College of Agricultural Sciences

The college connects people and the environment, helping communities and industries thrive by finding real-world solutions that are both economically and ecologically sustainable. With over 2600 students, 250 professorial faculty, $500,000 in scholarships, and $90 million in research grants and contracts, AgSci is integral to OSU's standing as a top-tier land-grant university and its international ranking for agriculture and forestry.

147 Strand Agricultural Hall
Oregon State University
Corvallis, OR 97331-2202
541-737-2211
Email: cassstudy@oregonstate.edu
Website: http://agsci.oregonstate.edu/
Facebook: @OSUAgSci (https://www.facebook.com/OSUAgSci/)
Twitter: @OSUAgSci (https://twitter.com/OSUAgSci/)

Administration
Alan Sams, Dean, 541-737-2331, alan.sams@oregonstate.edu
William G. Boggess, Executive Associate Dean, 541-737-2331, bill.boggess@oregonstate.edu
Joyce Loper, Associate Dean, 541-737-2331, joyce.loper@oregonstate.edu
W. Dan Edge, Associate Dean, 541-737-2910, daniel.edge@oregonstate.edu
Sam Angima, Assistant Dean of Outreach and Engagement, 541-737-3742, sam.angima@oregonstate.edu
Penelope Diebel, Assistant Dean of Academic Programs, 541-737-5317, penelope.diebel@oregonstate.edu
John Talbott, Assistant Director, Oregon Agricultural Experiment Station, 541-737-2194, john.talbott@oregonstate.edu
Christina Walsh, Student Engagement coordinator, 541-737-2580, christina.walsh@oregonstate.edu (%20christina.walsh@oregonstate.edu)
Paul Dorres, Manager of Student Information, Scholarships, and Education Abroad, 541-737-5655, paul.dorres@oregonstate.edu
Michelle McAllaster, Head Advisor, 541-737-5816, michelle.mcallaster@oregonstate.edu (nick.fleury@oregonstate.edu%20)

College of Agricultural Sciences (AgSci)

Academics within the College of Agricultural Sciences prepare the next generation of scientists, managers, and leaders in the fields of food, agriculture, natural resources, and life sciences. With 14 academic programs, learning is integrated with research and Extension to provide students with inquiry-based, hands-on experiences in laboratories and field locations across Oregon and the world.

Individualized Advising

Each student is considered an important individual. A student’s study program is developed in personal consultation with an advisor in the department of their major interest. A student’s advisor is the primary resource for advising, obtaining information about registration, and gaining signatures and support for petitions and forms. They are a student’s link to campus support resources, and can help with other advising issues including professional development, leadership opportunities, experiential learning and career based topics or questions. Advisors know how to find help for almost any issue—they are a great place to start when students feel lost.

As early as possible, each student is encouraged to select a subject area and become associated with instructors and other students with similar interests. Initial or early advising is based upon the student’s high school record and placement test scores. When high school preparation is found to be inadequate, the student is encouraged to enroll in courses providing the education, training, and experience necessary to help ensure success at the university level, even though such work may require the student to take one or more additional terms to complete a prescribed four-year curriculum. Students planning to transfer from a community college or another four-year institution are encouraged to contact an advisor to discuss their plan of study as far in advance of transferring as possible.

Opportunities

Internships

College of Agricultural Sciences departments offer academic credit for on-the-job learning experiences that connect to student learning objectives. Internships are available (https://agsci.oregonstate.edu/academic-programs/opportunities/internships/) in all facets of agriculture and can be paid, unpaid, local, national or international. Details regarding specific departmental requirements are available from departmental advisors. Industries, agencies and students interested in general internship information should contact the Academic Programs Office (https://agsci.oregonstate.edu/academic-programs/contact/).

Scholarships

The College of Agricultural Sciences offers a variety of scholarships. Several are reserved for incoming high school or transfer students, and are included in the admissions process (http://admissions.oregonstate.edu/apply-choose-application/). Additional information and application forms for college-level scholarships can be found here (https://agsci.oregonstate.edu/academic-programs/scholarships/). For information about departmental scholarships, contact each department directly (https://agsci.oregonstate.edu/main/operating-units/). For more information about university-level scholarships, contact the Scholarships Office (http://scholarships.oregonstate.edu/).

Global

The College of Agricultural Sciences has International Exchange Agreements (https://international.oregonstate.edu/agreements/list/) with numerous institutions spanning thirteen countries. Students may choose to study abroad via the exchange program with Lincoln University in New Zealand; learn about various regions across the globe by participating in the Exploring World Agriculture class and companion Faculty-led Educational Tour; or encounter cultures and traditions through their peers in the International Agriculture Club.

Research

The College of Agricultural Sciences provides multiple pathways for students to apply their knowledge through research (https://agsci.oregonstate.edu/academic-programs/undergraduate-research/). Whether you are just starting out, or ready to begin an independent research project (https://agsci.oregonstate.edu/academic-programs/agsci-all-star-ananiya/), we have mentors and funding to help you gain research experience.

Undergraduate Minor Programs

Minors (https://agsci.oregonstate.edu/academic-programs/undergraduate-degrees/#minor) are offered through most departments of the College of Agricultural Sciences. Students interested in pursuing a minor must first contact the key advisor (https://agsci.oregonstate.edu/academic-programs/about/advisors/) in the area of interest. The minor
must consist of a minimum of 27 designated credits of related course work, including at least 12 in upper-division courses.

**Graduate Programs**

Take your education to the next level with one of our advanced degrees, or broaden your skill-set by completing a graduate certificate. The College of Agricultural Sciences offers a variety of graduate studies ([https://agsci.oregonstate.edu/academic-programs/graduate-degrees/](https://agsci.oregonstate.edu/academic-programs/graduate-degrees/)) both on-campus and online. Our graduate student body includes ARCS® Foundation Scholars, Fulbright Fellows and Fellows supported by NOAA and other organizations or federal agencies. Funding opportunities are available through graduate teaching and research assistant positions. Graduate program requirements, deadlines, and application processes can be found on the Graduate School website ([https://gradschool.oregonstate.edu/](https://gradschool.oregonstate.edu/)).

**Graduation Requirements**

To be eligible for a bachelor of science (BS) degree, a student must complete a minimum of 180 credits including:

1. University Baccalaureate Core requirements
2. Courses in agricultural sciences: 36 credits including 24 credits at the upper-division level.

**Agricultural Education (AED)**

**AED 235, INTRODUCTION TO AGRICULTURAL EDUCATION, 2 Credits**

Introduces students to the field of agricultural education. Explore the historical foundations and career pathways in non-formal and school-based agricultural education. Topics will include school-based agricultural education, non-formal and extension education, and agricultural literacy. Develop career skills and a plan to pursue a future career in agricultural education.

**AED 313, THEORY AND PRACTICUM III: FIELD, 4 Credits**

Field based experience for students preparing to be agricultural teachers. Focus on teaching models. 
*Available via Ecampus*

**AED 325, PLANNING AND DELIVERING NON-FORMAL AGRICULTURAL EDUCATION, 3 Credits**

This course uses adult learning theory and practice, including planning non-formal agricultural education programs for youth and adults, methods of instructional delivery, effective use of instructional technology, marketing agricultural education programs, and evaluation of agricultural education outcomes. Microteaching (practice teaching presentations) and group presentations required as part of laboratory assignments.

**AED 407, SEMINAR, 1-16 Credits**

*This course is repeatable for 16 credits.*

**AED 499, SPECIAL TOPICS, 1-16 Credits**

*This course is repeatable for 16 credits.*

**AED 501, RESEARCH, 1-16 Credits**

*This course is repeatable for 16 credits.*

*Available via Ecampus*

**AED 503, THESIS, 1-16 Credits**

*This course is repeatable for 999 credits.*

**AED 505, READING AND CONFERENCE, 1-16 Credits**

*This course is repeatable for 16 credits.*

*Available via Ecampus*

**AED 507, SEMINAR, 1-16 Credits**

*This course is repeatable for 16 credits.*

**AED 508, WORKSHOP, 1-16 Credits**

*This course is repeatable for 16 credits.*

**AED 509, PRACTICUM, 1-16 Credits**

*This course is repeatable for 16 credits.*

**AED 510, PROFESSIONAL INTERNSHIP: AGRICULTURE EDUCATION, 1-40 Credits**

A field experience in which the intern will integrate academic study with classroom teaching experience to learn specific competencies relating to functioning well in the context of the classroom and the school, and demonstrate this competency through the assessment of work by supervisors and by evidence collected and presented in work samples. 
*This course is repeatable for 40 credits.*

*Available via Ecampus*

**AED 518, EXTENSION COURSE IN TEACHER EDUCATION/PEDAGOGY, 1-3 Credits**

Enables present and prospective teachers of agriculture to continue their professional development on pedagogical topics of current importance. 
*(This course is limited to 9 credits per term.)*

*Equivalent to: AG 518*

*This course is repeatable for 50 credits.*

*Available via Ecampus*

**AED 533, RURAL SURVEY METHODS, 3 Credits**

Technique; analyzing, interpreting, and using results of survey data; identifying and utilizing community resources; develop and organize agriculture programs to meet community needs.

**AED 552, PROGRAM ORGANIZATION AND MANAGEMENT, 3 Credits**

Explores the foundations of vocational education, essential learning skills, advisory committees, and development of a vocational education philosophy. Students will study the elements of educational reform as they apply to specific service areas. Resource analysis, student organizations, and school-to-work transitions will also be studied.
AED 553, APPLIED INSTRUCTIONAL STRATEGIES, 3 Credits
Helps students in the identification and development of goals, objectives and units. The course includes the development and application of subject area instructional strategies/models, including applied math, writing, communication skills, measurement and evaluation of achievement, and delivery of instruction to at-risk students. Safety is a primary focus.

AED 554, MICRO-TEACHING, 3 Credits
Planning, presenting and evaluating lessons in a micro-teaching lab. It includes application of content pedagogy strategies, subject matter principles and media technology. Lessons presented on safety.

AED 555, LABORATORY PEDAGOGY, 3 Credits
Applications of efficient planning, organizing, and teaching skills within the laboratory setting and utilization of laboratory facilities to optimize learning experiences. Laboratory facilities could include a shop, greenhouse, land laboratories/outdoors, agriscience labs, aquaculture, computer lab, field trips, etc.

AED 556, LINK RESEARCH, TEACHING, AND PRACTICE, 3 Credits
Links research to teaching. Students will work with cooperating teachers to identify and apply research to teaching.

AED 557, ISSUES AND TRENDS IN CURRICULUM AND INSTRUCTION, 3 Credits
Emphasizes trends related to subject matter curriculum issues unique to agricultural education at the secondary level.

AED 558, IMPROVING AGRICULTURAL SCIENCE AND TECHNOLOGY PROGRAMS, 3 Credits
Provides impetus toward evaluation and improvement of local programs of agricultural science and technology (AST), such that they better reflect community, regional, and national needs.

AED 580, COMMUNICATING AGRICULTURAL AND LIFE SCIENCES TO THE PUBLIC, 3 Credits
Focuses on communicating with the public about research-based science in agricultural and life sciences for the purposes of education, influencing public policy, promoting positive agricultural practices and creating change. Explores various communication outlets and media and how they are appropriate for different messages.

AED 599, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

AED 603, DISSERTATION, 1-16 Credits
Students engage in research and writing related to the completion of their dissertation to fulfill the requirements of the College of Education PhD program.
This course is repeatable for 999 credits.

AED 640, INSTRUMENTATION AND DATA COLLECTION IN SOCIAL SCIENCE, 3 Credits
Addresses the selection, development, and analysis of various types of quantitative instruments and procedures for collecting research data. The course has a quantitative focus and is oriented toward social science research. Lec/lab.
Recommended: SED 580 or equivalent introductory research methods course.

Applied Economics (AEC)

AEC 121, DISCOVERING AGRICULTURAL AND RESOURCE ECONOMICS, 1 Credit
Explore issues, opportunities, and challenges in the dynamic and diverse employment field of agricultural and resource economics.
Equivalent to: AREC 121

AEC 199, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural and resource economics. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
Equivalent to: AREC 199
This course is repeatable for 8 credits.

AEC 211, AGRICULTURAL AND FOOD MANAGEMENT, 4 Credits
Economic and business principles applied to the management of firms in agricultural and food industries, including farms, ranches and nurseries, agricultural input suppliers, packers, shippers, processors and food manufacturers and distributors; firm-level goal setting, information management and financial analysis.
Prerequisite: AEC 250 with C- or better or AEC 251 with C- or better or AREC 250 with C- or better or ECON 201 with C- or better or ECON 201H with C- or better
Equivalent to: AREC 211
Available via Ecampus

AEC 221, AGRICULTURAL AND FOOD MARKETING, 3 Credits
Organization and functions of agricultural and food markets both domestic and international; market channels and supply chains for various agricultural commodities and food products; role of agribusiness, cooperatives, and government in marketing decisions.
Equivalent to: AREC 221
Available via Ecampus
AEC 240, *RURAL ECONOMICS OF PLACE AND PEOPLE, 3 Credits
Provides perspective on issues influencing rural communities and economic development in rural America. People, places and natural resources of rural communities play a vital role in economic vitality of the West, yet rural landscapes are changing faster than many urban counterparts. (Bacc Core Course)
Attributes: CPWC – Core, Pers, West Culture
Equivalent to: AREC 240

AEC 243, *GLOBAL POVERTY AND SUSTAINABLE DEVELOPMENT, 3 Credits
Students are introduced to the challenges of eradicating extreme poverty and achieving sustainable economic development in the world. Topics include: the measurement of poverty and inequality; analysis of food security and agricultural development; the role of health and education in economic development; credit markets; risk and insurance; climate change and biodiversity; gender equality; rural-urban and international migration; population growth and development; institutions and economic performance; the political economy of development. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst

AEC 250, *INTRODUCTION TO ENVIRONMENTAL ECONOMICS AND POLICY, 3 Credits
Examines how economic forces and social institutions cause environmental degradation and help build management solutions. Explains key economic concepts for valuing environmental resources and evaluating the trade-offs of alternative management approaches from private markets to regulation. Applies the concepts and theories to topical environmental issues such as water pollution and conserving biodiversity. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Equivalent to: AEC 250H, AEC 250, AREC 250
Recommended: MTH 111
Available via Ecampus

AEC 250H, *INTRODUCTION TO ENVIRONMENTAL ECONOMICS AND POLICY, 3 Credits
Examines how economic forces and social institutions cause environmental degradation and help build management solutions. Explains key economic concepts for valuing environmental resources and evaluating the trade-offs of alternative management approaches from private markets to regulation. Applies the concepts and theories to topical environmental issues such as water pollution and conserving biodiversity. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Recommended: MTH 111
Available via Ecampus

AEC 251, *INTRODUCTION TO AGRICULTURAL AND FOOD ECONOMICS, 3 Credits
An introductory applied microeconomics course focused on the unique challenges of agricultural and food systems. Topics include rational choice theory, models of supply and demand, and price formation, with particular attention on markets for agricultural and food products. Additional topics include market interdependencies, government policy, the behavior of firms, and market structure within agricultural and food systems. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Recommended: MTH 111
Available via Ecampus

AEC 253, *ENVIRONMENTAL LAW, POLICY, AND ECONOMICS, 4 Credits
A general introduction to federal environmental law and policy in the U.S. Familiarizes students with basic legal institutions and concepts of the American legal system, outlines the transition of environmental policy from its common law roots to its modern administrative law form, and gives an overview of the major federal environmental statutes. Relationships among legal theory and process and economic principles are emphasized. (Bacc Core Course)
Attributes: CPWC – Core, Pers, West Culture
Equivalent to: AEC 250
Available via Ecampus

AEC 299, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural and resource economics. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ. Equivalent to: AEC 299
This course is repeatable for 8 credits.

AEC 310, EXPLORING EXPERIENTIAL LEARNING OPPORTUNITIES, 2 Credits
Provides background and preparation for students’ experiential learning (EL) activities. Students will be shown examples of appropriate EL, how to find and compete for opportunities, and how to establish and define their learning objectives for EL. Resume writing, appropriate conduct in the workplace, as well as writing and oral presentation skills will be covered. A proposal for an EL activity will be prepared and presented to classmates. Graded P/N.
Recommended: WR 121

AEC 311, INTERMEDIATE APPLIED ECONOMICS I: PRODUCERS AND CONSUMERS, 4 Credits
An examination of the theories of consumer behavior and demand, production cost, the firm, supply, and competitive and monopoly market structures. Prerequisite: ((AEC 250 with C- or better or AEC 250 with C- or better) or AEC 251 with C- or better or (ECON 201 with C- or better or ECON 201H with C- or better)) and (MTH 241 [C-] or (MTH 251 [C-] or MTH 251H [C-]))
Equivalent to: AEC 311
Available via Ecampus
AEC 313, INTERMEDIATE APPLIED ECONOMICS II: MARKETS, WELFARE & POLICY, 4 Credits
Complementing the private-decision focus in AEC 311, the present course focuses on the intermediate microeconomic theory of social welfare and public decision-making. Topics include exchange, monopoly, game theory, social welfare, externalities, public goods and choice, asymmetric information, uncertainty, and cost-benefit analysis. Substantial attention will be given to the implications of these theories for real-world problems, especially regarding resource and environmental issues.
Prerequisite: MTH 241 with C- or better or (AEC 311 with C- or better or AREC 311 with D- or better or ECON 311 with C- or better)
Equivalent to: AREC 313
Available via Ecampus

AEC 351, *NATURAL RESOURCE ECONOMICS AND POLICY, 3 Credits
Application of principles of economics to identify the causes, consequences, and ways of dealing with natural resource problems, including problems associated with fisheries, forests, water resources, and land. Conceptual topics and policy applications. Emphasis is on developing students' skill in applying an economic way of thinking about natural resource management. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Prerequisite: (AEC 250 with D- or better or AREC 250 with D- or better or ECON 201 with D- or better or ECON 201H with D- or better)
Equivalent to: AREC 351
Recommended: MTH 111
Available via Ecampus

AEC 352, *ENVIRONMENTAL ECONOMICS AND POLICY, 3 Credits
Provides an overview of the interrelationships between economic activity, the environment, and public policy. Through case studies, discussion groups, readings, and group activities, students learn how economists define and analyze environmental problems and the types of policies they advocate for managing environmental quality. CROSSLISTED as AEC 352/ ECON 352. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Prerequisite: AEC 250 with D- or better or AREC 250 with D- or better or ECON 201 with D- or better or ECON 201H with D- or better
Equivalent to: AREC 352
Available via Ecampus

AEC 372, AGRICULTURAL COOPERATIVES, 3 Credits
An introduction to and in-depth examination of the agricultural cooperative. Students will gain a working knowledge of the concepts, principles, and terminology of agricultural cooperatives through reference materials, lectures, presentations by guest speakers and a cooperatives tour. Students will consider the strengths and weaknesses of the agricultural cooperative as well as the unique management and operational challenges inherent to this form of business operation.
Prerequisite: AEC 211 with D- or better or AREC 211 with D- or better
Equivalent to: AREC 372

AEC 388, AGRICULTURAL LAW, 4 Credits
Application of legal principles to business decision making in farming, ranching, and the agricultural support industry. Consideration of the obligations arising out of contract, tort, property, water, public land, and natural resource law.
Equivalent to: AREC 388
Available via Ecampus

AEC 399, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural and resource economics. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
Equivalent to: AEC 399H, AREC 399H
This course is repeatable for 8 credits.

AEC 399H, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural and resource economics. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
Attributes: HNRS – Honors Course Designator
Equivalent to: AEC 399, AREC 399
This course is repeatable for 8 credits.

AEC 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: AREC 401
This course is repeatable for 16 credits.

AEC 402, INDEPENDENT STUDY, 1-16 Credits
Equivalent to: AREC 402
This course is repeatable for 16 credits.

AEC 403, THESIS, 1-16 Credits
Equivalent to: AREC 403
This course is repeatable for 16 credits.

AEC 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: AREC 405
This course is repeatable for 16 credits.

AEC 406, PROJECTS, 1-16 Credits
Equivalent to: AREC 406
This course is repeatable for 16 credits.
Available via Ecampus
AEC 407, SEMINAR, 1-16 Credits
Equivalent to: AEC 407H, AREC 407, AREC 407H
This course is repeatable for 16 credits.

AEC 407H, SEMINAR, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: AEC 407, AREC 407, AREC 407H
This course is repeatable for 16 credits.

AEC 408, WORKSHOP, 1-16 Credits
Equivalent to: AREC 408
This course is repeatable for 16 credits.

AEC 410, INTERNSHIP, 1-6 Credits
Practical on-the-job training in agricultural business, marketing, commercial agricultural production, or related private or public organizations. Graded P/N.
Equivalent to: AREC 410
This course is repeatable for 6 credits.

AEC 421, ECONOMICS OF RURAL POVERTY AND THE U.S. SOCIAL SAFETY NET, 4 Credits
Introduces students to the geography of poverty in the United States and the "social safety net" that the U.S. has constructed to reduce poverty and its negative effects. The course focuses on the geography of the social safety net, the operation and administration of the safety net, and how recent changes in the social safety net may have disadvantaged rural people and places.
Equivalent to: AREC 421, RS 421
Available via Ecampus

AEC 432, ENVIRONMENTAL LAW, 4 Credits
Legal relationships arising out of rights to air, water, and land. The impact of federal and state regulation on pollution control and on the production, use, and disposal of hazardous materials.
Equivalent to: AREC 432
Available via Ecampus

AEC 434, ^BENEFIT-COST ANALYSIS, 4 Credits
Develops the fundamental tools for Benefit-Cost Analysis, a technique for evaluating a project or investment by comparing the economic benefits with the economic costs of the activity. Examines the tricky topic of how to measure the benefits of non-market such as good health and higher environmental quality. The methods introduced here apply to a wide variety of situations. Explores the broad issues of how to think about uncertainty and risk, how to discount future costs and benefits, to value lives saved, and other challenging topics. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisite: AEC 311 with C- or better or ECON 411 with C- or better
Equivalent to: AREC 434
Recommended: STAT 352 or familiarity with regression analysis
Available via Ecampus

AEC 440, THE ECONOMICS OF BUSINESS ORGANIZATION IN THE FOOD SYSTEM, 4 Credits
Application of economic analysis to questions related to the choice of an appropriate form of business organization for a wide variety of food system enterprises. Topics include costs of contracting, costs of ownership, enterprise scope and scale, and the dynamics of business ownership and structure. Particular emphasis is given to entrepreneurial enterprises and cooperative businesses in the food system.
Prerequisite: AEC 311 with D- or better or ECON 311 with D- or better

AEC 442, AGRICULTURAL BUSINESS MANAGEMENT, 4 Credits
Application of economic, financial, and strategic management principles to agricultural business with a focus on a case-study framework for analysis and business decision making for alternative business management strategies.
Equivalent to: AREC 442

AEC 444, COMMODITY FUTURES AND OPTIONS MARKETS, 4 Credits
Provides an overview of the basic concepts needed to use commodity futures and options markets to successfully manage price risk. To address the increasingly global economy in which commodity transactions occur, the course also includes financial futures such as interest rates and currencies. Specific topics covered include contract standardization, speculation and hedging, opening and closing of positions, and basis, i.e. the relationship between cash and futures markets, input-output hedges, and spreads. Students also gain hands-on experience through a trading simulation.
Equivalent to: AREC 444
Available via Ecampus

AEC 446, INTRODUCTION TO APPLIED ECONOMETRICS, 4 Credits
Introduces students to applied econometrics: the use of statistical techniques to estimate and test economic relationships. Topics include multiple regression models, multicollinearity, and simultaneous equations. The applications and labs will focus on econometric analysis of real world problems pertaining to issues in environmental, food, and resource economics and policy. Lec/lab.
Prerequisite: AEC 311 with D- or better and ST 351 [D-]

AEC 447, AGRICULTURAL PRICE AND MARKET ANALYSIS, 4 Credits
Price determination for food and agricultural commodities; development of quantitative economic models that explain and predict prices and other market outcomes. Lec/lab.
Equivalent to: AREC 447
Recommended: AEC 311 and ST 351
AEC 448, ADVANCED TOPICS IN ENVIRONMENTAL AND RESOURCE ECONOMICS, 3 Credits
Reviews core concepts of economic efficiency and market failures and then focuses on the economics of environmental regulation. Develops an appreciation for the structure of key concepts that underlie the economic approach to environmental issues and applications to policy and regulations. Builds skills in assessing regulatory policies from the perspective of economics.
Prerequisite: AEC 311 with D- or better and AEC 352 [D-]

AEC 452, MARINE ECONOMICS, 3 Credits
Economic aspects of marine resource utilization and management will be analyzed. Topics include open access aspect of marine resources; conflict and allocation of marine resources, marine resource markets, marine recreation, pollution, and aquaculture, with special emphasis on commercial fisheries.
Prerequisite: AEC 351 with D- or better or AEC 352 with D- or better or AEC 351 with D- or better or AEC 352 with D- or better
Equivalent to: AREC 452

AEC 453, CONSERVATION ON PRIVATE LAND, 3 Credits
Explore and experience the increasingly popular phenomenon of conservation on private land. This exploration includes the explosive growth of land trusts and the use of conservation easements to restrict the use of private land and often promote ecological goals.

AEC 454, RURAL DEVELOPMENT ECONOMICS AND POLICY, 3 Credits
Learn economic and regional development conceptual frameworks. Explore U.S. rural development and government interventions. Discuss differing popular local strategies for development that emphasize building current assets like local entrepreneurship to attracting resources and incomes from outside the region like amenity migration and tourism.
Equivalent to: AREC 454
Available via Ecampus

AEC 455, PROGRAM EVALUATION, 3 Credits
Explores the leading methods for evaluating the effectiveness of public programs and policies, specifically focusing on causal inference and empirical applications.
Prerequisite: (AEC 311 with C- or better or ST 351 with C- or better) and AEC 313 [C-]
Available via Ecampus

AEC 460, CAPITAL INVESTMENT ANALYSIS USING AGBIZ LOGIC, 3 Credits
Learn and understand the important factors in measuring the impacts of implementing technologies and/or conservation practices, adding value to products, or changing cropping systems or livestock enterprises. The AgBiz Logic program will be used to apply financial and economic principles to better understand and reduce the financial, production, marketing, and human resource risks facing agribusinesses.
Equivalent to: AREC 460

AEC 461, AGRICULTURAL AND FOOD POLICY ISSUES, 4 Credits
Principles of agricultural and food policy formulation; agricultural price and income policies in relation to land use, water, and food policies; interrelationships among U.S. and foreign agriculture and trade policies. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisite: AEC 311 with D- or better or ECON 311 with D- or better
Equivalent to: AREC 461

AEC 465, AGRICULTURAL AND FOOD FINANCIAL MANAGEMENT, 4 Credits
Students will develop risk management strategies utilizing the AgBiz Logic program to reduce the financial, production, marketing, and human resource risks facing agribusinesses. This course is designed to help students apply financial and economic principles to business decisions under diverse and changing circumstances. The course reviews basic financial reporting statements, details accounting and financing practices specific to agricultural and food enterprises.
Prerequisite: (AEC 211 with D- or better or AEC 211 with D- or better) and AEC 311 [D-]
Equivalent to: AREC 465

AEC 466, AGRICULTURAL AND FOOD MARKETING MANAGEMENT, 4 Credits
Principles, trends, issues, barriers, policies, strategies and decisions involved in domestic and international marketing of perishable and storable agricultural commodities and food products from the point of production to the point of consumption. Topics include firm-level marketing concepts, the integration of marketing with firms’ overall strategic management goals, as well as comparative studies across multiple outlets for agricultural and food products, to include local, regional, and global markets.
Prerequisite: AEC 221 with D- or better and (AEC 250 [D-] or AEC 251 [D-] or ECON 201 [D-])

AEC 475, WRITING BUSINESS PLANS: AGRICULTURE/FOOD-RELATED ENTERPRISES, 2 Credits
Students choose an enterprise and write a comprehensive business plan that describes the business vision, marketing plan, financial projections, risk management, and implementation strategy. At the end of term selected students present their plan to a commercial lender.
Equivalent to: AREC 475
Recommended: AEC 211 and AEC 221

AEC 499, SPECIAL TOPICS, 1-16 Credits
Various topics in agricultural and resource economics of special and current interest not covered in other courses.
Equivalent to: AREC 499
This course is repeatable for 16 credits.

AEC 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.
AEC 502, INDEPENDENT STUDY, 1-16
Credits
This course is repeatable for 16 credits.

AEC 503, THESIS, 1-16 Credits
Equivalent to: AREC 503
This course is repeatable for 999 credits.

AEC 505, READING AND CONFERENCE, 1-16 Credits
Equivalent to: AREC 505
This course is repeatable for 16 credits.

AEC 506, SPECIAL PROJECTS, 1-16
Credits
This course is repeatable for 16 credits.

AEC 507, SEMINAR, 1-16 Credits
Equivalent to: AREC 507
This course is repeatable for 16 credits.

AEC 508, WORKSHOP, 1-16 Credits
Equivalent to: AREC 508
This course is repeatable for 16 credits.

