms, Markets and Industry Structure	Econ 415	3	Econ 301				X
Managerial Economics	Econ 431	3	Econ 301				X
Agricultural, Food and Trade Policy	Econ 560	3	Econ 301 or 501				X
Intermediate Environmental and Resource Economics	Econ 580	3	Econ 301 or 501				X
Advanced Environmental Economics	Econ 581	3	Econ 501 or 601				X
Econometrics I	Econ 671	4	Econ 501 and Stat 447 or Stat 542				X
Advanced Resource Economics	Econ 680	3	Econ 603				X
Environmental Systems	EEOB/Biol/EnSci 581	4	12 credits in natural science, microbiology and chemistry	X	X		
Environmental Biophysics	EnSci/Agron/Mteor 505	3	Math 166 or equivalent	X			X
Environmental Engineering Chemistry	EnSci 520	3	Chem 177, Chem 178, Math 166			X	X
Environmental Biotechnology	EnSci 521	3	C E 326			X	X
Design and Evaluation of Soil and Water Conservation Systems.	EnSci 531	3	E M 378 or Ch E 356		X		
Engineering Analysis of Biological Systems	EnSci 580	3	216; Math 266; Biol 211 or 212; M E 330	X			X
Environmental Systems I: Intro to Environmental Systems	EnSci 581	4	12 credits of natural science including biology and chemistry				X
Environmental Systems II: Analysis of Environmental Systems	EnSci 582	4	EnSci 581				X
Ecosystem Ecology	EnSci/EEOB 584	3	Combined 12 credits in biology and chemistry		X		
Food Chemistry	FS HN 311	3	TSM 115, Chem 231 and 231L or 331 and 331L; BBMB 301			X	
Introduction to Food Engineering Concepts	FS HN 351	3	PHYS 111 or 115			X	
Food Processing I	FS HN 471	3	FS HN 351/AE451/ChE 357, Micro 201 or 302; Chem 163 or 177			X	
Food Processing Laboratory II	FS HN 572	2	FS HN 351, 451, Ch E 357			X	
Advanced Food Science - Chemistry	FS HN 502	1	3 credits in organic chemistry			X	
Advanced Food Science - Processing	FS HN 503	1	3 credits each in FS HN coursework at 200 level or above			X	
Advanced Food Science - Microbiology	FS HN 504	1	3 credits each in microbiology and organic chemistry			X	
Food and Bioprocessing Enzymology	FS HN/BRT 610	3	FS HN 311 or 411 or 502 or BBMB 404			X	
Lipid Chemistry and Applications	FS HN 612	3	FS HN 311 or 411 or 502 or BBMB 404			X	X
Food Proteins	FS HN 613	3	FS HN 311 or 411 or 502 or BBMB 404			X	X
Carbohydrates: Structures, Properties and Applications	FS HN 614	3	FS HN 311 or 411 or 502 or BBMB 404			X	X
Advanced Food Microbiology	FS HN/Micro/Tox 626	3	FS HN 420 or 421 or 504			X	
Wood Anatomy and Fiber Analysis	FOR 480	3	For 280 or permission of instructor			X	X
Conversion of Lignocellulosic Materials	FOR 481	3	For 280 or equivalent			X	X
Wood Deterioration and Preservation	FOR 483	3	For 280			X	X
Wood and Natural Fiber Composites	FOR 485	3	For 280, TSM 240			X	X
Drying Processes for Wood and Other Lignocellulosic Materials	FOR 486	3	For 280, TSM 240			X	X
Physical Properties of Wood	FOR 487	4	For 280			X	X
Molecular Genetics	Gen 409	3	Bio 313, (211 and 212 prereq for 313)	X			
Analytical Genetics	Gen 410	3	Gen 409	X			
Introduction to Bioinformatics	Gen 444	4	Math 165 or Stat 401 or equivalent	X			
Biotechnology in Agriculture, Food, and Human Health	GDCB 508	3	Biol 211 and 212	X	X	X	

Transmission Genetics	GDCB 510	3	Gen 410	X			
Molecular Genetics	GDCB/MCDB/PIBIO 511	3	Biol 313 and BBMB 405	X			
Plant Growth and Development	GDCB512/MCDB, PIBio	2	Biol 330 or course in devl bio, GDCB 545 or BBMB 404, 405, or GDCB 520	X	X		
Plant Metabolism	GDCB/PLBIO 513	2	Biol 330, Phys 111, Chem 331	X	X		
Genetic Engineering	GDCB/BBMB,MCDB 520	3	Gen 411 or BBMB 405	X			
Introduction to Molecular Biology Techniques	GDCB 542	1	Graduate classification	X			X
Engineering Economic Analysis	IE 305	3	Math 166	X	X	X	X
Production scheduling	IE 514	3	IE 312, IE 341	X	X	X	
Systems Engineering and Analysis	IE/AER E, EE 565	3	Coursework in basic statistics		X	X	X
Applied Systems Engineering	IE 566	3	IE 565				X
Advanced Energy Systems and Analysis	M E 531X	3	Any undergrad thermodynamics course, math through differential equations			X	X
Advanced Combustion	M E 542	3	M E 332 or Ch E 381			X	X
Thermal Systems Design	M E 545	3	M E 436			X	
Microbial Genetics and Genomics	Micro 502	3	Micro 302, Biol 313			X	
Plant Virology	Micro 509	4	Pl P 408, Bio 454, BBMB 405, Chem 211		X		
Prokaryotic Diversity and Ecology	Micro/BBMB 530	3	Micro 302, Micro 302L			X	
Bacterial-Plant Interactions	Micro/PLP 577	3	3 credits in microbiology or plant pathology	X	X		
Controversies in Renewable Resource Management	NREM/EnSci460	3	NREM 120 and A Ecl 312 or NREM 301, Jr clasification		X		
Landscape Change and Conservation	NREM 565	3	L A 202		X		
Agroecosystem Analysis	SusAg/Agron/Soc 509	3	Senior or above classification		X		
Integrated Crop and Livestock Production Systems	SusAg/AE/Agron/An S 515	3	Sus Ag 509		X		
Ecologically Based Pest Management Strategies	SusAg/Agron/ENT/PL P 530	3	Sus Ag 509		X		
Strategies for Diversified Food and Farming Systems	SusAg/Agron/Hort 546	3	Sus Ag 509		X		
Foundations of Sustainable Agriculture	SusAg/Agron/AE/Anthr/Soc 61	3	Graduate classification, permission of instructor		X		