AEC 512, MICROECONOMIC THEORY I, 4 Credits
Fundamental topics in microeconomic theory. Topics include utility maximization and consumer demand, profit maximization and the theory of the firm, and labor and capital markets.
Recommended: AEC 312 and MTH 252

AEC 513, MICROECONOMIC THEORY II, 4 Credits
Emphasizes principles for microeconomic theory at the master's level. Builds upon the foundations covered in AEC 512, and extends the theory and principles to cover uncertainty, game theory, competitive market equilibrium and welfare analysis, imperfect competition, and market failures. Primary emphasis is on understanding microeconomic theory and the underlying assumptions, and how it is applied to real world settings.
Prerequisite: AEC 512 with C or better

AEC 521, ECONOMICS OF RURAL POVERTY AND THE U.S. SOCIAL SAFETY NET, 4 Credits
Introduces students to the geography of poverty in the United States and the "social safety net" that the U.S. has constructed to reduce poverty and its negative effects. The course focuses on the geography of the social safety net, the operation and administration of the safety net, and how recent changes in the social safety net may have disadvantaged rural people and places.
Equivalent to: AREC 521, RS 521
Available via Ecampus

AEC 525, APPLIED ECONOMETRICS, 4 Credits
General principles of applied econometric research are emphasized, including model building, data analysis, hypothesis testing, and evaluation and interpretation of results. A variety of estimators are applied to real data, including least squares, panel data, simultaneous equations, discrete choice, and limited dependent variable models.

AEC 532, ENVIRONMENTAL LAW, 4 Credits
Legal relationships arising out of rights to air, water, and rights to air, water, and land. The impact of federal and state regulation on pollution control and on the production, use, and disposal of hazardous materials.
Equivalent to: AREC 532
Available via Ecampus

AEC 534, ENVIRONMENTAL AND RESOURCE ECONOMICS, 3 Credits
Environmental problems and misuse of natural resources are caused by humans' behavior, and thus must be solved by changing behavior. Explores the ways economics is central to understanding the incentive behind the causes, consequences, and potential for effective solutions to environmental and resource problems involving air, water, fish, forests, climate change, and biodiversity. Builds on microeconomics principles to include theories of market failures, externalities, common-pool resources, and institutions, as well as growth and sustainability. Equips students with tools for non-market valuation and for critical evaluation of environmental policies' benefits and costs.
Equivalent to: AREC 534
Recommended: AEC 311 or AREC 311
Available via Ecampus

AEC 540, THE ECONOMICS OF BUSINESS ORGANIZATION IN THE FOOD SYSTEM, 4 Credits
Application of economic analysis to questions related to the choice of an appropriate form of business organization for a wide variety of food system enterprises. Topics include costs of contracting, costs of ownership, enterprise scope and scale, and the dynamics of business ownership and structure. Particular emphasis is given to entrepreneurial enterprises and cooperative businesses in the food system.
Recommended: AEC 311 or ECON 311

AEC 543, INTERNATIONAL TRADE, 4 Credits
Introduction to the major theories of international trade and to models that are useful for applied policy and regional analysis. Effects of trade and trade policy on consumers, workers, and firms are emphasized.
Prerequisite: AEC 513 with C or better
Equivalent to: AREC 543
AEC 544, COMMODITY FUTURES AND OPTIONS MARKETS, 4 Credits
Provides an overview of the basic concepts needed to use commodity futures and options markets to successfully manage price risk. To address the increasingly global economy in which commodity transactions occur, the course also includes financial futures such as interest rates and currencies. Specific topics covered include contract standardization, speculation and hedging, opening and closing of positions, and basis, i.e. the relationship between cash and futures markets, input-output hedges, and spreads. Students also gain hands-on experience through a trading simulation.
Equivalent to: AREC 544
Available via Ecampus

AEC 546, INTRODUCTION TO APPLIED ECONOMETRICS, 4 Credits
Introduces students to applied econometrics: the use of statistical techniques to estimate and test economic relationships. Topics include multiple regression models, multicollinearity, and simultaneous equations. The applications and labs will focus on econometric analysis of real world problems pertaining to issues in environmental, food, and resource economics and policy.
Recommended: AEC 311 and ST 351

AEC 548, ADVANCED TOPICS IN ENVIRONMENTAL AND RESOURCE ECONOMICS, 3 Credits
Reviews core concepts of economic efficiency and market failures and then focuses on the economics of environmental regulation. Develops an appreciation for the structure of key concepts that underlie the economic approach to environmental issues and applications to policy and regulations. Builds skills in assessing regulatory policies from the perspective of economics.

AEC 550, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, 4 Credits
Presents concepts, theories, and methods used in the economic analysis of environmental and natural resource issues. The emphasis is on the economics of environmental policies and the development of decision rules regarding the efficient use of natural resources.
Prerequisite: AEC 512 with C or better
Equivalent to: AREC 550

AEC 551, APPLICATIONS OF ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS, 4 Credits
Applies and expands upon concepts, theories, and methods in environmental and natural resource economics introduced in AEC 550. Topics include non-market valuation, discounting, and benefit-cost analysis, as well as the role and importance of institutions, appropriate research methods, and the philosophical basis for normative judgments in economics.
Prerequisite: AEC 550 with C or better or AREC 550 with C or better
Equivalent to: AREC 551

AEC 552, MARINE ECONOMICS, 3 Credits
Economic aspects of marine resource utilization and management will be analyzed. Topics include open access aspect of marine resources; conflict and allocation of marine resources, marine resource markets, marine recreation, pollution, and aquaculture, with special emphasis on commercial fisheries. CROSSLISTED as AEC 552/MRM 552.
Equivalent to: AREC 552, MRM 552
Recommended: (AEC 351 or AREC 352 or AREC 351 or AREC 352)

AEC 553, CONSERVATION ON PRIVATE LAND, 3 Credits
Explore and experience the increasingly popular phenomenon of conservation on private land. This exploration includes the explosive growth of land trusts and the use of conservation easements to restrict the use of private land and often promote ecological goals.

AEC 554, RURAL DEVELOPMENT ECONOMICS AND POLICY, 3 Credits
Learn economic and regional development conceptual frameworks. Explore U.S. rural development and government interventions. Discuss differing popular local strategies for development that emphasize building current assets like local entrepreneurship to attracting resources and incomes from outside the region like amenity migration and tourism.
Equivalent to: AREC 554
Available via Ecampus

AEC 555, PROGRAM EVALUATION, 3 Credits
Explores the leading methods for evaluating the effectiveness of public programs and policies, specifically focusing on causal inference and empirical applications.
Available via Ecampus

AEC 560, CAPITAL INVESTMENT ANALYSIS USING AGBIZ LOGIC, 3 Credits
Learn and understand the important factors in measuring the impacts of implementing technologies and/or conservation practices, adding value to products, or changing cropping systems or livestock enterprises. The AgBiz LogicTM software programs will be used to apply financial and economic principles to better understand and reduce the financial, production, marketing, and human resource risks facing agribusinesses.
Equivalent to: AREC 560

AEC 565, AGRICULTURAL AND FOOD FINANCIAL MANAGEMENT, 4 Credits
Students will develop risk management strategies utilizing the AgBiz Logic program to reduce the financial, production, marketing, and human resource risks facing agribusinesses. This course is designed to help students apply financial and economic principles to business decisions under diverse and changing circumstances. The course reviews basic financial reporting statements, details accounting and financing practices specific to agricultural and food enterprises.
Equivalent to: AREC 565
Recommended: (AEC 211 or AREC 211) and AEC 311
AEC 566, AGRICULTURAL AND FOOD MARKETING MANAGEMENT, 4 Credits
Principles, trends, issues, barriers, policies, strategies and decisions involved in domestic and international marketing of perishable and storable agricultural commodities and food products from the point of production to the point of consumption. Topics include firm-level marketing concepts, the integration of marketing with firms’ overall strategic management goals, as well as comparative studies across multiple outlets for agricultural and food products, to include local, regional, and global markets.
Recommended: AEC 221 and (AEC 250 or AEC 251 or ECON 201)

AEC 599, SPECIAL TOPICS, 0-16 Credits
Various topics in applied economics of special and current not covered in other courses. May be repeated for credit when topics differ.
Equivalent to: AREC 599
This course is repeatable for 16 credits.

AEC 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Equivalent to: AREC 601
This course is repeatable for 16 credits.

AEC 602, INDEPENDENT STUDY, 1-16 Credits
Equivalent to: AREC 605
This course is repeatable for 16 credits.

AEC 603, THESIS, 1-16 Credits
Equivalent to: AREC 603
This course is repeatable for 999 credits.

AEC 605, READING AND CONFERENCE, 1-16 Credits
Equivalent to: AREC 605
This course is repeatable for 16 credits.

AEC 606, SPECIAL PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

AEC 607, SEMINAR, 1-16 Credits
Equivalent to: AREC 607
This course is repeatable for 16 credits.

AEC 608, WORKSHOP, 1-16 Credits
Equivalent to: AREC 608
This course is repeatable for 16 credits.

AEC 611, ADVANCED MICROECONOMIC THEORY I, 4 Credits
A rigorous development of the theory of consumption and production, with emphasis on duality.
Prerequisite: (AEC 512 with C or better and AEC 513 [C])
Recommended: MTH 254

AEC 612, ADVANCED MICROECONOMIC THEORY II, 4 Credits
A rigorous extension of the theory of the consumer and firm to aggregate and heterogeneous populations, decision making under uncertainty, and related game theory concepts.
Prerequisite: AEC 611 with C or better

AEC 613, ADVANCED MICROECONOMIC THEORY III, 4 Credits
A rigorous development of the theory of competitive equilibrium, market power, public goods, and information.
Prerequisite: AEC 612 with C or better

AEC 625, ADVANCED ECONOMETRICS I, 4 Credits
Emphasizes the basic theory underlying the main types of estimators used in econometrics, as well as their application in empirical research. Includes derivation, properties, and application of method of moments, maximum likelihood, ordinary and generalized least squares, and instrumental variables estimators, statistical inference and hypothesis testing, and model building and specification analysis. Provides the necessary foundation for estimation techniques covered in AEC 626. Lec/lab.
Prerequisite: AEC 525 with C or better

AEC 626, ADVANCED ECONOMETRICS II, 4 Credits
Extensions to the generalized linear regression model are considered: discrete choice, limited dependent variable, panel data, and simultaneous equations models, and new solutions to identification problems. Strong applied orientation, emphasizing problems of data measurement, model selection and specification.
Prerequisite: AEC 625 with C or better

AEC 627, COMPUTATIONAL ECONOMICS, 4 Credits
Covers the numerical analysis of static optimization models and stochastic dynamic models in resource and development economics, emphasizing formulation, solution, and simulation of dynamic optimization, rational expectations, and arbitrage pricing models. Lec/lab.

AEC 640, SUSTAINABLE DEVELOPMENT, 3 Credits
Surveys research on the quantitative economic analysis of sustainable development, with an emphasis on integrated assessment methods and models and their application to agriculture and rural development policy, agricultural technology impact assessment, and climate change impact assessment.
Prerequisite: AEC 611 with D- or better and AEC 612 [D-] and AEC 625 [D-]
Equivalent to: AREC 640

AEC 643, ADVANCED TOPICS IN DEVELOPMENT ECONOMICS, 3 Credits
Introduces students to key issues in the economics of development and equips them with the theoretical and empirical tools required to conduct advanced research in these topics.
Prerequisite: AEC 613 with C or better and AEC 626 [C]
Equivalent to: AREC 643
AEC 651, ADVANCED NATURAL RESOURCE ECONOMICS, 3 Credits
Contemporary economic theory of dynamic natural resource allocation is introduced. Assignments focus on analytical and numerical methods for solving dynamic optimization problems in resource and environmental management. Lecture and readings emphasize current research trends in the field and relevant advances in quantitative methodology.
Prerequisite: AEC 611 with C or better
Equivalent to: AREC 651

AEC 652, ADVANCED ENVIRONMENTAL ECONOMICS, 3 Credits
Interrelationships of natural resource use and the environment; applied welfare and benefit-cost analysis; externalities and pollution abatement; non-market valuation of resources; property rights; legal and social constraints; policy approaches.
Prerequisite: (AEC 513 with C or better or AREC 513 with C or better) and (AEC 525 [C] or AREC 525 [C])
Equivalent to: AEC 652

AEC 653, EMPIRICAL ENVIRONMENTAL AND RESOURCE ECONOMICS, 3 Credits
Introduces empirical methods at the current frontiers of research in environmental and resource economics. General topics may include the identification of non-market values, revealed and stated preference methods, environmental policy evaluation, equilibrium sorting models, and climate econometrics.
Prerequisite: AEC 513 with C or better and AEC 525 [C]
Equivalent to: AEC 653

AEC 699, SPECIAL TOPICS, 1-16 Credits
Various topics in applied economics of special and current interest not covered in other courses.
Equivalent to: AREC 699
This course is repeatable for 16 credits.

AG 211, SURVEY AND CONSTRUCTION, 3 Credits
Land measurement and leveling as applied to agricultural uses. Concrete and agricultural building construction including the use of construction power tools, selection of materials and cost estimating.

AG 221, METALS AND WELDING, 3 Credits
Practices of metal working including the use of metal working machines, metal identification, heat treating and metal properties. Fabrication of metals including arc and oxy-acetylene welding and cutting. Lec/lab.

AG 230, INTRODUCTION TO EXTENSION AND ENGAGEMENT, 3 Credits
For students interested in pursuing a career with the OSU Extension Service. An introduction to the OSU Extension Service mission, philosophy, history, organization, structure, administration, program areas, Extension program development, Extension teaching and delivery methods, and the involvement and use of volunteers.
This course is repeatable for 6 credits.

AG 301, *ECOSYSTEM SCIENCE OF PACIFIC NW INDIANS, 3 Credits
Designed and presented in partnership with Pacific Northwest Indians and Alaska Natives, focusing on natural ecosystems, differing views, power relationships, policymaking, and gender roles. (Bacc Core Course)
Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination
Available via Ecampus

AG 311, *NATIVE AMERICAN AGRICULTURE, 3 Credits
Explores Native North American agriculture and land management--prehistory of important domesticates such as maize, historic change, and contemporary issues including modern stereotypes, women in agriculture, cultural survival, and both the physical and spiritual significance of these crops in Native American communities and around the globe past and present. (Bacc Core Course)
Attributes: CPCD – Core, Pers, Cult Diversity
Available via Ecampus

AG 312, ENGINE THEORY AND OPERATION, 3 Credits
Engine construction, operational theories and principles, lubrication, fuels and oils, emissions and preventive maintenance are taught through the process of small engine lab activities. Engine efficiency theories and measurement are presented.

AG 318, ACCESSING INFORMATION FOR AGRICULTURAL RESEARCH, 1 Credit
Designed for students at a distance to develop library skills and improve access to information used to conduct technical agricultural research.
AG 351, *COMMUNICATING AGRICULTURE TO THE PUBLIC, 3 Credits
Students will explore various outlets for communicating with the public about agriculture using appropriate, professional writing. Additionally, students will articulate their thoughts on controversial issues as well as write feature and editorial pieces promoting positive agricultural practices and people in agriculture. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Available via Ecampus

AG 391, FARM IMPLEMENTS, 3 Credits
Power farming implements including operation, maintenance, adjustments, calibration and use are covered. Field trips may be required.
Available via Ecampus

AG 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

AG 402, INDEPENDENT STUDIES, 1-16 Credits
This course is repeatable for 16 credits.

AG 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

AG 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

AG 406, SPECIAL PROBLEMS, 1-16 Credits
This course is repeatable for 16 credits.

AG 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

AG 409, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

AG 410, INTERNSHIP, 1-16 Credits
A work internship to give students practical on-the-job preparation in any of the main facets of agriculture or related industries.
This course is repeatable for 16 credits.
Available via Ecampus

AG 412, AG SAFETY AND HEALTH, 3 Credits
An examination of various hazards associated with agriculture. Control strategies will be explored and prevention methods identified. Hazards examined include machinery, livestock, controlled spaces, pesticides, and other items common to the agricultural workplace. Lec/lab.
Available via Ecampus

AG 421, ^WRITING IN AGRICULTURE, 3 Credits
Students will synthesize their knowledge in various areas of agricultural sciences and analyze how current issues impact the agriculture industry, explore careers in agriculture, and develop their written communication skills. Students will share their ideas and demonstrate their learning primarily in writing. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Available via Ecampus

AG 425, DEVELOPMENTS IN AGRICULTURAL MECHANICS, 3 Credits
Emphasis on the development of instructional units for agricultural instruction programs. Wide applications to agricultural mechanization and biotechnology.
This course is repeatable for 9 credits.

AG 435, PROFESSIONAL PRESENTATIONS IN AGRICULTURE, 3 Credits
Students will learn to effectively create and deliver professional presentations relevant to careers in agriculture and natural resources. This includes developing skills for both formal and informal presentations, using visual aids effectively, and using appropriate strategies to engage various audiences.
Available via Ecampus

AG 445, SOCIAL MEDIA ADVOCACY IN AGRI SCIENCES & NATURAL RESOURCES, 3 Credits
Through practice and application, students develop the ability to communicate effectively in writing using social media and other digital platforms for business purposes, including internal communication, stakeholder engagement, educational messaging, event promotion, and product marketing.

AG 455, *RISK AND CRISIS COMMUNICATIONS IN AG SCI & NATURAL RESOURCES, 3 Credits
Examine potential risk and crisis communications scenarios in agriculture, natural resources and environmental sciences, plus the relevant theories, models, and processes involved in addressing these types of situations effectively. Explores the mitigation, management, and response to risks and crises from a communications perspective with special application to natural resources, along with agricultural and environmental sciences, hazardous situations through completing case studies and creating a risk and crisis communications manual. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Available via Ecampus
AG 465, AG SCI AND NATURAL RESOURCES COMMUNICATIONS MINOR CAPSTONE, 2 Credits
Reflect on accumulated knowledge and technical/soft skills gained and conceptualize how to apply communication theories and practices in the context of future agricultural and natural resources careers. Integrate real-life agriculture and natural resources communications scenarios, which will allow for the practice of strategy development, proper implementation, and appropriate assessment methods. Helps package and demonstrate skills verbally and in a portfolio.
Prerequisite: AG 351 with D- or better

AG 492, TECHNOLOGY TRANSFER IN AGRICULTURE, 3 Credits
Examination of processes by which formal and informal agricultural instruction programs influence the introduction and acceptance of technology in agriculture. An emphasis in the international arena will be maintained. The focus throughout the course will be on the role of a professional change agent working with technological change.

AG 499, SPECIAL TOPICS, 1-4 Credits
Topics may vary from term to term and from year to year. May be repeated for credit when topics differ. This course is repeatable for 12 credits.

AG 507, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

AG 509, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

AG 518, EXTENSION COURSE IN TEACHER EDUCATION: TECHNICAL, 1-3 Credits
Enables present and prospective teachers of agriculture to continue their professional development on technical topics of current importance.
Equivalent to: AED 518
This course is repeatable for 9 credits.

AG 521, WRITING IN AGRICULTURE, 3 Credits
Students will synthesize their knowledge in various areas of agricultural sciences and analyze how current issues impact the agriculture industry, explore careers in agriculture, and develop their written communication skills. Students will share their ideas and demonstrate their learning primarily in writing.
Available via Ecampus

AG 525, DEVELOPMENTS IN AGRICULTURAL MECHANICS, 3 Credits
Emphasis on the development of instructional units for agricultural instruction programs. Wide applications to agricultural mechanization and biotechnology.
This course is repeatable for 45 credits.
Available via Ecampus

AG 541, COMMUNITY PROGRAMS IN AGRICULTURE, 3 Credits
Evaluating agricultural education program effectiveness and technical appropriateness. Development of long-range plans for agricultural programs to meet the technical needs of a community.

AG 592, TECHNOLOGY TRANSFER IN AGRICULTURE, 3 Credits
Examination of processes by which formal and informal agricultural instruction programs influence the introduction and acceptance of technology in agriculture. An emphasis in the international arena will be maintained. The focus throughout the course will be on the role of a professional change agent working with technological change.

AG 808, WORKSHOP, 1-4 Credits
Designed to enhance professionalism and create a knowledge base to increase personal effectiveness. This course will provide a basis for future leadership by synthesizing theoretical knowledge with practical application. Individuals will have the opportunity to explore their own personality, reflect on their leadership ability, and develop the professional skills and networking abilities necessary to become influential leaders in their home, community and profession.
This course is repeatable for 4 credits.

Agricultural Sci, College of (AGRI)

AGRI 199, SPECIAL TOPICS, 1-3 Credits
This course is repeatable for 8 credits.

AGRI 299, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agriculture and natural resources. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
This course is repeatable for 8 credits.

AGRI 399, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural science. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
This course is repeatable for 8 credits.
Available via Ecampus

AGRI 402, INDEPENDENT STUDIES, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

AGRI 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

AGRI 411, *INTRODUCTION TO FOOD SYSTEMS: LOCAL TO GLOBAL, 3 Credits
What is a food system, what does it look like, and how does it work? How do our food choices shape our world? Food systems, farm to plate, operate within social, political, economic, and natural environments, at multiple scales. This multidisciplinary course will introduce students to the complex topic of food systems, at different scales and from a variety of perspectives. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Available via Ecampus
AGRI 420, INTRO TO ORGANIC PRODUCTION, 3 Credits
History of organic farming, advantages and disadvantages, review of long-term studies comparing organic and conventional production systems, a review of the federal organic production guidelines, methods and applications for organic production facilities, crop nutrition, compost and manure utilization, organic amendments, organic field crop production, organic gardening, organic livestock production, weed and pest control in organic systems, and marketing of organic produce.
Prerequisite: CROP 200 with D- or better or SOIL 205 with D- or better or BI 213 with D- or better
Available via Ecampus

AGRI 438, EXPLORING WORLD AGRICULTURE, 2 Credits
Global practices of food production are highly diverse. However, there are also many common global issues related to agriculture, food, and natural resources. Speakers with international backgrounds and experiences will present material, as well as student teams who will research a topic of personal interest. In addition, opportunities for global study, internship, and research will be explored.
Equivalent to: AEC 438

AGRI 499, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agriculture and natural resources. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
This course is repeatable for 8 credits.

AGRI 506, ORGANIC AGRICULTURE CAPSTONE, 3 Credits
Recommended: AGRI 520, CROP/SOIL 530, ANS 550

AGRI 511, INTRODUCTION TO FOOD SYSTEMS: LOCAL TO GLOBAL, 3 Credits
What is a food system, what does it look like, and how does it work? How do our food choices shape our world? Food systems, farm to plate, operate within social, political, economic, and natural environments, at multiple scales. This multidisciplinary course will introduce students to the complex topic of food systems, at different scales and from a variety of perspectives.
Available via Ecampus

AGRI 520, INTRODUCTION TO ORGANIC FOOD PRODUCTION, 3 Credits
History of organic farming, advantages and disadvantages, review of long-term studies comparing organic and conventional production systems, a review of the federal organic production guidelines, methods and applications for organic production facilities, crop nutrition, compost and manure utilization, organic amendments, organic field crop production, organic gardening, organic livestock production, weed and pest control in organic systems, and marketing of organic produce.
Recommended: CROP 200 or SOIL 205 or BI 213
Available via Ecampus

AGRI 599, SPECIAL TOPICS, 1-4 Credits
Targeted courses that focus on specific topics in agricultural science. Topics may vary from term to term and from year to year. May be repeated for credit when topics differ.
This course is repeatable for 8 credits.

Animal Sciences (ANS)

ANS 100, ORIENTATION TO ANIMAL AND RANGELAND SCIENCES, 1 Credit
Designed to provide incoming Animal and Rangeland Sciences students an introduction to college life at OSU with an emphasis on the faculty, facilities, services, and the curricula of the Department of Animal and Rangeland Sciences.

ANS 121, *INTRODUCTION TO ANIMAL SCIENCES, 4 Credits
Principles of breeding, physiology, nutrition, and management as they apply to modern livestock and poultry production. Lec/lab. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science
Equivalent to: ANS 121H
Available via Ecampus

ANS 121H, *INTRODUCTION TO ANIMAL SCIENCES, 4 Credits
Principles of breeding, physiology, nutrition, and management as they apply to modern livestock and poultry production. Lec/lab. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science; HNRS – Honors Course Designator
Equivalent to: ANS 121

ANS 207, SOPHOMORE SEMINAR, 2 Credits
Examination of career opportunities in animal sciences.
Available via Ecampus

ANS 215, BEEF/DAIRY INDUSTRIES, 3 Credits
Introduction to beef and dairy industries; history, current industry status, and demonstration and practice of basic husbandry skills.
Recommended: ANS 121

ANS 216, SMALL RUMINANT/SWINE INDUSTRIES, 3 Credits
Introduction to the small ruminant and swine industries including history, current status and production practices, with demonstration and hands-on experience of basic husbandry practices.
Recommended: ANS 121

ANS 217, POULTRY INDUSTRIES, 3 Credits
Familiarization of the organizational structure and marketing arrangement of poultry industries; hands-on managerial techniques, practices and procedures carried out by the poultry industries.
ANS 220, INTRODUCTORY HORSE SCIENCE, 3 Credits
Introduction to horses, their history, breeds, form and function, performance evaluation, current industry status, and general management. 
Recommended: ANS 121

ANS 223, EQUINE MARKETING, 2 Credits
Course covers practical concepts of equine marketing. Emphasis on market assessment, targeting buyers, marketing and advertising strategies, hands-on experience in product preparation and presentation, marketing legalities. 
Recommended: ANS 121, ANS 220 and ANS 192

ANS 231, LIVESTOCK EVALUATION, 3 Credits
Focuses on an individual animal's economic merit as compared to a sample group. Visual appraisal, performance data, and carcass merit are stressed. Includes the evaluation of both market and breeding animals. The livestock species of concentration include beef cattle, swine, sheep, and meat goats. Lec/lab. 
Recommended: ANS 121

ANS 251, PRINCIPLES OF ANIMAL FOODS TECHNOLOGY, 3 Credits
Processing of meat, milk and eggs into human food products. Lec/lab. 
Recommended: ANS 121

ANS 280, COMPANION ANIMAL MANAGEMENT, 4 Credits
An introduction to the challenges, responsibilities, and benefits of interaction with selected companion animals. Topics covered will provide an overview of the human-animal bond, the position of companion animals in society, ethical issues of pet ownership and potential career opportunities. In addition, the course will serve as an introduction to preventive care and normal behavior of dogs, cats, and selected exotic pets. As the Department of Animal and Rangeland Sciences curriculum offers courses addressing equine care and husbandry, horses will not be discussed in this class. 
Available via Ecampus

ANS 302, COMMON DISEASES OF COMPANION ANIMALS, 4 Credits
An introduction to common diseases of selected companion animals. Emphasis will be placed on identifying predisposing factors, clinical signs, common diagnostic procedures and potential implications for human health. A $10 course fee will be required. Lec/rec. 
Prerequisite: ((BI 211 with D- or better or BI 211H with D- or better) and (BI 212 [D-] or BI 212H [D-]) and (BI 213 [D-] or BI 213H [D-]) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-])) and CH 121 [D-] and CH 122 [D-] and CH 123 [D-] 
Recommended: ANS 280 
Available via Ecampus

ANS 311, PRINCIPLES OF ANIMAL NUTRITION, 3 Credits
Classification, digestion, absorption, and metabolism of nutrients in animals; consequences of nutritional deficiencies and toxicities. 
Prerequisite: ((BI 211 with D- or better or BI 211H with D- or better) and (BI 212 [D-] or BI 212H [D-]) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-]))) 
Available via Ecampus

ANS 313, APPLIED ANIMAL NUTRITION: FEEDS AND RATION FORMULATION, 4 Credits
Discusses topics relevant to feedstuff identification and nutrient analysis, feed processing and formulation of balanced animal diets based on nutrient requirements. Provides students hands-on experiences in identifying various feedstuffs and formulating rations based on the nutrient composition of those feedstuffs. 
Recommended: MTH 111 
Available via Ecampus

ANS 314, ANIMAL PHYSIOLOGY, 4 Credits
Biological basis of animal performance; describes how networks of cells act cooperatively to enable locomotion, provide a stable internal environment, allocate resources, remove metabolic end-products, and counteract microorganisms. 
Recommended: General principles of biology equivalent to BI 211, BI 212, BI 213 and junior standing or higher 
Available via Ecampus

ANS 315, *CONTENTIOUS SOCIAL ISSUES IN ANIMAL AGRICULTURE, 3 Credits
Discussion of contentious issues including role of animal products and human health; use of hormones and antibiotics; new animal biotechnologies; animal rights/welfare; livestock grazing on public lands. (Bacc Core Course). 
Attributes: CSST – Core, Synthesis, Science/Technology/Society 
Available via Ecampus

ANS 316, REPRODUCTION IN DOMESTIC ANIMALS, 4 Credits
Anatomy and physiology of mammalian and avian reproductive systems; fertilization, embryonic and fetal development, parturition and reproductive technologies. Lec/rec. 
Prerequisite: ((BI 211 with D- or better or BI 211H with D- or better) or ((BI 221 with D- or better or BI 221H with D- or better) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-])) and CH 121 [D-] or CH 221 [D-] or CH 231 [D-] or CH 231H [D-]) 
Recommended: ANS 121 
Available via Ecampus

ANS 317, REPRODUCTION IN DOMESTIC ANIMALS LABORATORY, 1 Credit
Gross and microscopic anatomy of the reproductive tract; semen collection, evaluation and extension; evaluation of fertilization, embryo and fetal development and parturition. Lec/lab. 
Prerequisite: ANS 316 (may be taken concurrently) with D- or better 
Available via Ecampus

ANS 318, MANAGEMENT OF ANIMALS IN INDUSTRIAL ENVIRONMENTS, 4 Credits
An introduction to the management practices and practical skills required to successfully work in animal based industries. A $60 course fee will be required. Lec/lab. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 380, COMPLIMENTARY ANIMAL MANAGEMENT, 4 Credits
An introduction to the cultural, ethical, and economic aspects of animal management. Emphasis will be placed on the role of animals in human society and the potential for conflict between human needs and animal welfare. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 390, INTERNSHIP IN ANIMAL SCIENCES, 6 Credits
An internship experience in the field of animal sciences. Opportunities will vary greatly depending on the particular internship, but may include research, animal husbandry, animal welfare, environmental advocacy, and other relevant areas. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 410, SPECIAL TOPICS IN ANIMAL SCIENCES, 1 Credit
A special topics course in the field of animal sciences. The specific topic will be announced at the beginning of the semester. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 420, SEMINAR IN ANIMAL SCIENCES, 1 Credit
A seminar in a specific area of animal sciences. The specific topic will be announced at the beginning of the semester. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 430, ADVANCED TOPICS IN ANIMAL SCIENCES, 4 Credits
A course focusing on advanced topics in animal sciences. The specific topic will be announced at the beginning of the semester. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus

ANS 440, INDEPENDENT STUDY IN ANIMAL SCIENCES, 4 Credits
An independent study project in the field of animal sciences. The specific project will be announced at the beginning of the semester. 
Prerequisite: BI 211 or BI 211H 
Recommended: ANS 121 
Available via Ecampus
ANS 320, PRINCIPLES OF COMPANION ANIMAL NUTRITION, 3 Credits
Learn about nutrients, the digestive process, and the application of nutritional sciences to the health and welfare of companion animals. Introduction to the metabolic basis and practical preventative management for nutritional diseases in companion animals.
Prerequisite: ((BI 211 with D- or better or BI 211H with D- or better) and (BI 212 [D-] or BI 212H [D-])) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-]))
Available via Ecampus

ANS 321, AVIAN EMBRYO, 4 Credits
Discussion and experimentation involving the development and the environmental requirements for the artificial incubation of avian embryos. Lec/lab. Offered even-numbered years.
Recommended: ANS 121 and ANS 217 and BI 211

ANS 333, EQUINE STABLE MANAGEMENT, 3 Credits
Discusses developing a business plan, financial statements, and ratios, budgeting, financial planning, taxation, and employment issues within the current equine industry.
Prerequisite: ANS 220 with D- or better
Recommended: ANS 222

ANS 335, EQUINE HEALTH AND DISEASE, 3 Credits
Recognition of common diseases and disorders including their cause, treatment and prevention. Management of internal and external parasites. Recognizing common lameness issues. 
Available via Ecampus

ANS 341, ANIMAL BEHAVIOR AND COGNITION, 3 Credits
Survey, discuss, and explore principles of animal behavior and cognition from a comparative perspective, taking into account the interacting influences of biology, environment, and life experience on the individual and group behavior of animals across species. Aspects of animal cognition, including reasoning, perception, memory and personality, that play an important role in animal behavior will also be addressed.
Prerequisite: BI 102 with D or better or (BI 213 with D or better or BI 213H with D or better) or (BI 221 with D or better or BI 221H with D or better) and (BI 222 [D] or BI 222H [D]) and (BI 223 [D] or BI 223H [D])
Available via Ecampus

ANS 351, ADVANCED PRINCIPLES OF ANIMAL FOODS TECHNOLOGY, 4 Credits
Provides in-depth coverage of both fresh and processed meats and eggs into products suitable for human consumption.
Recommended: ANS 251

ANS 378, ANIMAL GENETICS, 4 Credits
Fundamentals of inheritance, principles of genetic segregation, population and quantitative genetics, response to natural selection and artificial manipulation of populations.
Prerequisite: BI 211 with D- or better or BI 211H with D- or better or BI 212 with D- or better or BI 212H with D- or better or BI 213 with D- or better or BI 213H with D- or better or BI 221 with D- or better or BI 221H with D- or better or BI 222 with D- or better or BI 222H with D- or better or BI 223 with D- or better or BI 223H with D- or better
Recommended: ANS 121 and ST 351
Available via Ecampus

ANS 380, PRINCIPLES OF ANIMAL ANATOMY AND PHYSIOLOGY, 3 Credits
An introductory course in animal anatomy to provide a foundation for advanced courses in the Animal Science curriculum. Emphasis is on acquisition of a basic knowledge of minute and gross anatomical structures, their operation, and integration. Begins with anatomical nomenclature such as body planes and directional terms then covers the following tissues and organ systems: epithelium, connective tissue, blood and bone marrow, bone/cartilage, muscle tissue, nervous tissue, digestive system, circulatory system, reproductive system, urinary system, and respiratory system.
Prerequisite: ([(BI 211 with D or better or BI 211H with D or better) and (BI 212 [D] or BI 212H [D]) and (BI 213 [D] or BI 213H [D])] or ([(BI 221 [D] or BI 221H [D]) and (BI 222 [D] or BI 222H [D]) and (BI 223 [D] or BI 223H [D])])
Available via Ecampus

ANS 385, FOUNDATIONS OF MAMMALIAN HISTOLOGY, 3 Credits
Provides a basic knowledge of mammalian microscopic anatomy. Emphasis will be on the appearance, organization and function of minute anatomical structures that can only be observed with the help of a visual enhancer, such as a microscope. Covers basic histological techniques and histology and related functions of the following tissues and organ systems: epithelium, connective tissue, bone/cartilage, blood, muscle tissue, nervous tissue, circulatory system, digestive system, reproductive system, urinary system, respiratory system, immune system, integument, eye and ear. Also covers gametogenesis, fertilization, and early development of the vertebrate embryo. Lec/rec.
Prerequisite: ([(BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])] or ([(BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-])] ) and (BB 314 [C-] or BB 314H [C-])
Available via Ecampus

ANS 390, GROSS ANATOMY OF DOMESTIC ANIMALS, 4 Credits
Provides a foundation for advanced courses in the Animal Sciences curriculum. Emphasis on gaining knowledge of mammalian anatomy. Lectures cover anatomical nomenclature, structure, operation, and integration of major organ systems. The dog is used as the general model while comparative domestic animal anatomy is also covered. Lec/lab.
Prerequisite: ([(BI 211 with D or better or BI 211H with D or better) and (BI 212 [D] or BI 212H [D]) and (BI 213 [D] or BI 213H [D])] or ([(BI 221 [D] or BI 221H [D]) and (BI 222 [D] or BI 222H [D]) and (BI 223 [D] or BI 223H [D])])

16 College of Agricultural Sciences
ANS 401, RESEARCH, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

ANS 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

ANS 405, READING AND CONFERENCE, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

ANS 407, SEMINAR, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

ANS 410, ANIMAL SCIENCE INTERNSHIP, 1-12 Credits
On- or off-campus, occupational work experience supervised by the department. Graded P/N.
This course is repeatable for 16 credits.

ANS 420, ETHICAL ISSUES IN ANIMAL AGRICULTURE, 3 Credits
Students are provided with an opportunity to discuss, debate and write extensively about current, relevant, and controversial social issues dealing with modern animal agriculture. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Available via Ecampus

ANS 427, APPLIED PHYSIOLOGY OF REPRODUCTION, 5 Credits
Principles, techniques and recent development in semen collection, evaluation, extension and preservation; artificial insemination, estrus detection and synchronization; pregnancy diagnosis and embryo transfer.
Prerequisite: ANS 316 with C or better and ANS 317 [C]
Equivalent to: ANS 327

ANS 430, EQUINE SYSTEMS I: EXERCISE SCIENCE, 4 Credits
Seniors and graduate students intensively explore and apply science to real-life situations regarding cardiorespiratory, muscle physiology, and bone physiology responses to exercise, climate, and altitude. Lec/lab.
Recommended: ANS 314

ANS 431, EQUINE SYSTEMS II: NUTRITION, 3 Credits
Senior and graduate students intensively explore and apply science to real-life situations regarding starch, fiber, protein, and fat metabolism in performance horses, breeding stock, and growing horses.
Recommended: ANS 313

ANS 432, EQUINE SYSTEMS III: REPRODUCTION, 4 Credits
Senior and graduate students explore the fundamentals of equine reproduction and their application in horse breeding. Includes practical training of laboratory techniques. Lec/lab.
Prerequisite: ANS 220 with D- or better and ANS 316 [D-]
Recommended: ANS 327

ANS 433, POULTRY MEAT PRODUCTION SYSTEMS, 3 Credits
Fundamental applications and the analysis of management principles applied to brooding, rearing, feeding and housing meat-type chickens and turkeys and their respective breeders. Decision case studies and practical management problems are incorporated into the course. Offered odd number years.
Recommended: ANS 217 and ANS 313 and ANS 316 and ANS 378

ANS 434, EGG PRODUCTION SYSTEMS, 3 Credits
Applications and analyses of egg production systems for brooding, rearing, feeding and housing egg producing chickens. Decision case studies and practical management problems are incorporated into the course. Offered even-numbered years.
Recommended: ANS 217 and ANS 313 and ANS 316 and ANS 378

ANS 435, APPLIED ANIMAL BEHAVIOR, 3 Credits
Exploration of the fundamental processes of animal behavior and implications for animal management, production, housing and welfare. Examples provided in class will cover a range of species, with emphasis on domestic animals. Lec/lab.
Recommended: ANS 314 and BI 350 or Z 350

ANS 436, SHEEP PRODUCTION SYSTEMS, 3 Credits
Integration of nutrition, genetics, reproduction, behavior, and health principles into management systems for production and marketing of lamb and wool.
Recommended: ANS 216 and ANS 311 and ANS 316 and ANS 378

ANS 439, DAIRY PRODUCTION SYSTEMS, 4 Credits
Fundamentals of nutrition, breeding, reproductive physiology and health programs and their applications in the care and management of dairy cattle.
Recommended: ANS 215 and ANS 313 and ANS 316 and ANS 378

ANS 440, DAIRY PRODUCTION SYSTEMS, 3 Credits
Decision case analysis or special topics in application of dairy management principles.
Prerequisite: ANS 439 with D- or better
ANS 441, TOPICS IN ANIMAL LEARNING, 3 Credits
Explore when and how the behavior of animals can be shaped by the environment, individual experiences, and interactions with other animals (including humans).
Prerequisite: (((BI 211 with D- or better or BI 211H with D- or better) and (BI 212 [D-] or BI 212H [D-])) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-])))
Recommended: ANS 435 or ANS 535 and (BI 350 or Z 350) and BI 213

ANS 443, BEEF PRODUCTION SYSTEMS: COW/CALF, 4 Credits
Fundamentals of nutrition, reproductive physiology, health care, and financial management of beef cow/calf operations in the western U.S. Discussions will focus on critical management stages and practices common to the beef cow/calf production cycle. Taught at EOU La Grande campus only.
Recommended: ANS 121 and ANS 313 and (BA 321 or AEC 211)

ANS 444, BEEF PRODUCTION SYSTEMS: STOCKER/FEEDLOT, 4 Credits
A continuation of the study of beef cattle management. Content will encompass the growth and development of weaned calves through slaughter for consumer beef production, with particular focus on the management of growing and yearling cattle in forage-based (stocker cattle) and drylot (feedlot) systems. Taught at EOU La Grande campus only.
Recommended: ANS 121 and ANS 313 and (BA 321 or AEC 211)

ANS 445, BEEF PRODUCTION SYSTEMS, 4 Credits
Students will be exposed to the fundamentals of nutrition, reproductive physiology, selection, health programs, and their applications in the care and management of beef cattle from conception through weaning, weaning, stocker/back grounding and the feedlot. Students will practice decision-making processes using working case studies. Overnight field trip with extra fee charged.
Recommended: ANS 313 and ANS 316 and ANS 317 and ANS 378

ANS 446, GRAZING LIVESTOCK PRODUCTION, 4 Credits
Equips non-animal science majors with basic ruminant livestock (beef cattle, sheep and meat goat) production knowledge, so they may communicate and collaborate effectively with livestock producers.
Prerequisite: ANS 121 with D- or better
Available via Ecampus

ANS 448, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits
Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. CROSSLISTED as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.
Equivalent to: CROP 448, RNG 448

ANS 452, LIVESTOCK HOUSING AND WASTE MANAGEMENT, 3 Credits
Basics in where, how, and why one would build, insulate, and ventilate livestock buildings. Manure and wastewater collection, treatment, storage, and utilization.
Available via Ecampus

ANS 456, COMPANION ANIMAL PRODUCTION SYSTEMS, 3 Credits
Fundamentals of dog and cat breeding stock selection, feeding and housing as well as biology and management from estrus through parturition to weaning. Due to the nature of this class, a variety of animals may be present during class session. Questions and interactions are encouraged but, while precautions are taken, any contact with animals carries some risk of injury or illness.
Prerequisite: (ANS 313 with D- or better and ANS 316 (may be taken concurrently) [D-] and ANS 378 [D-])

ANS 460, SWINE PRODUCTION SYSTEMS, 4 Credits
Students will be exposed to the fundamentals of nutrition, reproductive physiology, selection, health programs, and their applications in the care and management of swine from conception through farrowing, weaning, and the growing/finishing phases. Students will practice decision-making processes using working case studies. Overnight field trip with extra fee charged.
Recommended: ANS 121 and ANS 216 and ANS 311 and ANS 316 and ANS 378

ANS 499, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

ANS 501, RESEARCH, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

ANS 503, THESIS, 1-16 Credits
Graded P/N.
This course is repeatable for 999 credits.

ANS 505, READING AND CONFERENCE, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

ANS 507, GRADUATE SEMINAR, 1 Credit
Section 1: Seminar/general for all graduate students. Preparation of effective visual aids. Practice explaining the validity or significance of experimental results to an informed audience. Section 2: Seminar/endocrinology, for graduate students interested in physiology.
This course is repeatable for 99 credits.

ANS 508, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.
ANS 509, TEACHING PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

ANS 511, DIGESTIVE PHYSIOLOGY AND NUTRITION OF RUMINANT ANIMALS, 4 Credits
Anatomy and physiology of the ruminant digestive tract including rumen microbiology and digestive processes. Nutritional biochemistry and physiology of ruminants. Feed chemistry, feed intake and principles of ration balancing. Theory of energy and protein metabolism.
Recommended: ANS 311 or ANS 313

ANS 512, MONOGASTRIC AND POULTRY NUTRITION, 3 Credits
Anatomical differences in digestive tracts of monogastrics; nutritional biochemistry of poultry; practical feeding of avian species; least-cost ration techniques; techniques for determining nutrient needs of monogastrics.
Recommended: ANS 311 and ANS 313

ANS 515, REVIEW OF APPLIED RUMINANT NUTRITION RESEARCH TECHNIQUES, 3 Credits
Review and discussion and applied techniques and methodology used for ruminant nutrition research.

ANS 530, EQUINE SYSTEMS I: EXERCISE SCIENCE, 4 Credits
Senior and graduate students intensively explore and apply science to real-life situations regarding cardiorespiratory, muscle physiology, and bone physiology responses to exercise, climate, and altitude. Lec/lab.
Recommended: ANS 314

ANS 531, EQUINE SYSTEMS II: NUTRITION, 3 Credits
Senior and graduate students intensively explore and apply science to real-life situations regarding starch, fiber, protein, and fat metabolism in performance horses, breeding stock, and growing horses.
Recommended: ANS 313

ANS 532, EQUINE SYSTEMS III: REPRODUCTION, 4 Credits
Designed for seniors and graduate students to explore the fundamentals of equine reproduction and their application in horse breeding. Includes practical training in laboratory techniques. Lec/lab.
Equivalent to: BI 532
Recommended: ANS 220 and ANS 316 and ANS 327

ANS 533, POULTRY MEAT PRODUCTION SYSTEMS, 3 Credits
Fundamental applications and the analysis of management principles applied to brooding, rearing, feeding and housing meat-type chickens and turkeys and their respective breeders. Decision case studies and practical management problems are incorporated into the course. Offered odd number years.
Recommended: ANS 217 and ANS 313 and ANS 316 and ANS 378

ANS 534, EGG PRODUCTION SYSTEMS, 3 Credits
Applications and analyses of egg production systems for brooding, rearing, feeding and housing egg producing chickens. Decision case studies and practical management problems are incorporated into the course. Offered even-numbered years.
Recommended: ANS 217 and ANS 313 and ANS 316 and ANS 378

ANS 535, APPLIED ANIMAL BEHAVIOR, 3 Credits
Exploration of the fundamental processes of animal behavior and implications for animal management, production, housing and welfare. Examples provided in class will cover a range of species, with emphasis on domestic animals. Lec/lab.
Recommended: ANS 314 and BI 350 or Z 350

ANS 536, SHEEP PRODUCTION SYSTEMS, 3 Credits
Integration of nutrition, genetics, reproduction, behavior, and health principles into management systems for production and marketing of lamb and wool.
Recommended: ANS 216 and ANS 311 and ANS 316 and ANS 378

ANS 538, BIOLOGY OF LACTATION, 3 Credits
Physiological and environmental factors affecting mammary gland development and function. Offered alternate years.
Recommended: Z 431 or Z 531

ANS 539, DAIRY PRODUCTION SYSTEMS, 4 Credits
Fundamentals of nutrition, breeding, reproductive physiology and health programs and their applications in the care and management of dairy cattle.
Recommended: ANS 215 and ANS 313 and ANS 316 and ANS 378

ANS 540, DAIRY PRODUCTION SYSTEMS, 3 Credits
Decision case analysis or special topics in application of dairy management principles.
Recommended: ANS 439
**ANS 541, TOPICS IN ANIMAL LEARNING, 3 Credits**
Explore when and how the behavior of animals can be shaped by the environment, individual experiences, and interactions with other animals (including humans).
**Recommended:** BI 211 and BI 212 and BI 213 and (ANS 435 or ANS 535) and (BI 350 or Z 350)

**ANS 543, BEEF PRODUCTION SYSTEMS: COW/CALF, 3 Credits**
Fundamentals of nutrition, reproductive physiology and health programs and their applications in the care and management of beef cattle. Overnight field trip with extra fee charged. Lec/lab. Taught at EOU La Grande campus only.
**Recommended:** ANS 315 and ANS 313 and ANS 316 and ANS 378

**ANS 544, BEEF PRODUCTION SYSTEMS: STOCKER/FEEDLOT, 3 Credits**
Continuation of the study of beef cattle management. Students will practice decision-making processes using area beef cattle operations as case studies. Overnight field trip with extra fee charged. Taught at EOU La Grande campus only.
**Recommended:** ANS 443 or ANS 543

**ANS 545, BEEF PRODUCTION SYSTEMS, 4 Credits**
Students will be exposed to the fundamentals of nutrition, reproductive physiology, selection, health programs, and their applications in the care and management of beef cattle from conception through calving, weaning, stocker/back grounding and the feedlot. Students will practice decision-making processes using working case studies. Overnight field trip with extra fee charged.
**Recommended:** ANS 313 and ANS 316 and ANS 317 and ANS 378

**ANS 548, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits**
Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. Crosslisted as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.
**Equivalent to:** CROP 548, RNG 548

**ANS 550, ORGANIC ANIMAL PRODUCTION SYSTEMS, 3 Credits**
Topics include the principles of livestock production, legislation, animal welfare, and marketing of organic production systems. Course emphasizes principles, concepts, and techniques of organic and sustainable production of animals.
*Available via Ecampus*

**ANS 552, LIVESTOCK HOUSING AND WASTE MANAGEMENT, 3 Credits**
Basics in where, how, and why one would build, insulate, and ventilate livestock buildings. Manure and wastewater collection, treatment, storage, and utilization. Offered alternate years.

**ANS 556, COMPANION ANIMAL PRODUCTION SYSTEMS, 3 Credits**
Fundamentals of dog and cat breeding stock selection, feeding and housing as well as biology and management from estrus through parturition to weaning. Due to the nature of this class, a variety of animals may be present during class session. Questions and interactions are encouraged but, while precautions are taken, any contact with animals carries some risk of injury or illness.
**Recommended:** ANS 313 and ANS 378 and completion or concurrent enrollment in ANS 316 and ANS 317

**ANS 560, LIPID METABOLISM, 3 Credits**
Digestion, absorption and metabolism of lipids with emphasis on lipoprotein metabolism, regulation of lipid metabolism in various tissues and metabolism of eicosanoids. Offered alternate years.
**Equivalent to:** NUTR 560
**Recommended:** BB 452 and BB 492

**ANS 599, SPECIAL TOPICS, 1-16 Credits**
This course is repeatable for 16 credits.

**ANS 601, RESEARCH, 1-16 Credits**
Graded P/N. This course is repeatable for 16 credits.

**ANS 603, THESIS, 1-16 Credits**
This course is repeatable for 99 credits.

**ANS 605, READING AND CONFERENCE, 1-16 Credits**
This course is repeatable for 16 credits.

**ANS 606, PROJECTS, 1-16 Credits**
This course is repeatable for 16 credits.

**ANS 607, GRADUATE SEMINAR, 1 Credit**
This course is repeatable for 99 credits.

**ANS 608, WORKSHOP, 1-16 Credits**
This course is repeatable for 16 credits.

**ANS 609, TEACHING PRACTICUM, 1-16 Credits**
This course is repeatable for 16 credits.

**ANS 662, HORMONE ACTION, 3 Credits**
Mechanisms of action of peptide and steroid hormones and related compounds at the cellular level. Offered every other year, winter term.
**Prerequisite:** BB 551 with C or better or BB 592 with C or better
**Equivalent to:** PHAR 662
ANS 673, BIOLOGY OF MAMMALIAN REPRODUCTION, 4 Credits
Physiological, neuroendocrine, endocrine and environmental factors that regulate reproduction of mammals. Offered alternate years.
Equivalent to: BI 673
Recommended: ANS 316 and BB 350

ANS 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

Biological Data Sciences (BDS)

BDS 211, USE AND ABUSE OF DATA: CRITICAL THINKING IN SCIENCE, 3 Credits
Critically examine how data analysis can support legitimate conclusions from biological datasets and also how deceptive visualizations, misleading comparisons, and spurious reasoning can lead to false conclusions. Analyze data to break down the logical flow of an argument and identify key assumptions, even when they are not stated explicitly.
Prerequisite: (MTH 251 (may be taken concurrently) with C- or better or MTH 251H (may be taken concurrently) with C- or better) or MTH 227 with C- or better or MTH 241 with C- or better or MTH 245 with C- or better

BDS 311, COMPUTATIONAL APPROACHES FOR BIOLOGICAL DATA, 3 Credits
The theory and practice underlying widely used computational methods for biological data analysis. Focuses on the analysis and visualization of large data sets using Python, with broad applications to genomics, ecology, and other disciplines. Topics may include image processing, time series analysis, dimensionality reduction, and resampling methods. Develops student expertise in designing and implementing algorithms in the Python programming language.
Prerequisite: (BI 223 with C- or better or BI 223H with C- or better) and (MTH 252 [C-] or MTH 252H [C-] or MTH 228 [C-]) and (CS 161 [C-] or BOT 476 [C-])

BDS 406, SPECIAL PROJECTS, 1-99 Credits
This course is repeatable for 99 credits.

BDS 411, ANALYSIS OF BIOLOGICAL DATA: CASE STUDIES, 3 Credits
Case studies; synthesize previously acquired knowledge and skills in biology, mathematics, statistics, and computer science to implement, in writing, an analysis strategy. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisite: ([BI 311 with C- or better or BI 311H with C- or better]) or (BB 314 with C- or better or BB 314H with C- or better) or (MB 310 with C- or better) and (MTH 252 with C- or better or MTH 252H with C- or better) or MTH 228 with C- or better) and CS 261 [C-] and (ST 352 [C-] or ST 412 [C-])

BDS 474X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits
Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.
Prerequisite: BI 311 (may be taken concurrently) with C- or better or BB 314 (may be taken concurrently) with C- or better
Equivalent to: BOT 474X

BDS 475, COMPARATIVE GENOMICS, 4 Credits
Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomic approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSLISTED as BDS 475/BOT 475 and BDS 575/BOT 575/MCB 575.
Prerequisite: (BB 314 with D- or better or BB 314H with D- or better) and (BI 311 [D-] or BI 311H [D-] or PGB 430 [D-])
Equivalent to: BOT 475
Recommended: Basic working knowledge of cell and molecular biology and genetics

BDS 478, FUNCTIONAL GENOMICS, 3 Credits
Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismal networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems.
Prerequisite: BB 314 with C- or better or BB 314H with C- or better
Equivalent to: BOT 460, BOT 478

BDS 491, CAPSTONE PROJECTS IN BIOLOGICAL DATA SCIENCE I, 3 Credits
Quantitative skills and biological thinking will be used to analyze and draw conclusions from real-world biological datasets. Projects will be completed in the context of small groups. Draws on skills in mathematics, statistics, computer science, and biology.
Prerequisite: (ST 352 with C- or better or ST 412 with C- or better) and (CS 162 [C-] or BOT 476 [C-] or BB 485 [C-] or MTH 427 [C-])
BDS 492, CAPSTONE PROJECTS IN BIOLOGICAL DATA SCIENCE II, 3 Credits
Quantitative skills and biological thinking will be used to analyze and draw conclusions from biological datasets retrieved in BDS 412. This is a synthesis course that draws skills in mathematics, statistics, computer science, and biology, in which the students will process their curated datasets and draw conclusions.
Prerequisite: BDS 491 with C- or better

BDS 574X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits
Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.
Equivalent to: BOT 574X

BDS 575, COMPARATIVE GENOMICS, 4 Credits
Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomic approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSTLISTED as BDS 475/BOT 475 and BDS 575/MCB 575.
Equivalent to: BOT 575, MCB 575
Recommended: BB 314 and (BI 311 or PBG 430) and basic working knowledge of cell and molecular biology and genetics

BDS 578, FUNCTIONAL GENOMICS, 3 Credits
Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismal networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems. CROSSTLISTED as BDS 478/BOT 478 and BDS 578/BOT 578.
Equivalent to: BOT 560, BOT 578

Botany and Plant Pathology (BOT)

BOT 101, *BOTANY: A HUMAN CONCERN, 4 Credits
Introductory botany for non-majors, emphasizing the role of plants in the environment, agriculture and society. Includes molecular approaches to the study of plant function and genetic engineering. Lec/lab. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science

BOT 220, *INTRODUCTION TO PLANT BIOLOGY, 4 Credits
Introduction to plant biology including an overview of major groups of plants, plant cells and cell types, plant anatomy and architecture, physiology and function, and ecology and the roles of plants in the environment. Laboratory exercises build on lecture themes and provide hands-on learning experiences including field trips. Lec/lab. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science
Available via Ecampus

BOT 313, PLANT STRUCTURE, 4 Credits
The structural components of vascular plants and how plant structure relates to function, development, environment, evolution, and human use of plants. Field trip. Lec/lab.
Prerequisite: ((BI 212 with D- or better or BI 212H with D- or better) and ((BI 211 with D- or better or BI 211H with D- or better) or (BI 213 with D- or better or BI 213H with D- or better)) ) or ((BI 221 with D- or better or BI 221H with D- or better) and (BI 222 [D-] or BI 222H [D-])) or (BI 205 [D-] and BI 206 [D-])
Recommended: BI 213 or BI 213H or BI 223 or BI 223H
Available via Ecampus

BOT 321, PLANT SYSTEMATICS, 4 Credits
Vascular plant classification, diversity, and evolutionary relationships. Lab emphasizes the collection and identification of ferns, gymnosperms, and flowering plants in Oregon. Field trips. Lec/lab.
Recommended: BI 213 or BI 213H or BI 223 or BI 223H
Available via Ecampus

BOT 322, ECONOMIC AND ETHNOBOTANY: ROLE OF PLANTS IN HUMAN CULTURE, 3 Credits
Economic and cultural (ethnobotanical) uses of plants and fungi by humans, including domesticated cultivated plants as well as wild-growing plants, and uses of plants and fungi by indigenous cultures. Ecampus course only.
Available via Ecampus

BDS 599, SPECIAL TOPICS, 1-4 Credits
This course is repeatable for 99 credits.
BOT 323, ^FLOWERING PLANTS OF THE WORLD, 3 Credits
Global perspective of plant biodiversity with a focus on evolutionary origins, classification, and evolutionary relationships of the major groups of plants. Development and application of scientific writing and utilization of online information resources in plant evolutionary biology. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: (BI 211, BI 212, BI 213) or (BI 221, BI 222, BI 223) or (BI 204, BI 205, BI 206)
Available via Ecampus

BOT 324, *FUNGI IN SOCIETY, 3 Credits
Explores the diverse roles played by fungi in relation to human civilization and the natural environment. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: One course in biological sciences.
Available via Ecampus

BOT 325, *INTERSECTIONS BETWEEN PLANTS AND HUMANITY, 3 Credits
The unique attributes of plants—including aspects of their biochemistry, growth, structure, and physiology—have influenced all aspects of life on earth, from biogeochemical cycles to the rise and expansion of human civilizations. Plants are sources of medicines, stimulants, hallucinogens, fibers and woods, resins and latex, oils and waxes; plants have inspired technological innovation, exploration, and exploitation of people and the environment. This course critically examines the intersections of plants with society and technology by exploring the roles plants have played in both historical and modern contexts. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: One course in biological sciences and junior standing.

BOT 331, PLANT PHYSIOLOGY, 4 Credits
Survey of physiological processes in plants, including photosynthesis and plant metabolism, mineral nutrition and ion uptake processes, plant cell/water relations, regulation of plant growth and development, and transpiration and translocation. Lec/rec.
Prerequisite: (BI 212 with D- or better or BI 212H with D- or better) and (BI 213 [D-] or BI 213H [D-]) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) or (BI 205 [D-] and BI 206 [D-]) and (CH 123 [D-] or (CH 233 [D-] or CH 263 [D-]))
Recommended: (BI 213 or BI 213H or BI 223 or BI 223H) and (CH 123 or (CH 233 and CH 263))
Available via Ecampus

BOT 332, LABORATORY TECHNIQUES IN PLANT BIOLOGY, 3 Credits
Laboratory experiences in the manipulation and observation of physiological processes in plant systems. Analysis and interpretation of physiological data generated in experimentation with plant systems. Training in basic laboratory skills, including the principles and procedures involved in the use of common items of laboratory instrumentation. Lab.
Recommended: BOT 331 or BI 314 or BB 314
Available via Ecampus

BOT 341, PLANT ECOLOGY, 4 Credits
Study of higher plants in relation to their environment. The relationship of plant physiology and reproduction to environmental factors; competition and other species interactions; the structure, dynamics and analysis of vegetation. Field trips. Lec/lab.
Recommended: BOT 321 and (BI 213 or BI 213H) or (BI 223 or BI 223H)
Available via Ecampus

BOT 350, INTRODUCTORY PLANT PATHOLOGY, 4 Credits
Symptoms, causal agents, diagnosis, and prevention of plant diseases, with emphasis on fungi, bacteria, nematode, and virus pathogens. Lec/lab.
Prerequisite: ((BI 211 with D- or better or BI 211H with D- or better) and (BI 212 [D-] or BI 212H [D-]) and (BI 213 [D-] or BI 213H [D-]) or ((BI 221 [D-] or BI 221H [D-]) and (BI 222 [D-] or BI 222H [D-]) and (BI 223 [D-] or BI 223H [D-]) or (BI 204 [D-] and BI 205 [D-] and BI 206 [D-]))
Available via Ecampus

BOT 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

BOT 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

BOT 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

BOT 406, PROJECTS: CURATORIAL ASSISTANT, 1-6 Credits
Students assist with curatorial projects in the OSU Herbarium. Admission is by application to the Department of Botany & Plant Pathology. This course is repeatable for 6 credits.

BOT 407, SEMINAR, 1 Credit
Section 1: Departmental seminar. Section 2: Lichens and Bryophytes Research (1). Weekly one-hour meetings for reporting and discussion of active research projects, discussion of proposal research, review and discussion of recent literature, and mini-workshops on particular problems. Normally graded P/N.
Equivalent to: BI 407H, BOT 407H
This course is repeatable for 16 credits.

BOT 407H, SEMINAR, 1 Credit
Section 1: Departmental seminar. Section 2: Lichens and Bryophytes Research (1). Weekly one-hour meetings for reporting and discussion of active research projects, discussion of proposal research, review and discussion of recent literature, and mini-workshops on particular problems. Normally graded P/N.
Attributes: HNRS – Honors Course Designator
Equivalent to: BOT 407
This course is repeatable for 16 credits.

BOT 408, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

BOT 410, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.
BOT 413, FOREST PATHOLOGY, 3 Credits
Effects of diseases on forest ecosystems. Recognition of important
groups, prediction of pathogen responses to environmental changes, and
management strategies for protection of forest resources. Field trips.
Lec/lab. CROSSLISTED as BOT 413/FOR 413.
Prerequisite: BI 204 with C or better or BI 212 with C or better or BI 212H
with C or better or BI 213 with C or better or BI 213H with C or better or
BI 221 with C or better or BI 221H with C or better
Equivalent to: FOR 413

BOT 414, AGROSTOLOGY, 4 Credits
Classification and identification of grasses, with emphasis on the modern
system of grass classification; laboratory practice in keying grass
specimens to genus and species. Lec/lab.
Recommended: BOT 321

BOT 416, AQUATIC BOTANY, 4 Credits
Taxonomy and ecology of aquatic vegetation, emphasizing freshwater
and marine algae and the submersed vascular plants. Morphology,
physiology, and classification of the algae; morphological and
physiological adaptations of aquatic vascular plants; and primary
production in aquatic ecosystems. Laboratory practice in the
identification of local taxa. Field trips. Lec/lab.
Recommended: (BI 213 or BI 213H) or (BI 223 or BI 223H)

BOT 417X, PHYCOLOGY, 4 Credits
A field and laboratory based introduction to micro- and macro-algal
biology, reproduction and evolution. Emphasis is placed on how the
endosymbiosis theory ties algae together as a functional group. Algal
diversity will be explored through lectures, laboratory and field trips. The
laboratory experience will include methods for isolation, culturing and
maintenance of algae for aquaculture and research.
Recommended: One year of biology

BOT 425, FLORA OF THE PACIFIC
NORTHWEST, 3 Credits
Vascular plant identification, terminology, and diagnostic characteristics
of plant families. Lab emphasizes the use of keys for identification to the
species level and ability to recognize by sight those plant families found
in the Pacific Northwest. Field trips. Lec/lab.
Recommended: BOT 321

BOT 440, FIELD METHODS IN PLANT
ECOLOGY, 4 Credits
Concepts and tools for describing, monitoring, and experimenting
on vegetation. Combines Web-based material, field experience at the
student’s location, and student projects.
Recommended: Course in ecology and a course in statistics.
Available via Ecampus

BOT 442, PLANT POPULATION ECOLOGY,
3 Credits
Ecological aspects of plant form and reproduction; demography and
population modeling; species interactions, including competition,
mutualism, and herbivory. Lec/lab.
Recommended: BOT 341

BOT 458, ECOSYSTEMS GENOMICS, 3
Credits
Genomic approaches used to understand species interactions with a
focus on plant-associated microbes. Learning the conceptual framework
and computational techniques of genomics to study the ecology of plant-
microbe interactions at the ecosystem level.
Prerequisite: (BI 311 with D- or better or BI 311H with D- or better) and (BI
314 [D-] or BI 314H [D-] or BB 314 [D-] or BB 314H [D-])

BOT 460, FUNCTIONAL GENOMICS, 3
Credits
Functional genomics describes a set of conceptual approaches and
associated laboratory techniques that rely on large-scale DNA sequence
datasets to investigate the function of, and interactions between, genes
as well as their RNA/protein products. This course will provide an
overview of these techniques, including a) approaches to predicting
protein function based on sequence analysis, b) large-scale genetic
approaches to identifying novel genotype-phenotype associations, and
c) transcriptomic, proteomic and metabolomic approaches that reveal
gene functions by measuring changes in abundance/modification of
associated RNA transcripts, proteins and metabolites.
Prerequisite: (BI 311 with C- or better or BI 311H with C- or better) and (BI
314 [C-] or BI 314H [C-] or BB 314 [C-] or BB 314H [C-])

BOT 461, MYCOLOGY, 4 Credits
Broad taxonomic survey of the fungi and their biology. Examines
fungal life histories, systematics, ecology, and genetics, as well as
ethnomycoLOGY. Introduces approaches to mycology in the field, including
collection and preparation of specimens.
Prerequisite: ((BI 211 with C- or better or BI 211H with C- or better) and
(BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])) or (BI 204 [C-]
and BI 205 [C-] and BI 206 [C-]) or ((BI 221 [C-] or BI 221H [C-]) and (BI 222
[C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-]))

BOT 465, LICHENOLOGY, 4 Credits
Biology of lichens; includes structure, life histories, classification, and
ecology. Field trip fee. Lec/lab. Offered alternate years.
Recommended: ((BI 213 or BI 213H) or (BI 223 or BI 223H)) and two
botany courses

BOT 466, BRYOLOGY, 4 Credits
Biology of bryophytes; includes structure, life histories, classification, and
ecology. Field trip fee. Lec/lab. Offered alternate years.
Recommended: ((BI 213 or BI 213H) or (BI 223 or BI 223H)) and two
botany courses
**BOT 474X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits**
Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.
Prerequisite: BI 311 (may be taken concurrently) with C- or better or BB 314 (may be taken concurrently) with C- or better
Equivalent to: BDS 474X

**BOT 475, COMPARATIVE GENOMICS, 4 Credits**
Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomic approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSTILLED as BDS 475/BOT 475 and BDS 575/BOT 575/MCB 575.
Prerequisite: (BB 314 with D- or better or BB 314H with D- or better) and (BI 311 [D] or BI 311H [D] or PBG 430 [D-])
Equivalent to: BDS 475
Recommended: Basic working knowledge of cell and molecular biology and genetics

**BOT 476, INTRODUCTION TO COMPUTING IN THE LIFE SCIENCES, 3 Credits**
Introduction to management of large datasets (e.g., nucleic acids, protein), computer programming languages, application of basic mathematical functions, and assembly of computational pipelines pertinent to life sciences.
Recommended: Cell and molecular biology or genetics. Familiarity with text editing software and unix/linux operating system is advantageous

**BOT 478, FUNCTIONAL GENOMICS, 3 Credits**
Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismal networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems.
Prerequisite: BB 314 with C- or better or BB 314H with C- or better
Equivalent to: BDS 478, BOT 460

**BOT 480, PHOTOSYNTHESIS AND PHOTOBIOLOGY, 3 Credits**
Explores the diverse use of light in biological systems, with particular emphasis on photosynthesis. Lectures will discuss the nature of light, light in the natural environment, light absorption in biological systems, use of light energy for photosynthesis, communication, defense, motility, and vision, as well as deleterious effects of light and its use for global monitoring satellite systems.
Recommended: One course in plant physiology or ecology

**BOT 488, ENVIRONMENTAL PHYSIOLOGY OF PLANTS, 3 Credits**
Introduces students to mechanisms of plant responses to environmental change caused by humans, including atmospheric, nutrient, water, and global climate factors. Concepts are built around principles of plant environment relations. Lec/lab.
Recommended: One course in plant physiology or one course in ecology

**BOT 499, SPECIAL TOPICS, 0-16 Credits**
Equivalent to: BOT 499H
This course is repeatable for 16 credits.

**BOT 499H, SPECIAL TOPICS, 0-16 Credits**
Attributes: HNRS – Honors Course Designator
Equivalent to: BOT 499
This course is repeatable for 16 credits.

**BOT 501, RESEARCH, 1-16 Credits**
Graded P/N.
This course is repeatable for 16 credits.

**BOT 503, THESIS, 1-16 Credits**
This course is repeatable for 999 credits.

**BOT 505, READING AND CONFERENCE, 1-16 Credits**
This course is repeatable for 16 credits.

**BOT 507, SEMINAR, 1-16 Credits**
Section 1: Departmental seminar (F; W, S). Section 2: Communication in Ecology (F). Section 3: Community and Habitat Analyses (W). Section 4: Lichens and Bryophytes Research (S). Weekly one-hour meetings for reporting and discussions of proposal research, review and discussion of recent literature, and mini-workshops on particular problems. Graded P/N.
This course is repeatable for 16 credits.

**BOT 508, WORKSHOP, 1-16 Credits**
This course is repeatable for 16 credits.

**BOT 510, INTERNSHIP, 1-16 Credits**
This course is repeatable for 16 credits.

**BOT 513, FOREST PATHOLOGY, 3 Credits**
Effects of diseases on forest ecosystems. Recognition of important groups, prediction of pathogen responses to environmental changes, and management strategies for protection of forest resources. Field trips. Lec/lab. CROSSTILLED as BOT 513/FOR 513.
Equivalent to: FOR 513
Recommended: BI 204 or BI 212 or BI 212H or BI 213 or BI 213H
BOT 514, AGROSTOLOGY, 4 Credits
Classification and identification of grasses, with emphasis on the modern system of grass classification; laboratory practice in keying grass specimens to genus and species. Lec/lab.
Recommended: BOT 321

BOT 516, AQUATIC BOTANY, 4 Credits
Taxonomy and ecology of aquatic vegetation, emphasizing freshwater and marine algae and the submergent vascular plants. Morphology, physiology, and classification of the algae; morphological and physiological adaptations of aquatic vascular plants; and primary production in aquatic ecosystems. Laboratory practice in the identification of local taxa. Field trips. Lec/lab.
Recommended: BOT 321 or BI 213H

BOT 517X, PHYCOLOGY, 4 Credits
A field and laboratory based introduction to micro- and macro-algal biology, reproduction and evolution. Emphasis is placed on how the endosymbiosis theory ties algae together as a functional group. Algal diversity will be explored through lectures, laboratory and field trips. The laboratory experience will include methods for isolation, culturing and maintenance of algae for aquaculture and research.
Recommended: One year of biology

BOT 525, FLORA OF THE PACIFIC NORTHWEST, 3 Credits
Vascular plant identification, terminology, and diagnostic characteristics of plant families. Lab emphasizes the use of keys for identification to the species level and ability to recognize by sight those plant families found in the Pacific Northwest. Field trips. Lec/lab.
Recommended: BOT 321

BOT 540, FIELD METHODS IN PLANT ECOLOGY, 4 Credits
Concepts and tools for describing, monitoring, and experimenting on vegetation. Combines Web-based material, field experience at the student's location, and student projects.
Recommended: Course in ecology and a course in statistics. Available via Ecampus

BOT 542, PLANT POPULATION ECOLOGY, 3 Credits
Ecological aspects of plant form and reproduction; demography and population modeling; species interactions, including competition, mutualism, and herbivory. Lec/lab.
Recommended: BOT 341

BOT 543, PLANT COMMUNITY ECOLOGY, 3 Credits
The structure, diversity, and successional dynamics of terrestrial plant communities; methods of analysis. Lec/lab.
Recommended: BOT 341 or equivalent.

BOT 547, NUTRIENT CYCLING, 3 Credits
Reviews and discusses ecosystem-level biogeochemical concepts for terrestrial and freshwater ecosystems, primarily by reading and discussing classic and current literature to determine the state-of-knowledge and uncertainties associated with it. Topics include root nutrient uptake mechanisms, soil chemical and biochemical transformations in different soil and ecosystems, measuring soil solution and watershed fluxes, soil organic matter formation and structure, the meaning of sustainability, the concept of N saturation in terrestrial ecosystems, and the use of natural abundance and tracer isotopes in ecosystem biogeochemistry. While forest biogeochemical processes will be emphasized, desert, aquatic, wetland, and prairie ecosystems will also be explored. CROSSLISTED as BOT 547/SOIL 547.
Equivalent to: FS 547, SOIL 547
Recommended: College-level chemistry and biology and one class in ecology (eg. BI 370) and/or soils (eg. SOIL 205)

BOT 550, PLANT PATHOLOGY, 5 Credits
Causal agents of plant disease, diagnosis, pathogenesis, epidemiology, and disease management principles and strategies. Field trip. Lec/lab/rec.
Recommended: BI 213 or BI 213H

BOT 552, PLANT DISEASE MANAGEMENT, 4 Credits
Analysis of host, pathogen, and environmental factors influencing the increase and spread of plant disease. Epidemiological theory will be used as a basis for developing and evaluating principles and concepts of plant disease management. Lec/lab/rec. Offered alternate years.
Recommended: BOT 350 or BOT 550

BOT 553, PLANT DISEASE DIAGNOSIS, 3 Credits
Diagnosis of plant diseases and identification of causal agents. Laboratory practice in identification techniques. Observation of symptoms exhibited by diseased plants in greenhouse and field locations. Field trips. Lec/lab. Offered alternate years in summer term.
Recommended: BOT 350 or BOT 550

BOT 554, BIOLOGY OF NEMATODES, 4 Credits
Survey of basic biology and biodiversity of nematodes. Includes taxonomy, identification, life cycles, ecology and pathology, and interaction with other organisms. Lec/lab. Offered alternate years. This course is repeatable for 4 credits.
Recommended: Plant pathology

BOT 558, ECOSYSTEMS GENOMICS, 3 Credits
Genomic approaches used to understand species interactions with a focus on plant-associated microbes. Learning the conceptual framework and computational techniques of genomics to study the ecology of plant-microbe interactions at the ecosystem level.
Recommended: BI 311 and BI 314
BOT 560, FUNCTIONAL GENOMICS, 3 Credits

Functional genomics describes a set of conceptual approaches and associated laboratory techniques that rely on large-scale DNA sequence datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. This course will provide an overview of these techniques, including a) approaches to predicting protein function based on sequence analysis, b) large-scale genetic approaches to identifying novel genotype-phenotype associations, and c) transcriptomic, proteomic and metabolomic approaches that reveal gene functions by measuring changes in abundance/modification of associated RNA transcripts, proteins and metabolites.

Recommended: (BI 311 or BI 311H) and (BI 314 or BI 314H)

BOT 561, MYCOLOGY, 4 Credits

Broad taxonomic survey of the fungi and their biology. Examines fungal life histories, systematics, ecology, and genetics, as well as ethnomycology. Introduces approaches to mycology in the field, including collection and preparation of specimens.

BOT 565, LICHENOLOGY, 4 Credits

Biology of lichens; includes structure, life histories, classification, and ecology. Field trip fee. Lec/lab. Offered alternate years.

Recommended: (BI 213 or BI 213H) and two botany courses.

BOT 566, BRYOLOGY, 4 Credits

Biology of bryophytes; includes structure, life histories, classification, and ecology. Field trip fee. Lec/lab. Offered alternate years.

Recommended: (BI 213 or BI 213H) and two botany courses.

BOT 570, COMMUNITY STRUCTURE AND ANALYSIS, 4 Credits

Quantitative methods for the analysis of biotic communities, including community concepts, estimation of community composition parameters, theoretical aspects of multivariate methods of analyzing species-importance data, and overview of multivariate tools; hands-on computer analysis of data sets. Lec/lab.

Equivalent to: BI 570

Recommended: BI 370 and (ST 412 or ST 512) and calculus

BOT 574X, INTRODUCTION TO GENOME BIOLOGY, 3 Credits

Explores how genomes underlie and influence biological phenomena, across the diversity of life, from prokaryotic microbes to eukaryotic multicellular organisms. Covers genome organization: the structure of chromosomes and chromatin; genes and gene families; and mechanisms that remodel genomes, such as mutation, recombination and transposable elements in the first part of the course. Focuses on genome expression and regulation: gene expression, cellular functions and biochemical pathways; transcriptional and post-transcriptional regulatory mechanisms; and genotype-to-phenotype relationships in the second part of the course. Emphasizes the use of recent technological advances and genome-wide assays that enable investigation of these topics.

Equivalent to: BDS 574X

BOT 575, COMPARATIVE GENOMICS, 4 Credits

Explores principles of comparative genomics. Examines methods for genome assembly and annotation. Discusses genomics approaches for the study of structural change, whole genome duplication, gene family evolution, gene networks, gene regulation and epigenetics. Lab topics include the analysis of next generation sequencing data and conducting comparative genomic analyses. CROSSLISTED as BDS 475/BOT 475 and BDS 575/BOT 575/MCB 575.

Recommended: BB 314 and (BI 311 or PBG 430) and basic working knowledge of cell and molecular biology and genetics

BOT 578, FUNCTIONAL GENOMICS, 3 Credits

Introduces conceptual approaches and associated laboratory techniques that rely on genome-scale datasets to investigate the function of, and interactions between, genes as well as their RNA/protein products. Examples include: predicting protein function based on nucleotide and amino acid sequence analysis; large-scale genetic approaches to identifying novel genotype-phenotype associations; and analysis of transcriptomic, proteomic and metabolomic datasets, which measure changes in RNA transcripts, proteins and metabolites, respectively, to explore gene function and cellular/organismal networks. Provides a conceptual framework for understanding how the wide range of available large-scale technologies can be applied to solve biological problems.

CROSSLISTED as BDS 478/BOT 478 and BDS 578/BOT 578.

Recommended: BDS 578, BOT 560

BOT 580, PHOTOSYNTHESIS AND PHOTOBIOLOGY, 3 Credits

Explores the diverse use of light in biological systems, with particular emphasis on photosynthesis. Lectures will discuss the nature of light, light in the natural environment, light absorption in biological systems, use of light energy for photosynthesis, communication, defense, motility, and vision, as well as deleterious effects of light and its use for global monitoring satellite systems.

Recommended: One course in plant physiology or ecology

BOT 588, ENVIRONMENTAL PHYSIOLOGY OF PLANTS, 3 Credits

Introduces students to mechanisms of plant responses to environmental change caused by humans, including atmospheric, nutrient, water, and global climate factors. Concepts are built around principles of plant environment relations. Lec/lab.

Recommended: One course in plant physiology or ecology

BOT 590, SELECTED TOPICS IN MYCOLOGY, 1-3 Credits

Advanced topics in mycology through analysis of current literature. Detailed study of an aspect of mycology beyond those covered in regular classes. Seminar and discussion format.

This course is repeatable for 16 credits.

Recommended: BOT 461 or BOT 561

BOT 599, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 16 credits.
BOT 601, RESEARCH, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

BOT 603, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

BOT 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

BOT 607, SEMINAR, 1 Credit
Section 1. Departmental seminar
This course is repeatable for 16 credits.

BOT 608, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

BOT 651, MOLECULAR BASIS OF PLANT PATHOGENESIS, 3 Credits
Analysis of current concepts in the physiology, biochemistry, and genetics of host-parasite interactions. Topics covered include specificity, recognition, penetration, toxin production, altered plant metabolism during disease, resistance mechanisms and regulatory aspects of gene expression during host-parasite interactions. Offered alternate years.
Equivalent to: MCB 651
Recommended: BOT 550

BOT 668, PLANT DISEASE DYNAMICS, 4 Credits
Evaluation of processes affecting the dynamics of plant disease and pathogen populations through analysis of current literature. Students will be expected to conduct extensive reading and analysis of literature and to meet with the instructor for small group discussions. Offered alternate years.
Recommended: BOT 550 and ST 412

BOT 691, SELECTED TOPICS-PLANT ECOLOGY, 1-3 Credits
Recent advances and developing problems in plant ecology, with critical evaluation of current literature. Topics vary from year to year.
This course is repeatable for 99 credits.
Recommended: Graduate-level ecology.

BOT 692, SELECTED TOPICS: PLANT PATHOLOGY, 1-3 Credits
Selected topics concerning plant pathogens and plant disease processes, emphasizing current literature and theory. Topics vary from year to year.
Equivalent to: MCB 692
This course is repeatable for 99 credits.
Recommended: BOT 550

BOT 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

Bioresource Research (BRR)

BRR 100, GREAT EXPERIMENTS IN BIORESOURCE SCIENCES, 2 Credits
For students interested in BRR and undergraduate research, to introduce the research process and help them start defining research interests and project areas. Faculty describe research projects and experimental approaches, and pose interesting political and ethical questions related to scientific research. Students work with junior and senior student mentors already involved in research projects. Offered fall term.
This course is repeatable for 4 credits.

BRR 200, SCIENCE AND RESEARCH, 2 Credits
An introduction to science concepts, professional skills and science literacy for organizing, planning, designing and conducting research in biological, agricultural and natural resource science. Learn the process of research, prepare a resume for prospective research mentors, and work in teams to analyze a timely and relevant problem, formulate experimental approaches to address it, and write a research proposal.

BRR 299, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

BRR 325, ENERGY TECHNOLOGY AND SOCIAL CHANGE, 3 Credits
Science and technology co-evolve with a prosperous human society. The course discusses key issues surrounding the interaction between social changes and energy technologies. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: One term physical science with lab.
Available via Ecampus

BRR 399, SPECIAL TOPICS, 0-4 Credits
This course is repeatable for 6 credits.

BRR 401, RESEARCH AND SCHOLARSHIP, 1-16 Credits
Undergraduate mentored research. Students select a faculty research mentor (from 7 OSU colleges) and complete 14 credits of research. Students follow established guidelines to prepare project proposals, progress reports, and a thesis; learn research methods applicable to their chosen field; gain professional skills and contacts. Students are evaluated on their ability to develop and complete a research project proposal, learn and develop research methodologies, conduct research and trouble-shooting procedures, and demonstrate responsible and ethical participation in the research project. Offered all terms.
This course is repeatable for 99 credits.

BRR 403, THESIS, 4 Credits
BRR students independently interpret and present their research in writing. Students write the thesis in a style appropriate for submission to a peer-reviewed journal in their chosen scientific discipline. Students receive a letter grade based on their final thesis. Timeliness of reports is factored in student assessments. The student’s faculty mentor and the BRR Director provide a consensus grade when the thesis is completed. Offered all terms. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
This course is repeatable for 16 credits.
BRR 404, WRITING AND CONFERENCE, 1-3 Credits
Thesis writing for Bioenergy minor and other students. 
This course is repeatable for 3 credits.

BRR 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

BRR 406, PROJECTS-DATA PRESENTATIONS, 1 Credit
For any student doing research, to learn to develop and evaluate poster and slide presentations containing scientific data. Students are exposed to a variety of scientific disciplines as they prepare and critique their own and other students’ posters and oral presentations. Students improve written and oral communication skills. Letter grade is based on participation, improvement, and the quality of a final poster project and oral presentation. Offered winter term. CROSSLISTED as BRR 406/HORT 406.
Equivalent to: HORT 406

BRR 407, SEMINAR, 1 Credit
For BRR students, to encourage excellence in public speaking. Exposes students to a variety of current seminar topics and provides them with the opportunity to evaluate components of good public seminars. Students receive a grade only after completing a public seminar on their own research (final research seminar). Offered spring term.

BRR 409, PRACTICUM: TEACHING AND PEER MENTORING, 2-4 Credits
Upper-division BRR students are grouped with lower-division students in BRR 100 to facilitate discussion and encourage dialogue about current research topics. Juniors and seniors continue to learn new ways to teach and communicate science issues in written and verbal formats. 
This course is repeatable for 16 credits.

BRR 410, INTERNSHIP, 1-12 Credits
Supervised internship allowing students to gain off-campus work experience for credit. Under direction and approval of the program director, students will submit a statement of intent, identify employer contact, and provide a written report upon completion. 
This course is repeatable for 16 credits.

BRR 499, SPECIAL TOPICS, 2 Credits
This course is repeatable for 4 credits.

Crop Science (CROP)
CROP 101, INTRODUCTION TO CROP, SOIL, AND INSECT SCIENCE, 1 Credit
Introduces students with interests in crop, soil, and insect sciences to educational and professional opportunities in these disciplines. Speakers will discuss opportunities in research and academia as well as in the applied professional job market. CROSSLISTED as CROP 101/ENT 101/SOIL 101.
Equivalent to: ENT 101, HORT 101, SOIL 101
Available via Ecampus

CROP 199, SPECIAL STUDIES: ISSUES IN SUSTAINABLE AGRICULTURE, 1-16 Credits
Invited speakers present seminars on specific aspects of agriculture relating to sustainability. Topics vary from term to term and year to year. May be repeated for credit when topics differ. 
Equivalent to: CROP 199H
This course is repeatable for 16 credits.

CROP 200, CROP ECOLOGY AND MORPHOLOGY, 3 Credits
An introduction to the concepts and principles of crop ecology and morphology and a foundation for other crop science courses. Examines the dynamics and function of crop communities, and the biotic and environmental interactions that influence productivity. Fundamentals of the developmental morphology of crop seeds, seedlings, and plants. Morphological features of seeds and plants in relation to the identification of crop families and species of economic importance. 
Equivalent to: CSS 200
Available via Ecampus

CROP 280, INTRODUCTION TO THE COMPLEXITY OF OREGON CROPPING SYSTEMS, 4 Credits
An introduction to field cropping systems of western Oregon. Provides students with a broad overview of the complexity of cropping systems and the knowledge required to grow and produce a crop–plant physiology, seed biology, plant pathology, soil fertility, entomology, and weed science. Students will observe a crop under different management strategies to enhance understanding of management approaches. 
Available via Ecampus

CROP 300, CROP PRODUCTION IN PACIFIC NORTHWEST AGROECOSYSTEMS, 4 Credits
Relation of crop production to human culture and the natural environment. Origins of agriculture and the processes of agricultural change, and productivity and sustainability of specific crop production systems in the Pacific Northwest. History, geography, resource requirements, and key challenges faced are presented. Fundamental crop production practices in relation to productivity and sustainability. Lec/lab/rec. CROSSLISTED as CROP 300/HORT 300.
Equivalent to: CSS 300, HORT 300
Recommended: One year of general biology
Available via Ecampus

CROP 310, FORAGE PRODUCTION, 4 Credits
Importance of, and current production practices for, forage crops. Lec/lab.
Equivalent to: CSS 310
Recommended: (CSS 300 or CROP 300 or HORT 300) and (CSS 305 or CSS 205 or SOIL 205) 
Available via Ecampus
CROP 325, ^AG AND ENVIRONMENTAL PREDICAMENTS: A CASE STUDY APPROACH, 3 Credits
Analyze controversial agricultural and environmental issues, synthesize information from diverse sources, and apply scientific knowledge to recommend specific courses of action to solve real world problems. Develop oral and written communication skills through individual and group work. CROSSTLISTED as CROP 325/SOIL 325/SUS 325. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Equivalent to: SOIL 325, SUS 325

CROP 330, *WORLD FOOD CROPS, 3 Credits
Origin, production, utilization, and improvement of the world's major food crops. The role of crop production in global economic and social development; food security and worldwide nutritional requirements. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: CSS 330
Recommended: CSS 200 or CROP 200
Available via Ecampus

CROP 340, *PENS AND PLOWS: WRITINGS OF WORKING THE LAND, 3 Credits
A survey of literature from ancient Greece to the twentieth century focusing on the significance of agricultural life and/or the natural world. Students read and discuss writings considered critical in the development of Western culture and receive input on the literary significance and the accuracy of agriculture presented within the readings. (Bacc Core Course) Taught via Ecampus only.
Attributes: CPWC – Core, Pers, West Culture
Equivalent to: CSS 340
Available via Ecampus

CROP 355, ORGANIC CERTIFICATION, 3 Credits
Learn about the USDA National Organic Program (NOP) standards relating to certified operations, inspection, certification processes, and labeling. Focus on the crops, processing, and livestock aspects of organic certification for farms and food manufacturing operations.
Available via Ecampus

CROP 401, RESEARCH, 1-16 Credits
Equivalent to: CSS 401
This course is repeatable for 16 credits.

CROP 403, THESIS, 1-16 Credits
Independent, original study and preparation of a senior thesis.
Equivalent to: CSS 403
This course is repeatable for 16 credits.

CROP 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: CROP 405H, CSS 405
This course is repeatable for 16 credits.

CROP 405H, READING AND CONFERENCE, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: CROP 405, CSS 405H
This course is repeatable for 16 credits.

CROP 407, SEMINAR, 1 Credit
Equivalent to: HORT 407, SOIL 407
Available via Ecampus

CROP 410, INTERNSHIP, 1-6 Credits
Professional work experience previously approved and supervised by the department, written report required.
Equivalent to: CSS 410
This course is repeatable for 12 credits.

CROP 414, PRECISION AGRICULTURE, 4 Credits
Provides insight into the technology available to support precision agriculture and data management planning applications. Examines the concepts and applications of precision agriculture to teach practical use of hardware, equipment and software. An overview of current technology including autonomous vehicles, GPS, soil and crop proximal sensors, imagery and mapping, variable rate control systems, and yield monitors. Lec/lab. CROSSTLISTED as CROP 414/HORT 414.
Equivalent to: HORT 414
Available via Ecampus

CROP 418, TOXIC PLANTS IN PNW PASTURES, 1 Credit
Identifying and understanding ecology and biology of harmful weeds and poisonous plants found in Pacific Northwest pastures and rangelands and determining best management and control options. Taught via Ecampus only.
Equivalent to: CSS 418
Recommended: College-level plant biology and/or taxonomy courses.

CROP 420, SEED SCIENCE AND TECHNOLOGY, 3 Credits
Seed formation and factors affecting their development and maturation. Seed structure and chemical composition. Physiological and biochemical aspects of seed germination, dormancy, deterioration and storability. The concept of seed quality, its importance in agriculture, its attributes and impact on field performance. Methods of measuring seed quality of conventional and genetically modified seeds. Taught via Ecampus only.
Equivalent to: CSS 420
Recommended: Biology, plant anatomy and/or physiology courses
Available via Ecampus
CROP 433, SYSTEMATICS AND ADAPTATION OF VEGETABLE CROPS, 4 Credits
Covers the botanical and taxonomic relationships, breeding systems and adaptation of vegetable crops. Fresh material is used to illustrate varietal differences and traits of importance. Lec/lab. Offered even years. CROSSLISTED as CROP 433/HORT 433 and CROP 533/HORT 533.
Prerequisite:
BI 102 with D- or better or BI 213 with D- or better or BI 213H with D- or better or BI 223 with D- or better or BI 223H with D- or better or BI 311 with D- or better or BI 311H with D- or better or HORT 430 with D- or better or CSS 430 with D- or better or PBG 430 with D- or better or HORT 450 with D- or better or CSS 450 with D- or better or PBG 450 with D- or better
Equivalent to: HORT 433

CROP 440, WEED MANAGEMENT, 4 Credits
Principles of weed control by cultural, biological, and chemical means; weed identification; introduction to herbicides and factors influencing their use. Lec/lab/rec.
Equivalent to: CSS 440
Recommended: One year biological science and one course in organic chemistry.
Available via Ecampus

CROP 448, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits
Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. CROSSLISTED as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.
Equivalent to: ANS 448, RNG 448

CROP 460, SEED PRODUCTION, 3 Credits
Equivalent to: CSS 460
Recommended: CROP 200 or CSS 200
Available via Ecampus

CROP 463, SEED BIOLOGY, 3 Credits
Information about reproductive development of plants such as pollination and fertilization, which is important for the initiation of seed formation, will be provided. Embryo and endosperm development as well as accumulation of seed storage materials, which are major events during seed development, will be covered, as well as the dormancy and germination mechanisms in mature seeds. Lectures and discussions (presentations required for graduate students). Offered even years. Lec/lab. CROSSLISTED as CROP 463/HORT 463 and CROP 563/HORT 563.
Equivalent to: HORT 463

CROP 470, OILSEEDS AND ESSENTIAL OIL CROPS, 3 Credits
Provides students with an understanding of the principles and the latest research information of field crop production, chemistry, oil extraction and utilization of OEC. Includes the importance of OEC, their uses, current trends, production systems for major crops, harvesting, drying, processing, and other post-harvest operations, fixed (fatty acid) and essential oil extraction methods, and oil utilization. Relevant recent research and review papers will be also included and the information discussed and assessed.
Prerequisite: CROP 200 with D- or better

CROP 480, CASE STUDIES IN CROPPING SYSTEMS MANAGEMENT, 4 Credits
Decision cases involving the production of field and horticultural crops; individual and group activities; discussion of the decision-making process. Multiple field trips required. A field trip fee will be charged. CROSSLISTED as CROP 480/HORT 480 and CROP 580/HORT 580.
Equivalent to: HORT 480
Recommended: CROP 300 or HORT 300
Available via Ecampus

CROP 499, SPECIAL TOPICS IN CROP SCIENCE AND SOIL SCIENCE, 1-16 Credits
Technical knowledge and skills development courses offered in a wide array of course formats. Topics vary from term to term and year to year. May be repeated for credit when topics differ.
Equivalent to: CROP 499H, CSS 499
This course is repeatable for 16 credits.
Available via Ecampus

CROP 499H, SPECIAL TOPICS IN CROP SCIENCE AND SOIL SCIENCE, 1-16 Credits
Technical knowledge and skills development courses offered in a wide array of course formats. Topics vary from term to term and year to year. May be repeated for credit when topics differ.
Attributes: HNRS – Honors Course Designator
Equivalent to: CROP 499, CSS 499H
This course is repeatable for 16 credits.

CROP 501, RESEARCH, 1-16 Credits
Equivalent to: CSS 501
This course is repeatable for 16 credits.

CROP 503, THESIS, 1-16 Credits
Equivalent to: CSS 503
This course is repeatable for 999 credits.

CROP 505, READING AND CONFERENCE, 1-16 Credits
Equivalent to: CSS 505
This course is repeatable for 16 credits.

CROP 506, PROJECTS, 1-16 Credits
Equivalent to: CSS 506
This course is repeatable for 16 credits.
CROP 507, SEMINAR, 1 Credit
Graded P/N.
Equivalent to: CSS 507
This course is repeatable for 99 credits.

CROP 509, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. CROSSTLISTED as CROP 509/ENT 509/PBG 509/SOIL 509.
Equivalent to: CSS 509, ENT 509, PBG 509, SOIL 509
This course is repeatable for 9 credits.

CROP 514, PRECISION AGRICULTURE, 4 Credits
Provides insight into the technology available to support precision agriculture and data management planning applications. Examines the concepts and applications of precision agriculture to teach practical use of hardware, equipment and software. An overview of current technology including autonomous vehicles, GPS, soil and crop proximal sensors, imagery and mapping, variable rate control systems, and yield monitors. Lec/lab.

CROP 520, SEED SCIENCE AND TECHNOLOGY, 3 Credits
Seed formation and factors affecting their development and maturation. Seed structure and chemical composition. Physiological and biochemical aspects of seed germination, dormancy, deterioration and storability. The concept of seed quality, its importance in agriculture, its attributes and impact on field performance. Methods of measuring seed quality of conventional and genetically modified seeds. Taught via Ecampus only.
Equivalent to: CSS 520
Recommended: Biology, plant anatomy and/or physiology courses
Available via Ecampus

CROP 530, ORGANIC SOIL AND CROP MANAGEMENT, 3 Credits
Overview of organic soil and crop management, organic soil system management, soil microbiology under organic systems, cropping systems, organic cereal production systems, organic forage production system, organic horticultural systems management, organic field and horticulture cropping systems; recent research and case studies. CROSSTLISTED as CROP 530/SOIL 530.
Equivalent to: SOIL 530
Recommended: SOIL 525, CROP 200, SOIL 205 or introductory biology. Completion or concurrent enrollment in AGRI 520
Available via Ecampus

CROP 533, SYSTEMATICS AND ADAPTATION OF VEGETABLE CROPS, 4 Credits
Covers the botanical and taxonomic relationships, breeding systems and adaptation of vegetable crops. Fresh material is used to illustrate varietal differences and traits of importance. Lec/lab. Offered even years. CROSSTLISTED as CROP 433/HORT 433 and CROP 533/HORT 533.
Equivalent to: CSS 533, HORT 533
Recommended: BI 102 or BI 213 or BI 311 or HORT 430 or CSS 430 or PBG 430 or HORT 450 or CSS 450 or PBG 450

CROP 540, WEED MANAGEMENT, 4 Credits
Principles of weed control by cultural, biological, and chemical means; weed identification; introduction to herbicides and factors influencing their use. Lec/lab/rec.
Equivalent to: CSS 540
Recommended: One year biological science and one course in organic chemistry.
Available via Ecampus

CROP 548, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits
Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. CROSSTLISTED as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.
Equivalent to: ANS 548, RNG 548

CROP 560, SEED PRODUCTION, 3 Credits
Equivalent to: CSS 560
Recommended: CROP 200 or CSS 200
Available via Ecampus

CROP 563, SEED BIOLOGY, 3 Credits
Information about reproductive development of plants such as pollination and fertilization, which is important for the initiation of seed formation, will be provided. Embryo and endosperm development as well as accumulation of seed storage materials, which are major events during seed development, will be covered, as well as the dormancy and germination mechanisms in mature seeds. Lectures and discussions (presentations required for graduate students). Offered even years. Lec/lab. CROSSTLISTED as CROP 463/HORT 463 and CROP 563/HORT 563.
Equivalent to: HORT 563
CROP 570, OILSEEDS AND ESSENTIAL OIL CROPS, 3 Credits

Provides students with an understanding of the principles and the latest research information of field crop production, chemistry, oil extraction and utilization of OEOC. Includes the importance of OEOC, their uses, current trends, production systems for major crops, harvesting, drying, processing, and other post-harvest operations, fixed (fatty acid) and essential oil extraction methods, and oil utilization. Relevant recent research and review papers will be also included and the information discussed and assessed.

Prerequisite: CROP 200 with D- or better
Recommended: Horticulture, biology or chemistry course

CROP 580, CASE STUDIES IN CROP SYSTEMS MANAGEMENT, 4 Credits

Decision cases involving the production of field and horticultural crops; individual and group activities; discussion of the decision-making process. Multiple field trips required. A field trip fee will be charged. CROSSLISTED as CROP 480/HORT 480 and CROP 580/HORT 580.

Equivalent to: HORT 580
Recommended: CROP 300 or HORT 300
Available via Ecampus

CROP 590, EXPERIMENTAL DESIGN IN AGRICULTURE, 4 Credits

Field layout, analysis, and interpretation of basic experimental designs used in agronomy and plant breeding and including field plot techniques such as optimum plot size and shape, factorial arrangement, replication, sub-sampling, randomization, and blocking. Recitation provides practical experience with SAS. Lec/rec.

Equivalent to: CSS 590
Recommended: ST 351
Available via Ecampus

CROP 599, SPECIAL TOPICS IN CROP SCIENCE AND SOIL SCIENCE, 0-16 Credits

Technical knowledge and skills development courses offered in a wide variety of course formats. Topics vary from term to term and year to year. May be repeated for credit when topics differ.

Equivalent to: CSS 599
This course is repeatable for 16 credits.

CROP 601, RESEARCH, 1-16 Credits

Equivalent to: CSS 601
This course is repeatable for 16 credits.

CROP 603, THESIS, 1-16 Credits

Equivalent to: CSS 603
This course is repeatable for 999 credits.

CROP 605, READING AND CONFERENCE, 1-16 Credits

Equivalent to: CSS 605
This course is repeatable for 16 credits.

CROP 606, PROJECTS, 1-16 Credits

Equivalent to: CSS 606
This course is repeatable for 16 credits.

CROP 607, SEMINAR, 1 Credit

Graded P/N.
Equivalent to: CSS 607
This course is repeatable for 99 credits.

CROP 608, WORKSHOP, 1-16 Credits

Equivalent to: CSS 608
This course is repeatable for 16 credits.

CROP 609, PRACTICUM IN TEACHING, 1-3 Credits

Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. Graded P/N.

Equivalent to: ENT 609, PBG 609, SOIL 609
This course is repeatable for 9 credits.

CROP 660, HERBICIDE SCIENCE, 4 Credits

Absorption, movement, and mechanism of action in plants; behavior of herbicides in soil. Offered alternate years.

Recommended: BOT 331 and (CSS 440 or CSS 540 or CROP 440 or CROP 540)

CROP 670, PHYSIOLOGY OF CROP YIELD, 3 Credits

Concepts of crop growth and production in relation to environmental and physiological factors and their interactions; current literature.

Equivalent to: CSS 670
Recommended: BOT 331

CROP 699, SPECIAL TOPICS IN CROP SCIENCE AND SOIL SCIENCE, 1-16 Credits

Equivalent to: CSS 699
This course is repeatable for 16 credits.

Crop and Soil Science (CSS)

CSS 205, *SOIL SCIENCE, 4 Credits

Introduction to the chemical, physical and biological nature of soils. Examines the functions of soil as a medium for plant growth, a recycling system for nutrients and wastes, a modifier of atmospheric chemistry, a habitat for soil organisms, a system for water purification, and an engineering medium. Field and laboratory projects provide an understanding of fundamental soil science principles and the impact of human activities on soil quality and sustainability. Lec/lab. (Bacc Core Course) Taught via Ecampus only.

Attributes: CPBS – Core, Pers, Biological Science; CPPS – Core, Pers, Physical Science
Equivalent to: CSS 305, SOIL 205
Available via Ecampus

CSS 305, PRINCIPLES OF SOIL SCIENCE, 4 Credits

Origin, formation, classification, physical, chemical, and biological characteristics; ecosystem functions of soils; effects of soil management on agricultural and forest crop production. Field trips. Taught at EOU LaGrande campus only.

Equivalent to: CSS 205, SOIL 205
Recommended: Two quarters of college chemistry and CSS 306
CSS 306, PROBLEM SOLVING: SOIL SCIENCE APPLICATIONS, 1 Credit
Problem solving for, and in-depth exploration of, Principles of Soil Science (CSS 305). Real-world problems requiring knowledge of soil physical, chemical, and biological properties. Taught at EOU LaGrande campus only.
Corequisites: CSS 305

CSS 315, ^NUTRIENT MANAGEMENT AND CYCLING, 4 Credits
Nutrient forms, transformations, and plant availability as influenced by chemical and biological reactions in soils; soil pH and management of acid and alkaline soils; characteristics and use of fertilizers, soil amendments and organic wastes. Labs include routine soil testing procedures, computer applications for soil fertility management, and field trips. Lec/lab. (Writing Intensive Course) Taught at EOU LaGrande campus only.
Attributes: CWIC – Core, Skills, WIC
Prerequisite: CSS 305 with D- or better
Recommended: CH 122 and courses in computers

CSS 320, PRINCIPLES OF OIL AND FIBER CROP PRODUCTION, 1 Credit
An overview of production practices and characteristics of oil seed, essential oil, and fiber crops. Taught at EOU LaGrande campus only.
Recommended: CSS 300 and CSS 305

CSS 321, PRINCIPLES OF CEREAL CROP PRODUCTION, 1 Credit
An overview of the principles underlying small grain production practices in the Pacific Northwest. Taught at EOU LaGrande campus only.
Recommended: CSS 300 and CSS 305

CSS 322, PRINCIPLES OF POTATO PRODUCTION, 1 Credit
Principles and practices governing all aspects of potato production, storage and use. Taught at EOU LaGrande campus only.
Recommended: CSS 300 and CSS 305

Entomology (ENT)

ENT 101, INTRODUCTION TO CROP, SOIL, AND INSECT SCIENCE, 1 Credit
Introduces students with interests in crop, soil, and insect sciences to educational and professional opportunities in these disciplines. Speakers will discuss opportunities in research and academia as well as in the applied professional job market. CROSSLISTED as CROP 101/ENT 101/ SOIL 101.
Equivalent to: CROP 101, HORT 101, SOIL 101
Available via Ecampus

ENT 300, *PLAUGUES, PESTS, AND POLITICS, 3 Credits
Integration and interaction of agricultural and public health aspects of entomology in society and history. CROSSLISTED as ENT 300/HORT 330. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: BI 300, HORT 330
Available via Ecampus

ENT 311, INTRODUCTION TO INSECT PEST MANAGEMENT, 4 Credits
Identification, biology and management of injurious and beneficial insects. Concurrent laboratory is designed to provide hands-on experience with identification of insect groups of relevance to agricultural cropping systems. Lec/lab.
Equivalent to: CSS 311
Recommended: Entomology course work or one year college biology.
Available via Ecampus

ENT 322, HONEY BEE BIOLOGY AND BEEKEEPING, 3 Credits
In this introduction to the fascinating honey bee and its biology, honey bees are used as model organisms to illustrate general principles of biology, entomology, and sociobiology. Students will learn the basics of beekeeping, have an opportunity to manipulate honey bee colonies, and gain hands-on experience, prevailing winter weather permitting.
Available via Ecampus

ENT 331, POLLINATORS IN PERIL, 3 Credits
Pollinators, human influences on pollination systems, and the potential consequences of pollinator decline. An introduction to the skills needed to investigate media reports and multidisciplinary scientific research. Effects of pesticides, habitat fragmentation, climate change, invasive species, pests, pathogens, and other threats to pollinators in critical natural and agricultural systems around the world.
Equivalent to: HORT 331
Recommended: Completion of a Baccalaureate Core biological science course.
Available via Ecampus

ENT 401, RESEARCH, 1-16 Credits
Work on approved problems carried on in the library, laboratory or field. This course is repeatable for 16 credits.

ENT 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

ENT 405, READING AND CONFERENCE, 1-16 Credits
Reading and discussions on special topics. This course is repeatable for 16 credits.

ENT 407, SEMINAR, 1-2 Credits
Graded P/N. This course is repeatable for 16 credits.

ENT 410, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.
ENT 420, INSECT ECOLOGY, 3 Credits
Insect ecology, evolution, and management. Biophysical ecology; foraging and feeding; life cycles; population dynamics, regulation, and control; species interactions including herbivore-plant, predator-prey, parasite-host, competition, and mutualism; diversity, food web structure, agricultural ecology, exercises merge models, experiments, and sampling. Offered on even years.
Recommended: BI 370

ENT 440, ISSUES IN INSECT TOXICOLOGY, 3 Credits
Introduction to concepts and mechanisms associated with molecular toxicology as it relates to insects, including interactions with naturally occurring and synthetic compounds. Overview of current research in insect toxicology including resistance to pesticides, protection of non-target species, and use of insects as model organisms. Discussion of laboratory and field approaches and potential strategies to address issues in insect toxicology.
Recommended: Background in basic chemistry and biology
Available via Ecampus

ENT 444, INSECT AGROECOLOGY, 3 Credits
Agroecology incorporates ecological concepts and principles to the design and management of sustainable agricultural systems. Topics include: the role of insects in sustainable agricultural systems; application of the principles of insect ecology to better manage insect pests and maximize crop yield; conserving beneficial insects and other natural resources in agroecosystems and the surrounding landscape. CROSSLISTED as ENT 444/HORT 444 and ENT 544/HORT 544.
Equivalent to: HORT 444
Recommended: General background or previous course work in entomology.

ENT 499, SPECIAL TOPICS, 1-6 Credits
Equivalent to: FW 499
This course is repeatable for 6 credits.

ENT 501, RESEARCH, 1-16 Credits
Work on approved problems carried on in the library, laboratory or field.
This course is repeatable for 16 credits.

ENT 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

ENT 505, READING AND CONFERENCE, 1-16 Credits
Reading and discussions on special topics.
This course is repeatable for 16 credits.

ENT 507, SEMINAR, 1-2 Credits
Graded P/N.
This course is repeatable for 16 credits.

ENT 508, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

ENT 509, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. CROSSLISTED as CROP 509/ENT 509/
PBG 509/SOIL 509.
Equivalent to: CROP 509, PBG 509, SOIL 509
This course is repeatable for 9 credits.

ENT 510, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.

ENT 518, CURRENT TOPICS IN ENTOMOLOGY, 2 Credits
A core course of the Horticulture graduate program. Provides an advanced understanding of entomology and its relationship to other disciplines through critical analysis of the scientific literature. Practice synthesizing information and presenting findings to peers. Instructors, topics, and specific learning objectives vary from term to term. CROSSLISTED as ENT 518/HORT 518.
Equivalent to: HORT 518
This course is repeatable for 12 credits.

ENT 520, INSECT ECOLOGY, 3 Credits
Insect ecology, evolution, and management. Biophysical ecology; foraging and feeding; life cycles; population dynamics, regulation, and control; species interactions including herbivore-plant, predator-prey, parasite-host, competition, and mutualism; diversity, food web structure, agricultural ecology, exercises merge models, experiments, and sampling. Offered even years.
Recommended: BI 370 and Z 365

ENT 523, ORGANIC BEEKEEPING AND HONEY PRODUCTION, 3 Credits
In this introduction to the fascinating honey bee and its biology, honey bees are used as model organisms to illustrate general principles of biology, entomology, and sociobiology. Learn the basics of beekeeping, organic beekeeping and honey production. Examine the culture and certification of organic and conventional systems of honey production. Available via Ecampus

ENT 540, ISSUES IN INSECT TOXICOLOGY, 3 Credits
Introduction to concepts and mechanisms associated with molecular toxicology as it relates to insects, including interactions with naturally occurring and synthetic compounds. Overview of current research in insect toxicology including resistance to pesticides, protection of non-target species, and use of insects as model organisms. Discussion of laboratory and field approaches and potential strategies to address issues in insect toxicology.
Recommended: Background in basic chemistry and biology
Available via Ecampus
ENT 542, PRINCIPLES OF INTEGRATED PEST MANAGEMENT: SYSTEMS DESIGN, 4 Credits
Principles of integrated pest management design focusing on the use of systems analysis as a means to integrate management tactics, environmental and biological monitoring, pest control models, and implementation elements into a cohesive whole. Introduction to integrated pest management on websites. Students will design a hypothetical crop-pest management system. Lec/lab.
Equivalent to: HORT 542
Recommended: ENT 311

ENT 544, INSECT AGROECOLOGY, 3 Credits
Agroecology incorporates ecological concepts and principles to the design and management of sustainable agricultural systems. Topics include: the role of insects in sustainable agricultural systems; application of the principles of insect ecology to better manage insect pests and maximize crop yield; conserving beneficial insects and other natural resources in agroecosystems and the surrounding landscape. CROSSLISTED as ENT 444/HORT 444 and ENT 544/HORT 544.
Equivalent to: HORT 544
Recommended: General background or previous course work in entomology.

ENT 548, INTEGRATED PEST MANAGEMENT IN ORGANIC SYSTEMS, 3 Credits
Prevention, detection, and management of pests and diseases in organic plant production systems. Content includes activities that require students to expand their experience of pest management in their locality by incorporating new and emergent technology for monitoring, diagnosing and managing insects, pathogen, and weed pests and their impacts on crops. Discussions will be centered on the logistics and potential of new technologies in pest management, incorporating biological, ecological and sustainable agriculture concepts.
Recommended: ENT 311 with minimum grade of D-
Available via Ecampus

ENT 599, SPECIAL TOPICS, 1-16 Credits
Important topics of current interest in the areas of systematics, insect physiology and toxicology, ecology and behavior, and pest management. Course content and title will change with each offering.
This course is repeatable for 16 credits.

Food Science and Technology (FST)

FST 101, FOOD SCIENCE ORIENTATION, 1 Credit
For food science majors. Orientation and academic guidance toward career planning in food science and technology.

FST 199, SPECIAL STUDIES, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

FST 210, FRUIT AND VEGETABLE PROCESSING, 3 Credits
Lectures, lab activities and plant tours to help majors and non-majors understand traditional and modern fruit and vegetable processing technologies.
Recommended: CH 123 or CH 223 or ((CH 233 or CH 233H) and (CH 263 or CH 263H))

FST 212, DAIRY PROCESSING, 2 Credits
Methods of processing and preserving milk and milk products and related unit operations.
Recommended: CH 123 or CH 223 or CH 233 or CH 233H

FST 213, DAIRY PROCESSING LABORATORY, 1 Credit
Laboratory and field work to accompany FST 212. Field trip required.
Recommended: Concurrent enrollment in FST 212

FST 251, INTRODUCTION TO WINES, BEERS, AND SPIRITS, 3 Credits
A descriptive introduction to the history, science, sensory, economics, and societal aspects of alcoholic beverages.
Recommended: High school biology and chemistry
Available via Ecampus

ENT 609, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. Graded P/N.
Equivalent to: CROP 609, PBG 609, SOIL 609
This course is repeatable for 9 credits.

ENT 699, SPECIAL TOPICS, 1-16 Credits
Important topics of current interest in the areas of systematics, insect physiology and toxicology, ecology and behavior, and pest management. Course content and title will change with each offering.
This course is repeatable for 16 credits.

ENT 601, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

ENT 603, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

ENT 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

ENT 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.
FST 260, *FOOD SCIENCE AND TECHNOLOGY IN WESTERN CULTURE, 3 Credits
Exploring the sciences and technologies of food processing and preservation within the context of their historical, current, and possible future influences on what we eat, the structure of our society, and our day-to-day lives. (Bacc Core Course)
Attributes: CPWC – Core, Pers, West Culture
Available via Ecampus

FST 273, *WINE IN THE WESTERN WORLD, 3 Credits
A study of wine throughout history, from its accidental discovery and refinement through today, with a focus on the profound role wine plays in agriculture, social rituals, human health, economics, and the ambivalent pursuit of pleasure. (Baccalaureate Core Course)
Attributes: CPWC – Core, Pers, West Culture
Available via Ecampus

FST 280, FOOD AND BEVERAGE FERMENTATION, 2 Credits
Investigates different types of fermentation processes, related techniques, and products. Engages in laboratory activities on cider fermentation and sensory evaluation. Lec/lab.
Prerequisite: CH 231 (may be taken concurrently) with C- or better and CH 261 (may be taken concurrently) [C-]

FST 315, PILOT PLANT EXPERIENCES, 2 Credits
Students will be working in one of the FST pilot plants (dairy, vegetables/fruit, brewing, wine making, distilling) and will be assisting with the manufacturing of foods or beverages. Students must have available blocks of time in their schedules to contribute significantly to a production run. Production schedules for each pilot plant will be determined in advance of registration for each term. Not all pilot plants will be available each term. Lab.

FST 360, FOOD SAFETY AND SANITATION, 3 Credits
Principles, practices, and regulations governing and ensuring the microbiological safety of our food supply through risk assessment, surveillance, and intervention.
Prerequisite: (BI 211 with D- or better or BI 211H with D- or better or BI 212 with D- or better or BI 212H with D- or better or BI 213 with D- or better or BI 213H with D- or better or BI 221 with D- or better or BI 221H with D- or better or BI 222 with D- or better or BI 222H with D- or better or BI 223 with D- or better or BI 223H with D- or better) and (CH 121 [D-] or CH 221 [D-] or CH 221H [D-] or CH 231 [D-] or CH 231H [D-])

FST 370, INDUSTRY PREPARATION/ HACCP, 3 Credits
Assists students in preparation for internships and employment in the food industry by introducing compliance with food safety regulations, HACCP, and audits.
Recommended: One year of chemistry and one year of biology.

FST 385, ^COMMUNICATING FOOD AND FERMENTATION SCIENCE, 3 Credits
This writing intensive course (WIC) will guide students in the investigation and critical evaluation of literature on a topic of current interest in food or fermentation science, and the development of their ability to write concisely and with precision about technical subject matter in this discipline. Lec/rec. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisite: WR 121 with C- or better and FST 360 [D-] and MB 302 (may be taken concurrently) [D-]
Recommended: Completion of Bacc Core Writing II requirement

FST 399, SPECIAL TOPICS, 0-16 Credits
Equivalent to: FST 399H
This course is repeatable for 16 credits.

FST 399H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: FST 399
This course is repeatable for 16 credits.

FST 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

FST 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

FST 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FST 407, SENIOR SEMINAR, 1 Credit

FST 410, INTERNSHIP, 1-16 Credits
A work internship to give students practical on-the-job training in the food processing or related industries. Graded P/N.
This course is repeatable for 16 credits.

FST 420, SENSORY EVALUATION OF FOOD, 4 Credits
Sensory test methods used in the evaluation of the taste, smell, texture, and color of foods as well as the evaluation of consumer acceptance of foods. This includes methods for measuring sensory qualities, underlying psychological principles, statistical methods for analyzing data, and proper interpretation of these results. Lec/lab.
Prerequisite: (ST 351 with C- or better or ST 411 with C- or better) and (ST 352 (may be taken concurrently) [D-] or ST 412 (may be taken concurrently) [D-])

FST 421, *FOOD LAW, 3 Credits
Concepts, statutes, regulations, and agencies controlling the production, processing, and distribution and promotion of food. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
FST 422, FOOD CHEMISTRY FUNDAMENTALS, 4 Credits
An integrated lecture/lab/recitation course applying theories of molecular reactivity to model food systems. Lectures focus on the molecular bases of chemical phenomena that dictate the behavior of foods. Laboratories and recitations provide opportunities for students to observe, manipulate, and explore model food systems. Emphasis on major food components (water, lipids, proteins, and carbohydrates) and their behavior under conditions of particular relevance to food processing. Lec/lab/rec.
Prerequisite: (BB 350 with D- or better or BB 450 with D- or better or BB 450H with D- or better) and (CH 332 [C-] or CH 336 [C-]) and (MTH 228 (may be taken concurrently) [D-] or MTH 252 (may be taken concurrently) [D-] or MTH 252H (may be taken concurrently) [D-])

FST 423, FOOD ANALYSIS, 4 Credits
An integrated laboratory/lecture course covering methods used for the quantitative analysis of the chemical composition of foods and agricultural products.
Recommended: CH 324 and CH 337 and BB 350

FST 425, FOOD SYSTEMS CHEMISTRY, 4 Credits
The chemistry of food components in real-world food systems. Focused on water, proteins, carbohydrates, lipids, and food polymers, their interactions, and the effects of food processing and storage. Integrates writing as a learning tool and means of professional communication. Lec/lab/rec.
Prerequisite: FST 422 with D- or better

FST 430, FOOD PRODUCT DEVELOPMENT, 3 Credits
Provides technical background and hand-on experience in food product development and food innovation.
Recommended: Junior or senior standing
Available via Ecampus

FST 437, CHEMISTRY AND BIOCHEMISTRY OF DISTILLED SPIRITS, 3 Credits
The underlying science of the production of the distilled spirits will be discussed systematically. The course will cover the requirements for water, the major raw materials (e.g., cereals, fruits, agave, syrups, and woods for maturation) and the conversion of these into fermentable extract. The scientific principles of fermentation will be explored, in the context of both ethanol and secondary metabolite production. Distillation will be considered, in terms of the physics and chemistry of liquid-liquid separations, before discussing post-fermentation options such as blending, maturation and product finishing.
Prerequisite: FST 251 with C- or better and BB 350 (may be taken concurrently) [D-]
Available via Ecampus

FST 438, PRODUCTION AND ANALYSIS OF DISTILLED SPIRITS, 3 Credits
Building on the prerequisite course, this course compares and contrasts different approaches to the manufacture of distilled spirits by using some of the major spirit categories as examples. The management of a distilled spirits production plant in terms of legislative, safety and process/product quality will be discussed before explicit consideration of the requirements for establishing a distilled spirits production plant. Successful completion of this course will provide students with a broad understanding of the distilled spirits sector.
Prerequisite: FST 437 with D- or better
This course is repeatable for 3 credits.

FST 455X, FOOD FOR CHANGE, 3 Credits
Focus on traditional regional recipes, explore and document how global change has affected food production and demand until today and how projected climate change will affect it in the future by analyzing the ingredient lists. Focus on one recipe/ingredient, find maps of past/current crop ranges, document changes, establish the carbon footprint, and identify possible replacement ingredients projecting future culinary solutions.
Available via Ecampus

FST 460, CHEMISTRY AND BIOCHEMISTRY OF BEER, 3 Credits
Chemistry, microbiology and engineering of malting and brewing operations for the production of beer, including the compositional analysis of barley, malt, hops, water, and beer and their effects on beer quality.
Prerequisite: (BI 212 with C- or better or BI 212H with C- or better or BI 221 with C- or better or BI 221H with C- or better) and CH 331 [C-] and CH 332 [C-]
Recommended: Completion or concurrent enrollment in BEE 472 and MB 302

FST 461, PRODUCTION AND ANALYSIS OF BEER, 3 Credits
Compositional analysis, laboratory techniques and sensory evaluation of barley, malt, hops, water, yeast and beer. Lec/lab.
Prerequisite: FST 460 with D- or better and MB 302 [D-] and (MB 303 (may be taken concurrently) [D-] or MB 303H (may be taken concurrently) [D-])

FST 466, WINE PRODUCTION PRINCIPLES, 3 Credits
Principles of wine production technology from grape berry development through bottling, covering the microbiology and chemistry of fermentation, aging and production practices of red and white table wines, as well as sparkling and dessert wines.
Prerequisite: (BI 212 with C- or better or BI 212H with C- or better or BI 221 with C- or better or BI 221H with C- or better) and CH 331 [C-] and CH 332 [C-]
Recommended: BB 350 and MB 302
FST 479, FERMENTATION MICROBIOLOGY, 3 Credits
An introduction to industrial microbiology with a focus on the physiology of fermentation and use of microorganisms for the production of food ingredients, fermented foods, and beverages. FST students need to take BB 350 and MB students need to take BB 450 for their respective majors. CROSSLISTED as FST 479/MB 479 and FST 579/MB 579.
Prerequisite: ((BI 212 with C- or better or BI 212H with C- or better) or ((BI 221 with C- or better or BI 221H with C- or better) and (BI 223 [C-] or BI 223H [C-]) ) and CH 331 [C-] and CH 332 [C-] and (BB 350 [D-] or BB 450 [D-]) and MB 302 [D-]
Equivalent to: MB 479
FST 480, TOPICS IN FERMENTATION, 0-2 Credits
Selected topics in fermentation science will be presented by department faculty and invited outside experts. Topics and format will change each quarter. Students may take the course for 1 or 2 credits as the topics change. Lec/lab.
This course is repeatable for 8 credits.
FST 490, FOOD PROCESSING CALCULATIONS, 2 Credits
Application of engineering principles to produce safe processed foods meeting consumer expectations for safety and quality. Validate process engineering models by comparing predicted values with new experimental data.
Prerequisite: BEE 472 with D- or better and FST 360 [D-]
Corequisites: FST 491
FST 491, FOOD PROCESSING CALCULATIONS LABORATORY, 1 Credit
Experiments in a pilot plant supported by a computer laboratory. Prepare samples of novel process technology products.
Corequisites: FST 490
Recommended: Microsoft Excel skills.
FST 495, FOOD PACKAGING, 3 Credits
Fundamentals of food packaging covering the major packaging solutions with a focus on plastic, paper, glass, metal, and paperboard. Modeling of gas and water permeation and accelerated shelf testing. Regulations in food contact surface and related to indirect food additives.
Prerequisite: MTH 111 with C- or better and PH 201 [C-] and CH 331 [C-]
FST 499, SPECIAL STUDIES, 0-16 Credits
This course is repeatable for 16 credits.
FST 501, RESEARCH, 1-16 Credits
PREREQ: Departmental approval required.
This course is repeatable for 16 credits.
FST 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.
FST 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
FST 507, SEMINAR, 1 Credit
This course is repeatable for 4 credits.
FST 509, PRACTICUM IN TEACHING, 1-16 Credits
This course is repeatable for 16 credits.
FST 510, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.
FST 514, HEALTH BENEFITS OF FUNCTIONAL FOODS, NUTRACEUTICALS AND DIETARY SUPPLEMENTS, 3 Credits
Functional foods, nutraceuticals and dietary supplements represent a rapidly expanding segment of domestic and international markets. This course will overview the principles and procedures necessary to evaluate and market these products. The chemistry and mechanisms of major nutraceutical ingredient categories and current scientific information supporting their biochemical and physiological efficacy will be addressed. Special dietary products, such as medical, weight control, sport, and herbal supplements, will be addressed. Regulatory aspects of labeling and structure-function claims will be covered. CROSSLISTED as FST 514/NUTR 514.
Equivalent to: NFM 514, NUTR 514
Recommended: BB 350 and CH 332
FST 520, SENSORY EVALUATION OF FOOD, 4 Credits
Sensory test methods used in the evaluation of the taste, smell, texture, and color of foods as well as the evaluation of consumer acceptance of foods. This includes methods for measuring sensory qualities, underlying psychological principles, statistical methods for analyzing data, and proper interpretation of these results. Lec/lab.
Recommended: Completion of ST 351 or ST 411 and completion or concurrent enrollment in ST 352 or ST 412
FST 521, FOOD LAW, 3 Credits
Concepts, statutes, regulations, and agencies controlling the production, processing, and distribution and promotion of food.
FST 522, FOOD CHEMISTRY FUNDAMENTALS, 4 Credits
An integrated lecture/lab/recitation course applying theories of molecular reactivity to model food systems. Lectures focus on the molecular bases of chemical phenomena that dictate the behavior of foods. Laboratories and recitations provide opportunities for students to observe, manipulate, and explore model food systems. Emphasis on major food components (water, lipids, proteins, and carbohydrates) and their behavior under conditions of particular relevance to food processing. Lec/lab/rec.
Recommended: (BB 350 or BB 450 or BB 450H) and (CH 332 or CH 336) and (MTH 228 or MTH 252 or MTH 252H)
FST 523, FOOD ANALYSIS, 4 Credits
An integrated laboratory/lecture course covering methods used for the quantitative analysis of the chemical composition of foods and agricultural products.
Recommended: CH 324 and CH 337 and BB 350

FST 525, FOOD SYSTEMS CHEMISTRY, 4 Credits
The chemistry of food components in real-world food systems. Focused on water, proteins, carbohydrates, lipids, and food polymers, their interactions, and the effects of food processing and storage. Integrates writing as a learning tool and means of professional communication. Lec/lab/rec.
Prerequisite: FST 522 with C or better

FST 527, CHEMISTRY AND BIOCHEMISTRY OF DISTILLED SPIRITS, 3 Credits
The underlying science of the production of the distilled spirits will be discussed systematically. The course will cover the requirements for water, the major raw materials (e.g., cereals, fruits, agave, syrups, and woods for maturation) and the conversion of these into fermentable extract. The scientific principles of fermentation will be explored, in the context of both ethanol and secondary metabolite production. Distillation will be considered, in terms of the physics and chemistry of liquid-liquid separations, before discussing post-fermentation options such as blending, maturation and product finishing.
Available via Ecampus

FST 538, PRODUCTION AND ANALYSIS OF DISTILLED SPIRITS, 3 Credits
Building on the prerequisite course, this course compares and contrasts different approaches to the manufacture of distilled spirits by using some of the major spirit categories as examples. The management of a distilled spirits production plant in terms of legislative, safety and process/product quality will be discussed before explicit consideration of the requirements for establishing a distilled spirits production plant. Successful completion of this course will provide students with a broad understanding of the distilled spirits sector.
Prerequisite: FST 537 with D- or better
This course is repeatable for 3 credits.

FST 555X, FOOD FOR CHANGE, 3 Credits
Focus on traditional regional recipes, explore and document how global change has affected food production and demand until today and how projected climate change will affect it in the future by analyzing the ingredient lists. Focus on one recipe/ingredient, find maps of past/current crop ranges, document changes, establish the carbon footprint, and identify possible replacement ingredients projecting future culinary solutions.
Equivalent to: ENSC 555X
Available via Ecampus

FST 560, CHEMISTRY AND BIOCHEMISTRY OF BEER, 3 Credits
Chemistry, microbiology and engineering of malting and brewing operations for the production of beer, including the compositional analysis of barley, malt, hops, water, and beer and their effects on beer quality.
Recommended: (BI 212 or BI 212H or BI 221 or BI 221H) and CH 331 and CH 332 and completion or concurrent enrollment in BEE 472 and MB 302

FST 561, PRODUCTION AND ANALYSIS OF BEER, 3 Credits
Compositional analysis, laboratory techniques and sensory evaluation of barley, malt, hops, water, yeast and beer. Lec/lab.
Prerequisite: FST 560 with D- or better

FST 566, WINE PRODUCTION PRINCIPLES, 3 Credits
Principles of wine production technology from grape berry development through bottling, covering the microbiology and chemistry of fermentation, aging and production practices of red and white table wines, as well as sparkling and dessert wines.
Recommended: (BI 212 or BI 212H or BI 221 or BI 221H) and CH 331, CH 332, BB 350 and MB 302

FST 567, PRODUCTION AND ANALYSIS OF WINE, 5 Credits
Examines the practical fundamentals of red and white wine production and the key analysis techniques used to assess grapes and wines. Wine will be produced and monitored from grape to bottle using standard chemical, microbial, and sensorial techniques.
Prerequisite: FST 566 with C or better and FST 579 (may be taken concurrently) [C]

FST 579, FERMENTATION MICROBIOLOGY, 3 Credits
An introduction to industrial microbiology with a focus on the physiology of fermentation and use of microorganisms for the production of food ingredients, fermented foods, and beverages. FST students need to take BB 350 and MB students need to take BB 450 for their respective majors.
Equivalent to: MB 579
Recommended: ((BI 212 or BI 212H) or ((BI 221 or BI 221H) and (BI 223 or BI 223H)) and CH 331, CH 332, (BB 350 or BB 450) and MB 302

FST 595, FOOD PACKAGING, 3 Credits
Fundamentals of food packaging covering the major packaging solutions with a focus on plastic, paper, glass, metal, and paperboard. Modeling of gas and water permeation and accelerated shelf testing. Regulations in food contact surface and related to indirect food additives.

FST 599, SPECIAL STUDIES, 0-16 Credits
This course is repeatable for 16 credits.

FST 601, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

FST 603, THESIS, 1-16 Credits
This course is repeatable for 999 credits.
FST 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FST 607, SEMINAR, 1 Credit
This course is repeatable for 4 credits.

FST 620, ADVANCED TOPICS IN SENSORY SCIENCE, 2 Credits
Current and/or advanced subjects in human sensory science. Includes 1) topics in human flavor perception that covers human psychophysics, neuroscience, and related fields, and 2) sensory evaluation techniques and data handling methods that are advanced in nature. Different points of view regarding above topics will be discussed.
Prerequisite: FST 520 with C or better
This course is repeatable for 4 credits.

FST 628, FLAVOR CHEMISTRY, 3 Credits
The definition of flavor, analytical methods in flavor chemistry, and mechanisms of odor interaction in food system will be discussed. In addition, an integrated approach will be used to study the flavor chemistry of economically-important agricultural products in the Pacific Northwest such as dairy products, fruits, and alcoholic beverages.
Recommended: FST 522 and FST 523

FST 639, FOOD POLYMER SCIENCE, 3 Credits
Investigates the theoretical principles and structure-function relationships of food macromolecules. The theoretical principles are related, where possible, to observable phenomena during thermal processing and storage of foods.
Recommended: (FST 422 or FST 522) and (FST 425 or FST 525)

FST 641, PROCESSING WHEAT AND OTHER SMALL GRAINS: A MOLECULAR VIEW, 3 Credits
Provides a fundamental overview of wheat and other cereals from the perspective of the molecular level events that are important in milling, baking, and other processes. Uses cereal processing (focused primarily on bread-making) as the vehicle for placing elements of food chemistry, food polymer science, physical chemistry, and rheology into the cohesive framework of a single food category. Students will experience how the sciences of chemistry, physics, engineering, microbiology, biochemistry, nutrition, etc. amalgamate in the production of the selected cereal products. Lec/lab.

FST 666, ADVANCED TOPICS IN ENOLOGY, 3 Credits
An in-depth investigation of advanced wine processing techniques and wine research, focusing on their impact on production and wine quality.
Prerequisite: FST 566 with B or better and FST 567 (may be taken concurrently) [B]
Recommended: Viticulture course such as HORT 454 and good understanding of how vineyard practices influence grape quality

Fisheries and Wildlife (FW)

FW 107, ORIENTATION TO FISHERIES AND WILDLIFE, 1 Credit
Information relevant to academic pathways and career planning in the fields of fisheries and wildlife. Graded P/N.
Available via Ecampus

FW 113, INTRODUCTION TO MARINE LIFE IN THE SEA-MARINE BIRDS AND MAMMALS, 1 Credit
Introduces first- and second-year undergraduates, teachers and non-degree students to the breadth of marine science course offerings and research at Oregon State University's Hatfield Marine Science Center located in Newport, Oregon. Using an experiential based format, students collect field data to better understand marine mammals (whales, dolphins and porpoises), seabirds, and their interactions with their environment. Lec/lab. Graded P/N.

FW 199, SPECIAL STUDIES, 1-16 Credits
Graded P/N.
Equivalent to: FW 199H
This course is repeatable for 16 credits.

FW 199H, SPECIAL STUDIES, 1-16 Credits
Graded P/N.
Attributes: HNRS – Honors Course Designator
Equivalent to: FW 199
This course is repeatable for 16 credits.

FW 209, CAREER SKILLS IN FISHERIES AND WILDLIFE SCIENCES, 1 Credit
A foundation for life-long career development in fisheries and wildlife sciences. Practice the skills needed to search, apply, and attain internships and jobs.
Prerequisite: FW 107 with P or better
Available via Ecampus

FW 251, PRINCIPLES OF FISH AND WILDLIFE CONSERVATION, 3 Credits
History of conservation and natural resource use; ecological principles, and social and economic limitations of conservation; principles and practices of wildlife and fisheries management; role of research in management.
Recommended: One course in introductory biology
Available via Ecampus

FW 255, FIELD SAMPLING OF FISH AND WILDLIFE, 3 Credits
Introduction to sampling populations and communities of vertebrate animals emphasizing sampling design, collection and management of data, and communication of results.
Recommended: WR 121 and familiarity with personal computers.
Available via Ecampus
FW 289, COMMUNICATION SKILLS FOR FISHERIES AND WILDLIFE PROFESSIONALS, 4 Credits
Introduces students to the theoretical and practical dimensions of interpersonal and public communication in a natural resource management field. Lec/rec. Recommended: FW 251
Available via Ecampus

FW 301, FIELD TECHNIQUES FOR MARINE MAMMAL CONSERVATION, 1 Credit
A laboratory and hands-on experience covering field techniques, computer software for data organization and analyses, and understanding the practical management conservation application for students who are taking or have taken FW/BI 302, Biology and Conservation of Marine Mammals. Taught summer term at HMSC, Newport, OR.
Prerequisite: BI 302 (may be taken concurrently) with D- or better or FW 302 (may be taken concurrently) with D- or better

FW 302, BIOLOGY AND CONSERVATION OF MARINE MAMMALS, 4 Credits
An examination of the biology of whales, pinnipeds, and other marine mammals, including general adaptations to a marine existence; systematics and biogeography; reproduction; diving physiology; communication and echolocation; feeding and migratory behavior; and marine mammal/human interactions; including conservation issues. Taught at Hatfield Marine Science Center OR online through Ecampus.
Equivalent to: BI 302
Recommended: One year of introductory biology
Available via Ecampus

FW 303, SURVEY OF GEOGRAPHIC INFORMATION SYSTEMS IN NATURAL RESOURCE, 3 Credits
Concepts underlying geographic information systems, global positioning system, and remote sensing; application to management and research, data quality issues, and case studies. Not a lab/skills class.
Available via Ecampus

FW 307, SPECIALIZATION DEVELOPMENT, 1 Credit
Students will examine career alternatives, develop career goals, learn what knowledge, skills, and abilities are important for diverse careers in fisheries and wildlife conservation, and develop an academic and lifelong plan for achieving their career goals. This course is intended to assist students in developing a specialization in fisheries and wildlife sciences. Graded P/N.
Equivalent to: FW 207
Recommended: FW 209
Available via Ecampus

FW 311, ORNITHOLOGY, 3 Credits
Survey of the adaptations of birds to a diverse array of habitats. Topics include origins, anatomy, reproductive strategies, migration, flight, behavior, physiology, nutrition, and conservation.
Recommended: One year introductory biology.
Available via Ecampus

FW 312, SYSTEMATICS OF BIRDS, 2 Credits
External anatomy, classification of birds of the world, and field identification of birds by sight and song. Field trips required.
Recommended: One year introductory biology.
Available via Ecampus

FW 315, ICHTHYOLOGY, 3 Credits
A survey of the diversity of biological adaptations of fishes. Topics include physiological and zoogeographical adaptations, reproduction, evolution, cladogenesis, morphology, behavior, and genetics.
Equivalent to: FW 313
Recommended: One year introductory biology.
Available via Ecampus

FW 316, SYSTEMATICS OF FISHES, 3 Credits
Phylogenetic diversity, evolution, relationships and identification of the world’s fishes, with particular focus on Oregon fishes. Includes identification, anatomy, use of keys, introduction to the comparative method, systematic theory, taxonomy, field collection and specimen curation. Lec/lab.
Prerequisite: (BI 211 with D- or better or BI 211H with D- or better or BI 221 with D- or better or BI 221H with D- or better or BI 204 with D- or better) and (BI 212 [D-] or BI 212H [D-] or BI 222 [D-] or BI 222H [D-] or BI 205 [D-] and (BI 213 [D-] or BI 213H [D-] or BI 223 [D-] or BI 223H [D-] or BI 206 [D-])
Recommended: FW 315
Available via Ecampus

FW 317, MAMMALOGY, 3 Credits
A survey of the origins, evolution, diversity, and adaptations of mammals to diverse environments. Topics include taxonomy, reproduction, sensory perception, herbivory, population cycles and behavior.
Recommended: One year introductory biology.
Available via Ecampus

FW 318, SYSTEMATICS OF MAMMALS, 2 Credits
A survey of the phylogenetic diversity of the mammals in Oregon from a habitat/community perspective. Identifying, using keys, and measuring specimens will be stressed.
Recommended: One year introductory biology.
Available via Ecampus
FW 320, INTRODUCTORY POPULATION DYNAMICS, 4 Credits
Principles and concepts of population dynamics related to fish and wildlife populations; methods of estimating abundance, mortality, sustainable harvest levels and extinction risk; hands-on introduction to models for population analysis. Lec/lab. 
Prerequisite: BI 370 (may be taken concurrently) with D- or better or BI 370H (may be taken concurrently) with D- or better or BI 371 (may be taken concurrently) with D- or better
Recommended: Introductory statistics and mathematics equivalent to MTH 245 or higher
Available via Ecampus

FW 321, APPLIED COMMUNITY AND ECOSYSTEM ECOLOGY, 3 Credits
Perspectives in community and ecosystem ecology, and their use in management of fisheries and wildlife resource systems. 
Prerequisite: FW 320 (may be taken concurrently) with D- or better
Available via Ecampus

FW 323, MANAGEMENT PRINCIPLES OF PACIFIC SALMON IN THE NORTHWEST, 3 Credits
Explores the nature of the salmon problem in the Northwest. Experts from diverse disciplines describe principles of salmon biology, habitat ecology and management, socioeconomics of direct and indirect users, and government policies. 
Available via Ecampus

FW 324, *FOOD FROM THE SEA, 3 Credits
Where does seafood come from, and how does seafood arrive on a plate? How productive are the world's oceans, and can the oceans continue to produce enough to feed (and employ) the masses? How do different cultures, ethnicities, and regions of the world rely upon food from the sea for daily meals? Food from the Sea is an exploration of the cultural, societal, economic, practical, and environmental features of the protein that feeds billions. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Available via Ecampus

FW 325, *GLOBAL CRISIS IN RESOURCE ECOLOGY, 3 Credits
Historical and contemporary implications of the impacts of burgeoning human populations on rates and patterns of global ecological change. Changes in ecosystem processes and crises of species extinction in the context of cultural and political institutions. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Available via Ecampus

FW 326, INTEGRATED WATERSHED MANAGEMENT, 3 Credits
A comprehensive approach to watershed management, one that includes biophysical, socioeconomic, planning and education related topics. Intended for students interested in the sustainable management of natural resources. 
Recommended: FW 251
Available via Ecampus

FW 328, WILDLIFE CAPTURE AND IMMOBILIZATION, 2 Credits
Manual and chemical restraint methods are covered with an emphasis on darting equipment, animal and human safety, drug pharmacology and species specific recommendations. 
This course is repeatable for 4 credits.
Available via Ecampus

FW 331, ECOLOGY OF MARINE AND ESTUARINE BIRDS, 4 Credits
Focusing on how marine and estuarine birds are adapted for life at sea. Topics include morphology, physiology, foraging ecology, and biogeography as well as introductory oceanography. Field trips.
Recommended: One year introductory biology.

FW 340, *MULTICULTURAL PERSPECTIVES IN NATURAL RESOURCES, 3 Credits
Explores multicultural influences on development of natural resources in the American West. Effects of diverse social values on changes in the physical landscape and biodiversity. (Bacc Core Course)
Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination
Equivalent to: FW 340H
Available via Ecampus

FW 341, FISH AND WILDLIFE LAW ENFORCEMENT, 2 Credits
Introduction to the philosophy, purposes, and methods of enforcing natural resource laws, emphasizing fish and wildlife laws.

FW 345, *GLOBAL CHANGE BIOLOGY, 3 Credits
Global Change Biology is the study of the impact of climate change on natural systems and actions to mitigate (slow) or adapt to climate change. Global climate change is having dramatic effects on natural resources including fish and wildlife populations and their habitats. Students will gain an understanding of the role that natural ecosystems (oceans, forests, wetlands, grasslands etc.) play in regulating the climate; how land use affects the earth’s climate; how climate change will affect fish, wildlife and their habitats; and the role that managers and researchers can play in mitigating and adapting to climate change. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Recommended: Introductory biology and ecology courses such as BI 370

FW 350, *ENDANGERED SPECIES, SOCIETY AND SUSTAINABILITY, 3 Credits
Provides a general background to endangered species biology, and the social and economic implications of the legislation enacted to conserve endangered species (Endangered Species Act, CITES Treaty). (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: FW 251
Available via Ecampus
**FW 356, *CITIZEN SCIENCE, 3 Credits***  
Citizen science involves non-specialists in scientific studies addressing large challenges best solved through collaboration. Citizens contribute data scientists may not otherwise be able to obtain, while improving their understanding of the scientific process, integrating technology into the learning process, and generating new knowledge for society. (Bacc Core Course)  
*Attributes:* CSST – Core, Synthesis, Science/Technology/Society  
*Available via Ecampus*

**FW 360, *ORIGINS OF F&W MANAGEMENT-EVOLUTION, GENETICS, AND ECOLOGY, 3 Credits***  
Examines genetics and human interactions with fisheries and wildlife from an ecological and evolutionary perspective. Basic principles of environmental interactions, and how humans interact with other species and their environments in the disciplines commonly recognized as fisheries, wildlife and conservation sciences. (Baccalaureate Core Course)  
*Attributes:* CSST – Core, Synthesis, Science/Technology/Society  
*Recommended:* Two terms of coursework at OSU  
*Available via Ecampus*

**FW 366, ENVIRONMENTAL CONTAMINANTS IN FISH AND WILDLIFE, 3 Credits***  
Environmental contamination is an important threat to many fish and wildlife populations and the habitats and prey upon which they rely. The field of ecotoxicology links the ecology of fish and wildlife with toxicology of environmental contaminants, and so spans political, scientific, and public relations realms. Through the pairing of introductory concepts with key case studies, this course provides students with a preparatory framework for understanding toxicological issues of importance for those focused on studying, managing or conserving fish and wildlife populations.  
*Prerequisite:* (BI 204 with D- or better or BI 211 with D- or better or BI 211H with D- or better) and (BI 205 [D-] or BI 212 [D-] or BI 212H [D-])  
*Available via Ecampus*

**FW 370, CONSERVATION GENETICS, 4 Credits***  
A foundational course in preparation for a degree in Fisheries and Wildlife or other degrees focused on conservation of natural resources. Covers a broad range of topics associated with issues surrounding genetics that working professionals in the biological sciences should be conversant about. One of the most important aspects of the course is the development of problem-solving and critical-thinking skills.  
*Prerequisite:* (BI 211 with D- or better or BI 211H with D- or better or BI 221 with D- or better or BI 221H with D- or better or BI 204 with D- or better) and (BI 212 [D-] or BI 212H [D-] or BI 222 [D-] or BI 222H [D-] or BI 205 [D-]) and (BI 213 [D-] or BI 213H [D-] or BI 223 [D-] or BI 223H [D-] or BI 206 [D-])  
*Recommended:* One year introductory biology  
*Available via Ecampus*

**FW 391, *RIDGE TO REEF: SUSTAINABLE RESOURCE MANAGEMENT IN PALAU, 4 Credits***  
How do small islands address issues of natural resource management, food security, and sustainability? What role do communities, governments, and non-profits play in addressing these issues? Can traditional ecological knowledge help solve these challenges? What about climate change on small Islands? The Republic of Palau will be our classroom. Students will work with and learn from fishers, farmers, community leaders, traditional chiefs, terrestrial and marine biologists, and policy makers. Key topics include food security/production, climate change adaptation, protected area management, biocultural conservation, sustainable forest management, watershed management, sustainable development, coral reef and fisheries management, biodiversity measurement methods and ecosystem restoration.  
*Attributes:* CSGI – Core, Synth, Global Issues  
*Available via Ecampus*

**FW 401, RESEARCH, 1-16 Credits***  
This course is repeatable for 16 credits.  
*Available via Ecampus*

**FW 403, THESIS, 1-16 Credits***  
This course is repeatable for 32 credits.  
*Available via Ecampus*

**FW 405, READING AND CONFERENCE, 1-16 Credits***  
This course is repeatable for 16 credits.  
*Available via Ecampus*

**FW 407, SEMINAR, 1-16 Credits***  
Graded P/N. Taught at Hatfield Marine Science Center.  
*Equivalent to:* FW 407H  
*Available via Ecampus*

**FW 407H, SEMINAR, 1-16 Credits***  
Graded P/N. Taught at Hatfield Marine Science Center.  
*Attributes:* HNRS – Honors Course Designator  
*Equivalent to:* FW 407  
*Available via Ecampus*

**FW 408, WORKSHOP, 1-16 Credits***  
This course is repeatable for 16 credits.  
*Available via Ecampus*

**FW 410, INTERNSHIP, 1-6 Credits***  
This course is repeatable for 99 credits.  
*Available via Ecampus*

**FW 415, FISHERIES AND WILDLIFE LAW AND POLICY, 3 Credits***  
Provides students with an understanding of the key legal frameworks within which they will work to conserve fish and wildlife resources. Examines federal law and policy relating to allocation and conservation of fish and wildlife resources.  
*Recommended:* PS 201 or other introductory political science course.  
*Available via Ecampus*
FW 418, URBAN ECOLOGY, 3 Credits
Understand how an increasing human population increases pressure on fish and wildlife communities and resources within ecosystems. Examines the interactions between humans and animal species within urban areas and the effects of urbanization on species, communities, and ecosystems. Topics include conserving biodiversity, invasive species, human health and well-being, and urban planning.
Recommended: FW 255, BI 370
Available via Ecampus

FW 419, THE NATURAL HISTORY OF WHALES AND WHALING, 3 Credits
Addresses the natural history of whales as a unique example of adaptation in an evolutionary lineage, and the history of whaling as a general example of the failings of international resource management.
Recommended: Some background in vertebrate ecology and evolution or genetics
Available via Ecampus

FW 421, AQUATIC BIOLOGICAL INVASIONS, 4 Credits
An overview of the background, theory, evolution, ecology, politics and conservation of invasions by introduced species in aquatic environments. Taught at Hatfield Marine Science Center OR online through Ecampus.
Equivalent to: BI 421
Recommended: One year of university-level biology.
Available via Ecampus

FW 422, INTRODUCTION TO OCEAN LAW, 3 Credits
Examination of US law and primary international law focused on fisheries management with coverage of regulation of other ocean resources including energy, marine mammals, endangered species, pollution, and protected areas. Final project is intended to provide students with hands-on exposure to real-world fisheries and ocean management issues.
Available via Ecampus

FW 426, COASTAL ECOLOGY AND RESOURCE MANAGEMENT, 5 Credits
Study of the ecology and management of coastal marine and freshwater ecosystems as well as natural resources, emphasizing experimental (participatory) learning in a field station setting. Lec/lab.

FW 427, PRINCIPLES OF WILDLIFE DISEASES, 4 Credits
Ecological aspects of important diseases affecting North American wildlife will be discussed. Demonstrations will mainly cover migratory birds, carnivores and ruminants. Lec/lab. Ecampus sections do not use lab demonstrations.
Available via Ecampus

FW 433, POPULATION DYNAMICS FOR CONSERVATION, 4 Credits
A synthesis of the principles of population dynamics from the viewpoint of a resource manager. Particular attention is paid to populations structured by age, size, or over space, and considering both fisheries and wildlife management. Laboratory work uses computer programming in the R language to implement examples from lecture.
Prerequisite: (FW 320 with C or better or BI 483 with C or better) and ((MTH 227 with C or better or MTH 228 with C or better) or (MTH 251 with C or better or MTH 252 with C or better))

FW 434, ESTUARINE ECOLOGY, 4 Credits
Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration, management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as FW 434/OC 434 and FW 534/OC 534.
Equivalent to: OC 434
Available via Ecampus

FW 435, WILDLIFE IN AGRICULTURAL ECOSYSTEMS, 3 Credits
Examines the relationships between agricultural production and fish and wildlife populations and communities. Explores the impacts of agricultural practices on fish and wildlife. Field trips required; transportation fee charged. OSU Ecampus students are not required to attend field trips. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: BI 370 and FW 251
Available via Ecampus

FW 439, HUMAN DIMENSIONS OF FISHERIES AND WILDLIFE MANAGEMENT, 3 Credits
Examines the human dimensions of fisheries and wildlife including economics, policy, communications, and management. Focuses on the application of social scientific theories and approaches to fisheries and wildlife issues. Independent and group work with a substantial writing component. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: FW 255, FW 289 and completion of human dimensions coursework
Available via Ecampus

FW 445, ECOLOGICAL RESTORATION, 4 Credits
Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSLISTED as FES 445/FW 445 and FES 545/FW 545.
Equivalent to: FES 445, FOR 445
Recommended: BI 370 or BI 370H
FW 451, AVIAN CONSERVATION AND MANAGEMENT, 3 Credits
Identification, classification, life history strategies, ecology and management of upland and migratory birds.
Recommended: FW 311
Available via Ecampus

FW 452, BIODIVERSITY CONSERVATION IN MANAGED FORESTS, 3 Credits
Designed for students in forestry, wildlife, fisheries and related fields. Introduces the concepts of, and approaches to, managing forest stands, landscapes and regions to achieve desired habitat conditions for indicator species and conservation of biological diversity. CROSSLISTED as FES 452/FW 452.
Equivalent to: FES 452
Recommended: FW 315 with D- or better and FW 320 [D-]
Available via Ecampus

FW 454, ^FISHERY BIOLOGY, 4 Credits
Principles and methods used in studying the biology of fishes; ecological requirements of freshwater and anadromous fishes; principles and practices in sport fishery management. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisite: FW 315 with D- or better and FW 320 [D-]
Available via Ecampus

FW 456, FRESHWATER ECOLOGY AND CONSERVATION, 5 Credits
Physical, chemical, biological, and environmental concepts in continental aquatic systems. Includes techniques related to assessing aquatic resources their management and conservation. Lec/lab.
Prerequisite: BI 370 with D- or better or BI 371 with D- or better
Recommended: 9 credits of upper-division biological sciences
Available via Ecampus

FW 458, MAMMAL CONSERVATION AND MANAGEMENT, 4 Credits
A thorough understanding of the management, conservation, and ecology of mammals in North America; includes population dynamics, harvest management, techniques to determine abundance, diets, reproduction, and the cultural and political variables that contribute to formulation of management programs.
Recommended: 9 credits of upper-division biological sciences
Available via Ecampus

FW 462, ECOSYSTEM SERVICES, 3 Credits
Introduces students to the ecological, economic, and social/ethical issues involved in the study of ecosystem services, with a major focus on biological components involved in ecosystem services. Topics covered include: 1) an introduction to the roles that living organisms play in the provision of ecosystem services, 2) the relationship of ecosystem functions and services, 3) the societal factors that influence this relationship, 4) general categories of ecosystem services, 5) identification of potential ecosystem services in terrestrial and aquatic systems, 6) an overview of the methods of valuation, and 7) translating ecosystems functions to services. Case studies will be used to illustrate key concepts and relationships within different ecological and social contexts.
Recommended: BI 370
Available via Ecampus

FW 464, MARINE CONSERVATION BIOLOGY, 3 Credits
Lectures, group library research, and class debates on current issues regarding the conservation of biodiversity in the sea. Topics include overfishing, invasive species, eutrophication, marine pollution, and global warming, as well as means of addressing these threats.
Prerequisite: BI 370 with D- or better or BI 370H with D- or better
Equivalent to: BI 464

FW 465, MARINE FISHERIES, 4 Credits
A global perspective on commercial fish and shellfish harvesting with emphasis on fishing technology and policy issues. Offered fall term in odd years.
Recommended: FW 315

FW 467, ANTARCTIC SCIENCE AND CONSERVATION, 4 Credits
Explores the history, geology, climate, and ecosystems of Antarctica, with an emphasis on current research and conservation issues. Focuses on critical thinking skills developed through independent research on a topic of interest, an internal peer review project, and discussions of relevant case studies in Antarctic research.
Available via Ecampus

FW 469, METHODS IN PHYSIOLOGY AND BEHAVIOR OF MARINE MEGAFANA, 4 Credits
An in-depth study of marine megafauna (mammals, birds, turtles) with an emphasis on methods and analyses of behavior and physiology for conservation. Lab and field exercises include investigations into the behavior–physiology nexus of diving, migration, thermoregulation, energy expenditure, and mating systems. Research techniques to be explored will include, for example, tracking and remote biotelemetry monitoring technologies, respirometry, genetics, and direct field study observation. Theoretical approaches, field techniques and statistical analyses will help prepare students for a career in fisheries or wildlife science. Lec/lab. Taught at HMSC.
Prerequisite: (BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-] and (BI 213 [C-] or BI 213H [C-] or (BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-]) or (BI 204 [C-] and BI 205 [C-] and BI 206 [C-])
Recommended: FW 302, FW 320, FW 331 and FW 475

FW 470, *ECOLOGY AND HISTORY: LANDSCAPES OF THE COLUMBIA BASIN, 3 Credits
Integrates environmental history and landscape ecology of the Columbia River Basin from geologic origins to the present, to create an understanding of change caused by natural processes and human activities. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: HSTS 470
Recommended: (HST 201 and HST 202 and HST 203) or BI 370
FW 471, ENVIRONMENTAL PHYSIOLOGY OF FISHES, 4 Credits
Principles of the functional biology of fishes with emphasis on environmental interactions and management implications.
Recommended: FW 315 and (BI 370 or BI 371

FW 473, FISH ECOLOGY, 4 Credits
Behavior of fishes as a mode of accommodation to various ecological and evolutionary constraints. Importance of heritable and learned patterns to population and community dynamics. Application of behavioral studies to the solution of management problems. Lec/lab/rec.
Prerequisite: (BI 370 with D- or better or BI 370H with D- or better) and FW 315 [D-]
Available via Ecampus

FW 474, EARLY LIFE HISTORY OF FISHES, 4 Credits
Overview of diversity of development patterns in fishes; emphasis on morphology, life history, and evolution. Offered alternate years.
Recommended: FW 315

FW 475, WILDLIFE BEHAVIOR, 4 Credits
Recommended: 9 credits of upper-division biology.
Available via Ecampus

FW 476, FISH PHYSIOLOGY, 4 Credits
Physiological specializations and adaptations of major groups of fishes.
Prerequisite: FW 315 with D- or better
Available via Ecampus

FW 479, WETLANDS AND RIPARIAN ECOLOGY, 3 Credits
Ecology of riparian freshwater and estuarine wetlands of the Pacific Northwest. Effects of land use on ecosystem structure, function, biodiversity, and restoration will be explored.
Recommended: BI 370 or BI 371
Available via Ecampus

FW 481, WILDLIFE ECOLOGY, 3 Credits
Interrelationships of wildlife, environmental change. Predicting and measuring responses of wildlife to altered habitat conditions
Prerequisite: BI 370 with D- or better or BI 370H with D- or better or BI 371 with D- or better
Available via Ecampus

FW 488, PROBLEM SOLVING IN FISHERIES AND WILDLIFE SCIENCE, 3 Credits
A capstone course designed to introduce students to the synthesis of scientific information on species, habitats and ecosystems and the use of such data in shaping fisheries and wildlife conservation, management and policy. Includes a group problem-solving project and case studies. For FW majors in their senior year.
Prerequisite: FW 320 with D- or better and FW 321 (may be taken concurrently) [D-]
Recommended: 400-level FW course work (e.g., FW 426 or FW 454 or FW 481)
Available via Ecampus

FW 489, EFFECTIVE COMMUNICATIONS IN FISHERIES AND WILDLIFE SCIENCE, 3 Credits
Centers on the synthesis and interpretation of data and effective communication of that information in written and oral communication to diverse audiences including scientists, managers, administrators and the general public.
Available via Ecampus

FW 491, FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE, 3 Credits
Introduction to diseases of fish including pathogens important to aquaculture and ornamental industries as well as to wild fish populations and conservation programs. CROSSTLISTED as FW 491/MB 491 and FW 591/MB 591.
Equivalent to: MB 491
Recommended: 9 credits of upper-division fisheries biology.

FW 493, FIELD METHODS FOR MARINE RESEARCH, 3 Credits
The primary focus is providing hands-on experience in a small class exploring various field sampling methodologies, research planning logistics, and field operations in estuary and nearshore environments. Topics covered include measurement and collection methods, animal handling techniques, equipment care and handling, sampling strategy, experimental design, data management planning and, if possible, small boat work.
Recommended: One year of biology

FW 496, FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE LAB, 2 Credits
This laboratory complements lectures in FW/MB 491/591, with students learning basic necropsy techniques; identification of bacterial, viral and metazoan pathogens; and molecular identification methods. CROSSTLISTED as FW 496/MB 496 and FW 596/MB 596.
Equivalent to: MB 496
Recommended: MB 303 or other upper-division laboratory course.
FW 497, AQUACULTURE, 3 Credits
Principles and practices for the aquaculture of fish, shellfish, and algae.
(Writing Intensive Course.)
Attributes: CWIC – Core, Skills, WIC
Recommended: 9 credits of upper-division biology.
Available via Ecampus

FW 498, AQUACULTURE LABORATORY, 3 Credits
Biology and culture requirements of fish, shellfish, and algae. Emphasis on laboratory culture techniques and practical experience in handling organisms. Taught at Hatfield Marine Science Center.
Recommended: 9 credits of upper-division biology.

FW 499, SPECIAL TOPICS IN FISHERIES AND WILDLIFE, 0-16 Credits
Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.
Equivalent to: ENT 499
This course is repeatable for 16 credits.
Available via Ecampus

FW 501, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

FW 502, TEACHING METHODS IN FISHERIES AND WILDLIFE, 1 Credit
This is a discussion course designed to help new GTAs and instructors who are learning the trials and tribulations of university-level teaching in our department. This is a great course for students who are interested in hearing more about teaching approaches, grading and assessment, student communication, problem students, and development of teaching.
Graded P/N.

FW 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.
Available via Ecampus

FW 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

FW 506, PROJECTS, 1-6 Credits
Projects are synthesis papers or outreach products that are developed with a mentor from campus, a natural resource agency, or the student’s place of employment. The purpose of your project is to contribute to the field of study with a product that reflects the principles and applications learned in your classes.
This course is repeatable for 12 credits.
Available via Ecampus

FW 507, SEMINAR, 1-16 Credits
Selected Topics. Taught at Hatfield Marine Science Center and Corvallis campus.
This course is repeatable for 16 credits.
Available via Ecampus

FW 508, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

FW 510, PROFESSIONAL INTERNSHIP, 1-16 Credits
This course is repeatable for 10 credits.
Available via Ecampus

FW 514, PROFESSIONAL DEVELOPMENT: MEETING COMMUNICATIONS, 1-3 Credits
Fisheries and wildlife professionals use meetings of scientists, managers and stakeholders to communicate key findings and develop consensus recommendations for policy. This experiential learning course exposes students to a scientific or management meeting in their chosen field (fisheries, wildlife, ecology, or conservation biology) and gets them to think about how meetings function as well as their content.
This course is repeatable for 3 credits.
Available via Ecampus

FW 515, FISHERIES AND WILDLIFE LAW AND POLICY, 3 Credits
Provides students with an understanding of the key legal frameworks within which they will work to conserve fish and wildlife resources. Examines federal law and policy relating to allocation and conservation of fish and wildlife resources.
Recommended: PS 201 or other introductory political science course.
Available via Ecampus

FW 518, URBAN ECOLOGY, 3 Credits
Understand how an increasing human population increases pressure on fish and wildlife communities and resources within ecosystems. Examines the interactions between humans and animal species within urban areas and the effects of urbanization on species, communities, and ecosystems. Topics include conserving biodiversity, invasive species, human health and well-being, and urban planning.
Available via Ecampus

FW 519, THE NATURAL HISTORY OF WHALES AND WHALING, 3 Credits
Addresses the natural history of whales as a unique example of adaptation in an evolutionary lineage, and the history of whaling as a general example of the failings of international resource management.
Recommended: Some background in vertebrate ecology and evolution or genetics
Available via Ecampus

FW 521, AQUATIC BIOLOGICAL INVASIONS, 4 Credits
An overview of the background, theory, evolution, ecology, politics and conservation of invasions by introduced species in aquatic environments. Taught at Hatfield Marine Science Center OR online through Ecampus.
Recommended: One year of university-level biology.
Available via Ecampus
**FW 522, INTRODUCTION TO OCEAN LAW, 3 Credits**

Examination of US law and primary international law focused on fisheries management with coverage of regulation of other ocean resources including energy, marine mammals, endangered species, pollution, and protected areas. Final project is intended to provide students with hands-on exposure to real-world fisheries and ocean management issues.  
*Available via Ecampus*

**FW 523, MONITORING WILDLIFE POPULATIONS AND THEIR HABITATS, 3 Credits**

An overview of monitoring plan design and the conceptual background needed to understand and critique monitoring plans, and have the basic skills to develop and implement a monitoring program as part of an interdisciplinary team.  
*Recommended: Introductory course in statistics and introductory course in ecology.*  
*Available via Ecampus*

**FW 524, INTRODUCTION TO FISHERIES ASSESSMENT, 3 Credits**

Fisheries management strategies rely on models that predict a population’s responses to exploitation. This course introduces approaches commonly used to assess and evaluate the dynamics and status of a population. Provides an overview of the terminology, data requirements, underlying rationale, assumptions, limitations and uncertainty associated with stock assessments.  
*Recommended: College algebra, introductory statistics and, if unfamiliar with data collection and analysis methods in fisheries, FW 454/554*  
*Available via Ecampus*

**FW 526, COASTAL ECOLOGY AND RESOURCE MANAGEMENT, 5 Credits**

Study of the ecology and management of coastal marine and freshwater ecosystems as well as natural resources, emphasizing experimental (participatory) learning in a field station setting. Lec/lab.  

**FW 527, PRINCIPLES OF WILDLIFE DISEASES, 4 Credits**

Ecological aspects of important diseases affecting North American wildlife will be discussed. Demonstrations will mainly cover migratory birds, carnivores and ruminants. Lec/lab. Ecampus sections do not use lab demonstrations.  
*Available via Ecampus*

**FW 528, DIVERSITY AND IDENTIFICATION OF LARVAL FISHES, 3 Credits**

Research on early life history stages of fishes has increased considerably in recent years, due to its importance in many research fields, such as fisheries science and oceanography, species conservation, systematics and morphology. Simultaneously, the ability to identify ichthyoplankton has decreased. This course is intended to provide students with an understanding of the evolutionary diversity of ichthyoplankton of the world.  
*Recommended: A completed 300-level systematics of fishes, ichthyology or comparative anatomy course.*  
*Available via Ecampus*

**FW 529, ICHTHYOPLEKTON IDENTIFICATION LABORATORY, 2 Credits**

Larval fishes are important in many research fields, and are part of many natural history collections. However, often museums are unable to provide the curatorial needs due to the lack of trained personnel. The lab will provide students with the necessary practical skills to identify larval fishes. Distinctive from the course 528, where students learn about the diversity and evolution of larval fish characters, the laboratory is designed to the identification of larvae from a real collection. Students are encouraged to bring unidentified ichthyoplankton samples or mixed species lots to the course to help with their identification.  

**FW 533, POPULATION DYNAMICS FOR CONSERVATION, 4 Credits**

A synthesis of the principles of population dynamics from the viewpoint of a resource manager. Particular attention is paid to populations structured by age, size, or over space, and considering both fisheries and wildlife management. Laboratory work uses computer programming in the R language to implement examples from lecture.  
*Prerequisite: IB 592 with C or better*  
*Recommended: (MTH 227 and MTH 228) or (MTH 251 and MTH 252)*

**FW 534, ESTUARINE ECOLOGY, 4 Credits**

Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration, management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as FW 434/OC 434 and FW 534/OC 534.  
*Equivalent to: OC 534*  
*Available via Ecampus*

**FW 535, WILDLIFE IN AGRICULTURAL ECOSYSTEMS, 3 Credits**

Examines the relationships between agricultural production and fish and wildlife populations and communities. Explores the impacts of agricultural practices on fish and wildlife. Field trips required, transportation fee charged. OSU Ecampus students are not required to attend field trips.  
*Recommended: BI 370 and FW 251*  
*Available via Ecampus*
FW 537, STRUCTURED DECISION MAKING
IN NATURAL RESOURCE MANAGEMENT, 2 Credits
Structured decision making (SDM) is used for making natural resource management and policy decisions. It is an ideal framework for interdisciplinary teams to cooperate and identify the most effective management strategies. Graduate students from diverse backgrounds (natural resources, political science, others) are provided with an understanding of the SDM process.
Recommended: One year of college-level mathematics and one quarter of fish and wildlife management
Available via Ecampus

FW 538, STRUCTURED DECISION MAKING
IN NATURAL RESOURCE MANAGEMENT LAB, 2 Credits
Students who are taking or have taken FW 537 are provided with the understanding of and ability to employ the techniques needed to build models that are used during the structured decision-making process. The laboratory emphasizes the use of graphical models and basic statistical techniques for building decision-making models. Lec/lab.
Prerequisite: FW 537 (may be taken concurrently) with D- or better

FW 544, QUANTITATIVE DECISION
ANALYSIS FOR FISH AND WILDLIFE
MANAGEMENT, 4 Credits
Decision analysis allows decision makers to examine the expected effects of different strategies before implementation; incorporate multiple objectives and values of stakeholders; determine the relative influence of various sources of uncertainty; and estimate the value of collecting additional data. Quantitatively oriented graduate students in natural resources are provided with an in-depth overview of decision analysis and adaptive management, emphasizing animal population management. Lec/lab.
Recommended: ST 511 and ST 512 or equivalent, basic background in animal population dynamics and management.

FW 545, ECOLOGICAL RESTORATION, 4 Credits
Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSLISTED as FES 445/FW 445 and FES 545/FW 545.
Equivalent to: FES 545, FOR 545
Recommended: BI 370 or BI 370H

FW 549, HISTORY OF FISHERIES
SCIENCE, 3 Credits
Surveys the development of fisheries science, professionalization of the discipline, patronage, and the political, economic, and social context in which fisheries science operates.
Available via Ecampus

FW 550, TROPHIC CASCADES, 2-3 Credits
Theory and empirical analysis of terrestrial carnivore effects on plants and ecosystems as mediated through herbivores. Emphasis on large carnivores, frequency/strength of trophic cascades, implications for ecosystem function, management, and restoration. Lectures, current literature, discussions, field exercise, term paper, and student presentations. CROSSLISTED as FES 550/FW 550.
Equivalent to: FES 550, FOR 547, FW 547
This course is repeatable for 3 credits.

FW 551, AVIAN CONSERVATION AND
MANAGEMENT, 3 Credits
Identification, classification, life history strategies, ecology and management of upland and migratory birds.
Recommended: FW 311 or equivalent course work.
Available via Ecampus

FW 552, FOREST WILDLIFE HABITAT
MANAGEMENT, 4 Credits
Management of terrestrial vertebrates in forest ecosystems. Effects on silvicultural practices and landscape pattern on habitats and populations. CROSSLISTED as FES 552/FW 552.
Equivalent to: FES 552
Recommended: FOR 341 or equivalent course in ecology.
Available via Ecampus

FW 554, FISHERY BIOLOGY, 4 Credits
Principles and methods used in studying the biology of fishes; ecological requirements of freshwater and anadromous fishes; principles and practices in sport fishery management.
Recommended: FW 315 and FW 320
Available via Ecampus

FW 556, FRESHWATER ECOLOGY AND
CONSERVATION, 5 Credits
Physical, chemical, biological, and environmental concepts in continental aquatic systems. Includes techniques related to assessing aquatic resources their management and conservation. Lec/lab.
Recommended: BI 370 or BI 371 or 9 credits of upper-division biological sciences
Available via Ecampus

FW 558, MAMMAL CONSERVATION AND
MANAGEMENT, 4 Credits
A thorough understanding of the management, conservation, and ecology of mammals in North America; includes population dynamics, harvest management, techniques to determine abundance, diets, reproduction, and the cultural and political variables that contribute to formulation of management programs.
Recommended: 9 credits of upper-division biological sciences.
Available via Ecampus
FW 560, PSYCHOLOGY OF ENVIRONMENTAL DECISIONS, 3 Credits
Natural resource management and conservation programs have one thing in common: to be effective, they must consider how and why humans make decisions. This course approaches this topic from a psychological lens and will cover the psychological processes associated with making individual and group decisions, common biases and heuristics in our decision-making, and how these apply to diverse natural resource management and conservation issues. Students will learn how to take these aspects of human decision making into consideration when participating in or facilitating collaborative environmental programs.
Available via Ecampus

FW 562, ECOSYSTEM SERVICES, 3 Credits
Introduces students to the ecological, economic, and social/ethical issues involved in the study of ecosystem services, with a major focus on biological components involved in ecosystem services. Topics covered include: 1) an introduction to the roles that living organisms play in the provision of ecosystem services, 2) the relationship of ecosystem functions and services, 3) the societal factors that influence this relationship, 4) general categories of ecosystem services, 5) identification of potential ecosystem services in terrestrial and aquatic systems, 6) an overview of the methods of valuation, and 7) translating ecosystems functions to services. Case studies will be used to illustrate key concepts and relationships within different ecological and social contexts.
Recommended: BI 370 or equivalent course work.
Available via Ecampus

FW 563, CONSERVATION BIOLOGY OF WILDLIFE, 3 Credits
Overview of the field of conservation biology with emphasis on the relationship to conservation and management of wildlife.
Available via Ecampus

FW 564, MARINE CONSERVATION BIOLOGY, 3 Credits
Lectures, group library research, and class debates on current issues regarding the conservation of biodiversity in the sea. Topics include overfishing, invasive species, eutrophication, marine pollution, and global warming, as well as means of addressing these threats.
Equivalent to: BI 370 or BI 370H

FW 565, MARINE FISHERIES, 4 Credits
A global perspective on commercial fish and shellfish harvesting with emphasis on fishing technology and policy issues. Offered fall term in odd years.
Recommended: FW 315

FW 567, ANTARCTIC SCIENCE AND CONSERVATION, 4 Credits
Explores the history, geology, climate, and ecosystems of Antarctica, with an emphasis on current research and conservation issues. Focuses on critical thinking skills developed through independent research on a topic of interest, an internal peer review project, and discussions of relevant case studies in Antarctic research.
Available via Ecampus

FW 569, BEHAVIOR AND PHYSIOLOGY OF MARINE MEGAFANA, 4 Credits
An in-depth study of marine megafauna (mammals, birds, turtles) with an emphasis on methods and analyses of behavior and physiology for conservation. Lab and field exercises include investigations into the behavior–physiology nexus of diving, migration, thermoregulation, energy expenditure, and mating systems. Research techniques to be explored will include, for example, tracking and remote biotelemetry monitoring technologies, respirometry, genetics, and direct field study observation. Theoretical approaches, field techniques and statistical analyses will help prepare students for a career in fisheries or wildlife science. Lec/lab. Taught at HMSC.
Recommended: FW 302, FW 320, FW 331, and FW 475

FW 570, ECOLOGY AND HISTORY: LANDSCAPES OF THE COLUMBIA BASIN, 3 Credits
Integrates environmental history and landscape ecology of the Columbia River Basin from geologic origins to the present, to create an understanding of change caused by natural processes and human activities.
Equivalent to: HSTS 570
Recommended: (HST 201 and HST 202 and HST 203) or BI 370

FW 571, ENVIRONMENTAL PHYSIOLOGY OF FISHES, 4 Credits
Principles of the functional biology of fishes with emphasis on environmental interactions and management implications.
Recommended: FW 315 and (BI 370 or BI 371)

FW 573, FISH ECOLOGY AND CONSERVATION, 4 Credits
Behavior of fishes as a mode of accommodation to various ecological and evolutionary constraints. Importance of heritable and learned patterns to population and community dynamics. Application of behavioral studies to the solution of management problems.
Recommended: BI 370 and FW 315
Available via Ecampus

FW 574, EARLY LIFE HISTORY OF FISHES, 4 Credits
Overview of diversity of development patterns in fishes; emphasis on morphology, life history, and evolution. Offered alternate years. CROSSLISTED as FW 574/OC 574.
Equivalent to: OC 574
Recommended: FW 315

FW 575, WILDLIFE BEHAVIOR, 4 Credits
Equivalent to: FW 585
Recommended: 9 credits of upper-division biology.
Available via Ecampus

FW 576, FISH PHYSIOLOGY, 4 Credits
Physiological specializations and adaptations of major groups of fishes.
Recommended: FW 315
Available via Ecampus
FW 579, WETLANDS AND RIPARIAN ECOLOGY, 3 Credits
Ecology of riparian freshwater and estuarine wetlands of the Pacific Northwest. Effects of land use on ecosystem structure, function, biodiversity, and restoration will be explored.
Recommended: BI 370 or BI 371
Available via Ecampus

FW 580, STREAM ECOLOGY, 3 Credits
Structure and function of stream ecosystems, with emphasis on biological processes; physical and chemical relations; riparian influences and landscape perspectives.
Recommended: 9 credits of upper-division science.
Available via Ecampus

FW 581, WILDLIFE ECOLOGY, 3 Credits
Interrelationships of wildlife, environment and humans. Evaluation of properties and habitats of wildlife populations.
Recommended: (BI 370 or BI 371) and FW 311 and FW 320 and ST 351
Available via Ecampus

FW 583, SPECIES RECOVERY PLANNING AND RESTORATION, 3 Credits
The importance of communication in science is stressed and a broad knowledge of endangered species-related information is provided. Students develop the ability to critically evaluate published information in scientific literature and to present and summarize it as part of the collaborative species recovery planning process with a varied audience of stakeholders.
Recommended: FW 563 and FW 573
Available via Ecampus

FW 591, FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE, 3 Credits
Introduction to diseases of fish including pathogens important to aquaculture and ornamental industries as well as to wild fish populations and conservation programs. CROSSLISTED as FW 491/MB 491 and FW 591/MB 591.
Equivalent to: MB 591
Recommended: 9 credits of upper-division fisheries biology.

FW 596, FISH DISEASES IN CONSERVATION BIOLOGY AND AQUACULTURE LAB, 2 Credits
This laboratory complements lectures in FW/MB 491/591, with students learning basic necropsy techniques; identification of bacterial, viral and metazoan pathogens; and molecular identification methods. CROSSLISTED as FW 496/MB 496 and FW 596/MB 596.
Equivalent to: MB 596
Recommended: MB 303 or other upper-division laboratory course.

FW 597, AQUACULTURE, 3 Credits
Principles and practices for the aquaculture of fish, shellfish, and algae.
Recommended: 9 credits of upper-division biology.
Available via Ecampus

FW 598, AQUACULTURE LABORATORY, 3 Credits
Biology and culture requirements of fish, shellfish, and algae. Emphasis on laboratory culture techniques and practical experience in handling organisms. Taught at Hatfield Marine Science Center.
Recommended: 9 credits of upper-division biology.

FW 599, SPECIAL TOPICS IN FISHERIES AND WILDLIFE, 0-16 Credits
Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.
Equivalent to: ENT 499
This course is repeatable for 99 credits.

FW 601, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

FW 603, THESIS, 1-16 Credits
This course is repeatable for 99 credits.
Available via Ecampus

FW 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

FW 606, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

FW 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

FW 620, ECOLOGICAL POLICY, 3 Credits
Policy issues associated with ecosystem management, risk assessment, biological diversity, ecosystem health, sustainability, invasive species, bioregionalism, globalization and transnational factors, and rights, ethics, and morals.
Recommended: Background in natural resources, environmental sciences, ecological sciences, ecological economics, political science, or similar discipline.
Available via Ecampus

FW 661, ANALYSIS OF ANIMAL POPULATIONS, 5 Credits
Quantitative methods for estimating parameters (abundance, survival, population stability) of animal populations. Emphasis is on vertebrate animals and statistical methods of hypothesis testing, parameter estimation, and inference testing. Offered odd-numbered years.
Recommended: ST 511 and ST 512 or equivalent

FW 699, SPECIAL TOPICS IN FISHERIES AND WILDLIFE, 1-4 Credits
Various topics in fisheries science and wildlife science. Taught at Hatfield Marine Science Center and Corvallis campus.
This course is repeatable for 8 credits.
FW 808, WORKSHOP, 1-16 Credits
Horticulture (HORT)
HORT 112, INTRODUCTION TO HORTICULTURAL SYSTEMS, PRACTICES AND CAREERS, 2 Credits
Overview of horticultural systems and practices, with an emphasis on the Pacific Northwest. Exploration of career opportunities in horticulture. Includes viticulture, environmental landscaping, turf management, greenhouse and nursery production, farming, education, and research. Required field trips. Available via Ecampus

HORT 199, SPECIAL TOPICS, 1-16 Credits
Equivalent to: HORT 199H
This course is repeatable for 16 credits.

HORT 199H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: HORT 199
This course is repeatable for 16 credits.

HORT 212, INTRODUCTION TO ORGANIC AGRICULTURAL SYSTEMS, 4 Credits
An introduction to organic agricultural systems with a focus on history, regulations, principles and practices, performance, trends, and careers. Available via Ecampus

HORT 217, *SOCIAL IMPACTS OF SCIENCE, 3 Credits
Contemporary societies provide funding for scientific research, at the same time they struggle with existing and emerging societal problems. This course will discuss how social problems can be addressed by science and technology, and how the impacts of research are quantified. (Bacc Core Course)
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Available via Ecampus

HORT 226, LANDSCAPE PLANT MATERIALS I: DECIDUOUS HARDWOODS AND CONIFERS, 4 Credits
Identification of trees, shrubs, vines, and ground covers used in landscape horticulture. Basic plant taxonomy, nomenclature, anatomy, and use of plants in the landscape. Diverse plant material covered with an emphasis on deciduous hardwoods and conifers. Available via Ecampus

HORT 228, LANDSCAPE PLANT MATERIALS II: SPRING FLOWERING TREES AND SHRUBS, 4 Credits
Identification of trees, shrubs, vines, and ground covers used in landscape horticulture. Basic plant taxonomy, nomenclature, anatomy, and use of plants in the landscape. Diverse plant material covered with an emphasis on spring flowering trees and shrubs. Lec/rec. Available via Ecampus

HORT 251, TEMPERATE TREE FRUIT, BERRIES, GRAPES, AND NUTS, 2 Credits
Covers fruit and nut crops for temperate zones. Emphasis placed on scientific and common names, plant adaptation, basic morphology, major cultivars, and markets. Offered alternate years.

HORT 255, HERBACEOUS ORNAMENTAL PLANT MATERIALS, 3 Credits
Identification and culture of herbaceous plants used in the landscape. Offered via Ecampus only. Available via Ecampus

HORT 260, ORGANIC FARMING AND GARDENING, 3 Credits
Organic farming and gardening methods are discussed in class and practiced in the field. The philosophical background of organic farming as well as the biological, environmental and social factors involved in organic food production are covered. Emphasis is on hands-on application of scientific principles to create sustainable food production systems. Lec/lab. Available via Ecampus

HORT 270, INTRODUCTION TO THERAPEUTIC HORTICULTURE, 2 Credits
An introduction to the history, benefits, and methods of therapeutic horticulture. Surveys program models for vocational, social/recreational, wellness and therapeutic applications of horticulture.

HORT 271, TECHNIQUES AND ADAPTIVE STRATEGIES IN THERAPEUTIC HORTICULTURE, 2 Credits
An introduction to the characteristics of therapeutic gardens. Survey of year-round, indoor and outdoor therapeutic horticultural programming adaptations, strategies and techniques for different special populations.
Prerequisite: HORT 270 with D- or better

HORT 272, BASIC THERAPEUTIC SKILLS I, 2 Credits
The assessment and evaluation process in therapeutic horticulture. Development of communication strategies, helping skills, and horticultural skills for therapeutic situations.
Prerequisite: HORT 271 with D- or better

HORT 273, BASIC THERAPEUTIC SKILLS II, 2 Credits
Assessment and documentation tools in therapeutic horticulture. Treatment issues related to different types of physical and mental issues. Conduct and evaluate therapeutic horticultural activity sessions.
Prerequisite: HORT 272 with D- or better

HORT 274, THERAPEUTIC HORTICULTURAL PROGRAMS FOR OLDER ADULTS/CHILDREN, 2 Credits
Benefits and applications of therapeutic horticulture to older adults and special needs children.
Prerequisite: HORT 273 with D- or better
HORT 275, THERAPEUTIC GARDEN DESIGN, MAINTENANCE AND PROGRAMMING, 2 Credits
The history, characteristics and design of the therapeutic garden. The use of the garden in therapeutic horticultural programming.
Prerequisite: HORT 274 with D- or better and HORT 280 [D-]

HORT 283, INTRODUCTION TO URBAN AGRICULTURE, 3 Credits
Focuses on the adaption of agricultural principles to the urban environment, specifically the production of plant crops. Topics include: (I) urban environments and infrastructure, (II) urban crop production practices, (III) urban markets and farm management. Exposes students to the breadth of items that they should consider in order to be a successful urban grower.
Recommended: General background or previous coursework in agriculture
Available via Ecampus

HORT 285, PERMACULTURE DESIGN AND THEORY: CERTIFICATE COURSE, 4 Credits
Permaculture design course meets internationally recognized standards for certification. Lectures, hands-on activities, experiential learning, group discussions, readings, student projects and presentations. Two mandatory weekend days. Design intensive, utilizing graphic and verbal presentation skills. Research into other functioning permaculture systems through literature, websites, and as observed on field trips. Lec/lab.
This course is repeatable for 8 credits.
Available via Ecampus

HORT 299, SPECIAL TOPICS, 0-16 Credits
Equivalent to: HORT 299H
This course is repeatable for 16 credits.

HORT 299H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: HORT 299
This course is repeatable for 16 credits.

HORT 300, CROP PRODUCTION IN PACIFIC NORTHWEST AGROECOSYSTEMS, 4 Credits
Relation of crop production to human culture and the natural environment. Origins of agriculture and the processes of agricultural change, and productivity and sustainability of specific crop production systems in the Pacific Northwest. History, geography, resource requirements, and key challenges faced are presented. Fundamental crop production practices in relation to productivity and sustainability. Lec/lab/rec. CROSSLISTED as CROP 300/HORT 300.
Equivalent to: CROP 300, CSS 300
Recommended: One year of general biology
Available via Ecampus

HORT 301, GROWTH AND DEVELOPMENT OF HORTICULTURAL CROPS, 3 Credits
Gain fundamental knowledge of plant growth and development of horticultural crops from a micro- to macro-level starting at double fertilization through fruit growth–covering seed-to-seed. The last section specifically examines how environmental factors affect growth and development. Lec/lab.
Recommended: General biology or botany sequence.
Available via Ecampus

HORT 303, HORTICULTURAL PROJECTS, 2 Credits
Student-managed crop production projects with emphasis on container grown, greenhouse crops. Crop scheduling, propagation and planting, selecting temperature and lighting regimes, specifying growth regulator applications, nutrient management, irrigation management, pest monitoring, and problem diagnosis and correction.
Recommended: HORT 301

HORT 306, INPUTS IN ORGANIC CROPPING SYSTEMS: SOURCING AND EFFICACY, 2 Credits
Applied course focused on the regulation, sourcing, and efficacy of organic inputs including soil amendments, fertilizers, and pesticides. Gain experience using science-, practice-, and regulation-based information to source and determine effectiveness of inputs in certified organic cropping systems.
Prerequisite: HORT 212 with C- or better and CROP 355 [C-]

HORT 307, ORGANIC SYSTEM PREDICAMENTS, 3 Credits
Analyze controversial organic agriculture and systems issues while developing critical- and systems-thinking skills. Synthesis of information from diverse sources and application of scientific knowledge will be required to recommend possible solutions to real world organic agriculture predicaments.
Available via Ecampus

HORT 308, WEED MANAGEMENT IN ORGANIC CROPPING SYSTEMS, 3 Credits
Applied organic weed identification and management course. Learn real-world application of science-, practice-, and regulation-based weed management information while designing and evaluating organic weed management plans for certified organic farming systems.
Available via Ecampus

HORT 310, PRINCIPLES OF PLANT PROPAGATION, 3 Credits
Plant propagation is the regeneration of plants using vegetative plant parts or seeds to maintain the desired genetic makeup. Theory and principles of horticultural and physiological concepts applicable for laboratory, greenhouse, nursery, field, and orchard propagators.
Prerequisite: HORT 301 with D- or better
Available via Ecampus
HORT 311, PLANT PROPAGATION, 4 Credits
The regeneration of plants from vegetative and reproductive tissue and organs. Horticultural and physiological principles, methods, and techniques for laboratory, greenhouse nursery, field, and orchard. 
Prerequisite: HORT 301 with D- or better
Available via Ecampus

HORT 314, PRINCIPLES OF TURFGRASS MAINTENANCE, 4 Credits
Identification and adaptation of common turfgrasses. Physiology of turfgrass growth and response to cultural and environmental stresses. Cultural practices including establishment, general maintenance, and pest control. Field trips required. 
Recommended: (CSS 205 or CSS 305 or SOIL 205)
Available via Ecampus

HORT 315, SUSTAINABLE LANDSCAPES: MAINTENANCE, CONSERVATION, RESTORE, 4 Credits
Sustainable care and maintenance practices for non-turf landscape areas. Low input pruning, planting, fertilization, and pest control with an emphasis on IPM. Plant responses to stress, particularly those encountered in the urban environment. Outdoor labs required. 
Recommended: Basic knowledge of plant physiology
Available via Ecampus

HORT 316, PLANT NUTRITION, 4 Credits
Basic concepts and principles of plant mineral nutrition that provide a basis for solving practical nutritional problems in horticultural crops. Areas covered include mineral nutrients, nutrient availability in the soil and plant uptake, nutrient deficiencies and toxicities and their causes and remedies, and plant and soil analysis. Lec/lab/rec. 
Prerequisite: CSS 205 with D- or better or CSS 305 with D- or better or SOIL 205 with D- or better
Available via Ecampus

HORT 318, APPLIED ECOLOGY OF MANAGED ECOSYSTEMS, 3 Credits
Survey of ecological processes in managed ecosystems emphasizing ecological management techniques. Ecosystem services; biodiversity management; weed dynamics; agroecology; urban ecology; restoration and mitigation; landscape management. Field trip required. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Available via Ecampus

HORT 319, RESTORATION HORTICULTURE, 3 Credits
As world population increases to some 9 billion plus by 2044, the importance of ecologically sound horticultural practices becomes increasingly apparent. Integration of ecological concepts and theory in management and development of created landscapes is critical for the preservation of many ecological services currently provided by undeveloped areas. Offered via Ecampus only. 
Recommended: WR 121 with proficiency in writing skills and ability to communicate through writing. Basic ecology course or practical experience providing understanding of ecological principals and concepts
Available via Ecampus

HORT 330, *PLAGUES, PESTS, AND POLITICS, 3 Credits
Integration and interaction of agricultural and public health aspects of entomology in society and history. CROSSLISTED as ENT 300/HORT 330. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: BI 300, ENT 300
Available via Ecampus

HORT 331, POLLINATORS IN PERIL, 3 Credits
Pollinators, human influences on pollination systems, and the potential consequences of pollinator decline. An introduction to the skills needed to investigate media reports and multidisciplinary scientific research. Effects of pesticides, habitat fragmentation, climate change, invasive species, pests, pathogens, and other threats to pollinators in critical natural and agricultural systems around the world. 
Equivalent to: ENT 331
Recommended: Completion of a Baccalaureate Core biological science course.
Available via Ecampus

HORT 344, INSECT AND DISEASE MANAGEMENT IN ORGANIC CROPPING SYSTEMS, 3 Credits
A skills-based course on the science, practice, and regulations related to insect and disease management in organic cropping systems. 
Prerequisite: BOT 350 with C- or better and ENT 311 [C-]
This course is repeatable for 3 credits.
Available via Ecampus

HORT 349, DIAGNOSING PLANT PROBLEMS, 3 Credits
Basic principles of problem diagnosis in crop, garden, and landscape plants are covered. Problems caused by cultural and environmental issues, plant diseases, insect pests, and other causes are addressed. Students will gain familiarity with resources for plant problem diagnosis. Offered via Ecampus only. 
Recommended: Background in basic biology, plant pathology and/or entomology from a university or practical setting
HORT 350, URBAN FORESTRY, 3 Credits
Introduction to principles and practices of planting and managing trees as a system of urban environment; understanding the economic, environmental, social aspects of urban forests, and an overview of contemporary land use issues and societal perspectives between people and plants. CROSSLISTED as FES 350/HORT 350.
Equivalent to: FES 350, FOR 350
Recommended: Foundational forestry and horticulture courses
Available via Ecampus

HORT 351, FLORICULTURE AND GREENHOUSE SYSTEMS, 4 Credits
For students interested in growing plants in commercial or educational greenhouses. Actively explores the production and scheduling of floriculture crops for various markets. Combines the practical aspects of growing floral crops under environments created by traditional and technologically advanced greenhouses. Greenhouse structures and crop environment manipulation will be emphasized. Students actively manage a floriculture crop and are responsible for developing and implementing production schedules, and for making key decisions on the culture of diverse floral crops.
Recommended: HORT 301

HORT 358, LANDSCAPE CONSTRUCTION TECHNIQUES, 4 Credits
Study of landscape construction process from initial site analysis to finished landscape. Techniques used in building hardscape and landscape areas. Field trips required. Lec/lab.

HORT 360, IRRIGATION AND DRAINAGE, 4 Credits
Familiarizes students with the principles and practices of irrigation and drainage systems. Optimum use of water, irrigation and drainage system design, installation, repairs, and troubleshooting are emphasized. Lec/lab.
Prerequisite: CSS 305 with D- or better or SOIL 205 with D- or better or (SOIL 205 with D- or better

HORT 361, PLANT NURSERY SYSTEMS, 4 Credits
Covers how to grow shrubs and trees, and herbaceous annuals and perennials in nurseries for use in urban landscapes and managed ecosystems such as forestry and restoration. Plant nursery systems are diverse and require intensive management involving a dynamic decision making process. This course actively explores field and container production systems as well as the marketing of plants, an overview of plant growth regulation and post-production handling, the influence of efficient production practices on plant quality, integrating pest management strategies, and natural resource utilization.
Recommended: HORT 301

HORT 380, SUSTAINABLE LANDSCAPE DESIGN, 3 Credits
The assessment of design problems/situations, the development of solutions and the communication of those solutions to the client through the design. Specific topics include designing for ecosystem maintenance/enhancement, introduction to computer-aided design (CAD), using color in landscape designs and rendering section/elevation views.

HORT 399, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

HORT 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

HORT 402, INDEPENDENT STUDY, 1-16 Credits
This course is repeatable for 16 credits.

HORT 403, THESIS, 1-16 Credits
This course is repeatable for 16 credits.

HORT 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: HORT 405H
This course is repeatable for 16 credits.

HORT 405H, READING AND CONFERENCE, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: HORT 405
This course is repeatable for 16 credits.

HORT 406, PROJECTS: DATA PRESENTATIONS, 1 Credit
For any student doing research, to learn to develop and evaluate poster and slide presentations containing scientific data. Students are exposed to a variety of scientific disciplines as they prepare and critique their own and other students’ posters and oral presentations. Students improve written and oral communication skills. Letter grade is based on participation, improvement, and the quality of a final poster project and oral presentation. Offered winter term. CROSSLISTED as BRR 406/HORT 406.
Equivalent to: BRR 406

HORT 407, SEMINAR, 1 Credit
Equivalent to: CROP 407, SOIL 407
Available via Ecampus

HORT 408, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

HORT 409, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

HORT 410, INTERNSHIP, 1-12 Credits
Work internship to acquaint horticulture majors with the practices of the horticulture industry. Under direction of departmental internship committee. Requires approved statement of intent, submission of employer and employee evaluation forms and written report. This course is repeatable for 12 credits.
Available via Ecampus
HORT 411, HORTICULTURE BOOK CLUB, 1 Credit
Reading and discussion of noteworthy books and associated topics relating to agriculture, society and the environment.
*This course is repeatable for 2 credits.*

HORT 412, CAREER EXPLORATION: INTERNSHIPS AND RESEARCH PROJECTS, 1 Credit
Provides orientation to the horticulture major internship and research project requirement. Covers procedures for selecting, performing, and reporting on an internship or research project. Includes guidance and skill development valuable in the pursuit of horticultural career goals, such as cover letter and resume preparation and interviewing experience.
Available via Ecampus

HORT 414, PRECISION AGRICULTURE, 4 Credits
Provides insight into the technology available to support precision agriculture and data management planning applications. Examines the concepts and applications of precision agriculture to teach practical use of hardware, equipment and software. An overview of current technology including autonomous vehicles, GPS, soil and crop proximal sensors, imagery and mapping, variable rate control systems, and yield monitors.
Lec/lab. CROSSTRAED as CROP 414/HORT 414.
Equivalent to: CROP 414
Available via Ecampus

HORT 418, GOLF COURSE MAINTENANCE, 4 Credits
Basic aspects of golf course maintenance under temperate zone conditions. Lec/lab.
Recommended: HORT 314

HORT 421, HERBS, SPICES, AND MEDICINAL PLANTS, 3 Credits
Principles of crop ecology, morphology, chemistry and utilization of natural products of herbs, spices, and medicinal plants (HSMP). Examines the history and importance of HSMP, their historic and modern uses, current market trends, botany, collection in the wild, fundamentals of production systems for HSMP, harvesting, drying, and other postharvest operations, natural products and their uses, regulations and legal concerns of herbal products.
Recommended: CROP 200 or equivalent horticulture course
Available via Ecampus

HORT 433, SYSTEMATICS AND ADAPTATION OF VEGETABLE CROPS, 4 Credits
Covers the botanical and taxonomic relationships, breeding systems and adaptation of vegetable crops. Fresh material is used to illustrate varietal differences and traits of importance. Lec/lab. Offered even years. CROSSTRAED as CROP 433/HORT 433 and CROP 533/HORT 533.
Prerequisite: BI 102 with D- or better or BI 213 with D- or better or BI 213H with D- or better or BI 223 with D- or better or BI 223H with D- or better or BI 311 with D- or better or BI 311H with D- or better or HORT 430 with D- or better or HORT 450 with D- or better or HORT 450 with D- or better or SS 330 with D- or better or PBG 430 with D- or better or PBG 450 with D- or better
Equivalent to: CROP 433

HORT 444, INSECT AGROECOLOGY, 3 Credits
Agroecology incorporates ecological concepts and principles to the design and management of sustainable agricultural systems. Topics include: the role of insects in sustainable agricultural systems; application of the principles of insect ecology to better manage insect pests and maximize crop yield; conserving beneficial insects and other natural resources in agroecosystems and the surrounding landscape. CROSSTRAED as ENT 444/HORT 444 and ENT 544/HORT 544.
Equivalent to: ENT 444
Recommended: General background or previous course work in entomology.

HORT 447, ARBORICULTURE, 4 Credits
The principles and practices of arboriculture, the art and science of selecting, planting, establishing and maintaining trees in urban, suburban, commercial and residential landscapes. CROSSTRAED as FES 447/HORT 447 and ENT 447/HORT 447.
Equivalent to: FES 447, FOR 447
Recommended: (FES 141 or FES 241 or HORT 226 or HORT 228) and (FOR 111 or HORT 112)
Available via Ecampus

HORT 451, TREE FRUIT PHYSIOLOGY AND CULTURE, 4 Credits
Plant growth and development in relation to tree fruit production; emphasis on canopy development and pruning theory, flowering and fruit set, and development, dormancy, and cold acclimation. Field trips required.
Recommended: Completion or concurrent enrollment in HORT 301 and BOT 331

HORT 452, BERRY AND GRAPE PHYSIOLOGY AND CULTURE, 4 Credits
Production of wine grapes, caneberrries, strawberries, blueberries, and other miscellaneous berry crops. Emphasis on plant growth and development; pruning and training systems; flower and fruit development and cultivars. Field trips required. Offered in alternate years.
Recommended: HORT 301
HORT 453, GRAPEVINE GROWTH AND PHYSIOLOGY, 3 Credits
The physiological aspects of grapevine growth and development including dormancy, flowering and fruit set, vegetative growth, fruit development and water relations. Additional topics include taxonomy, morphology and physiological influences of vineyard mesoclimate and vine microclimate. Lec/lab.
Prerequisite: HORT 301 with C- or better
Recommended: HORT 301

HORT 454, PRINCIPLES AND PRACTICES OF VINEYARD PRODUCTION, 3 Credits
The relationship of vineyard and canopy management to grapevine physiology and fruit quality. Nutrient/water relations within the soil/vine continuum. Vineyard microclimate, floor management, and pests will also be discussed. Lec/lab.
Prerequisite: HORT 301 with D- or better
Recommended: Completion or concurrent enrollment in HORT 453

HORT 455, URBAN FOREST PLANNING, POLICY AND MANAGEMENT, 4 Credits
Examination of planning, policy, and management strategies used in the stewardship of urban natural resources. Fundamentals for developing effective programs to maximize the economic, environmental, and social values and benefits of urban forest landscapes. CROSSLISTED as FES 455/HORT 455 and FES 555/HORT 555.
Prerequisite: FES 350 with C- or better or HORT 350 with C- or better
Equivalent to: FES 455, FOR 455
Available via Ecampus

HORT 456, PHYSIOLOGY AND PRODUCTION OF BERRY CROPS, 4 Credits
Physiology and production systems of blueberries, red and black raspberries, blackberries, and other berry crops. Emphasis on plant growth and development; flower and fruit development; cultivars; pruning and training systems; irrigation; harvesting; nutrient management; and conventional and organic production systems.
Prerequisite: HORT 301 with D- or better
Available via Ecampus

HORT 463, SEED BIOLOGY, 3 Credits
Information about reproductive development of plants such as pollination and fertilization, which is important for the initiation of seed formation, will be provided. Embryo and endosperm development as well as accumulation of seed storage materials, which are major events during seed development, will be covered, as well as the dormancy and germination mechanisms in mature seeds. Lectures and discussions (presentations required for graduate students). Offered even years. Lec/lab. CROSSLISTED as CROP 463/HORT 463 and CROP 563/HORT 563.
Equivalent to: CROP 463, HORT 363

HORT 480, CASE STUDIES IN CROPPING SYSTEMS MANAGEMENT, 4 Credits
Decision cases involving the production of field and horticultural crops; individual and group activities; discussion of the decision-making process. Multiple field trips required. A field trip fee will be charged. CROSSLISTED as CROP 480/HORT 480 and CROP 580/HORT 580.
Equivalent to: CROP 480
Recommended: CROP 300 or HORT 300
Available via Ecampus

HORT 481, HORTICULTURE PRODUCTION CASE STUDIES, 4 Credits
Field-based case studies investigate production issues encountered in horticultural crops; individual and group activities; discussion of processes for troubleshooting, decision-making and management recommendations; assessment of economic, practical, and logistical feasibility. Prior knowledge of plant physiology, soils, entomology, and plant nutrition are required. Multiple field trips required. A field trip fee will be charged.
Prerequisite: HORT 301 with D- or better

HORT 482, DESIGN AND MANAGEMENT OF ORGANIC CROPPING SYSTEMS, 3 Credits
This capstone course is the final stage of the Organic Farming Systems Certificate Program. Iteratively design and evaluate organic farming system management plans. Apply real-world science-, practice-, and regulation-based information to the design and management of organic farming systems.
Prerequisite: HORT 212 with C- or better and CROP 355 [C-] and HORT 306 (may be taken concurrently) [C-] and HORT 307 (may be taken concurrently) [C-] and HORT 344 (may be taken concurrently) [C-] and SOIL 360 (may be taken concurrently) [C-]

HORT 483, CASE STUDIES IN URBAN AGRICULTURE, 3 Credits
Provides an overview of the diversity of endeavors that are available to potential urban agriculturists. These include urban and peri-urban farms (for profit and non-profit), community and school gardens, controlled climate facilities, rooftop farms and gardens, and more. For each case study, we will specifically examine: (1) the market where the farmer sells goods, (2) methods of achieving growth, particularly while avoiding debt, (3) increasing livelihood reliance upon on-farm income.
Recommended: General background or previous coursework in agriculture
Available via Ecampus
HORT 485, ADVANCED PERMACULTURE DESIGN TOOLS FOR CLIMATE RESILIENCE, 3 Credits
Understand how permaculture as a design system can create sustainable human habitation that is beneficial to the natural world. Use tools specific to permaculture designers to assess, analyze, and project future climate scenarios and respond to them with appropriate design. Climate analogue identification and climate change forecasting provide the basis for a student assessment project that addresses current and future climatic conditions. Assessment and mapping assignments utilize Google Earth Pro, Google Docs, and Google Sheets. Prerequisite: HORT 285 with B or better Available via Ecampus

HORT 495, HORTICULTURAL MANAGEMENT PLANS, 3 Credits
Develop an integrated management plan for a horticultural enterprise. This course is repeatable for 6 credits.

HORT 499, SPECIAL TOPICS, 1-16 Credits
Equivalent to: HORT 499H
This course is repeatable for 16 credits.

HORT 499H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: HORT 499
This course is repeatable for 16 credits.

HORT 501, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

HORT 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

HORT 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

HORT 506, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

HORT 507, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

HORT 508, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

HORT 509, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

HORT 510, INTERNSHIP, 1-12 Credits
Offered via Ecampus only. This course is repeatable for 12 credits.

HORT 511, RESEARCH AND EDUCATIONAL PERSPECTIVES IN HORTICULTURE, 2 Credits
Introduces beginning graduate students to the faculty in horticulture and provides an in-depth discussion of their research and education programs.

HORT 518, CURRENT TOPICS IN ENTOMOLOGY, 2 Credits
A core course of the Horticulture graduate program. Provides an advanced understanding of entomology and its relationship to other disciplines through critical analysis of the scientific literature. Practice synthesizing information and presenting findings to peers. Instructors, topics, and specific learning objectives vary from term to term. CROSSTLISTED as ENT 518/HORT 518. Equivalent to: ENT 518
This course is repeatable for 12 credits.

HORT 519, CURRENT TOPICS IN PLANT BREEDING AND GENETICS, 2 Credits
Provides an advanced understanding of plant breeding and genetics and their relationship to other disciplines through critical analysis of the scientific literature. Practice synthesizing information and presenting findings to peers. Instructors, topics, and specific learning objectives vary from term to term. CROSSTLISTED as HORT 519/PBG 519. Equivalent to: PBG 519
This course is repeatable for 12 credits.

HORT 520, CURRENT TOPICS IN HORTICULTURAL RESEARCH, 2 Credits
This is a core course in the horticulture graduate program. Students gain an advanced understanding of horticulture science and its relationship to other disciplines through critical analysis of the scientific literature. Students practice synthesizing information and presenting findings to their peers. Instructors, topics and specific learning objectives vary from term to term. This course is repeatable for 12 credits.

HORT 521, HERBS, SPICES, AND MEDICINAL PLANTS, 3 Credits
Principles of crop ecology, morphology, chemistry and utilization of natural products of herbs, spices, and medicinal plants (HSMP). Examines the history and importance of HSMP, their historic and modern uses, current market trends, botany, collection in the wild, fundamentals of production systems for HSMP, harvesting, drying, and other postharvest operations, natural products and their uses, regulations and legal concerns of herbal products. Recommended: CROP 200 or equivalent course in HORT. Available via Ecampus
HORT 533, SYSTEMATICS AND ADAPTATION OF VEGETABLE CROPS, 4 Credits
Covers the botanical and taxonomic relationships, breeding systems and adaptation of vegetable crops. Fresh material is used to illustrate varietal differences and traits of importance. Lec/lab. Offered even years. CROSSLISTED as CROP 433/HORT 433 and CROP 533/HORT 533.
Equivalent to: CROP 533
Recommended: BI 102 or BI 213 or BI 311 or HORT 430 or CSS 430 or HORT 450 or CSS 450

HORT 540, ORGANIC VEGETABLE PRODUCTION SYSTEMS: DESIGN AND MANAGEMENT, 3 Credits
Design, management, and troubleshooting in organic vegetable production systems. Students learn to integrate knowledge from various technical disciplines and explore the social, economic, and environmental dimensions of vegetable production to analyze and evaluate organic vegetable farm enterprises.
Recommended: CROP/SOIL 530 and ENT 548
Available via Ecampus

HORT 544, INSECT AGROECOLOGY, 3 Credits
Agroecology incorporates ecological concepts and principles to the design and management of sustainable agricultural systems. Topics include: the role of insects in sustainable agricultural systems; application of the principles of insect ecology to better manage insect pests and maximize crop yield; conserving beneficial insects and other natural resources in agroecosystems and the surrounding landscape. CROSSLISTED as ENT 444/HORT 444 and ENT 544/HORT 544.
Equivalent to: ENT 544
Recommended: General background or previous course work in entomology.

HORT 547, ARBORICULTURE, 4 Credits
The principles and practices of arboriculture, the art and science of selecting, planting, establishing and maintaining trees in urban, suburban, commercial and residential landscapes. CROSSLISTED as FES 447/HORT 447 and FES 547/HORT 547.
Equivalent to: FES 547
Available via Ecampus

HORT 552, BERRY AND GRAPE PHYSIOLOGY AND CULTURE, 4 Credits
Production of wine grapes, caneberries, strawberries, blueberries, and other miscellaneous berry crops. Emphasis on plant growth and development; pruning and training systems; flower and fruit development and cultivars. Field trips required. Offered in alternate years.
Recommended: HORT 301

HORT 555, URBAN FOREST PLANNING, POLICY AND MANAGEMENT, 4 Credits
Examination of planning, policy, and management strategies used in the stewardship of urban natural resources. Fundamentals for developing effective programs to maximize the economic, environmental, and social values and benefits of urban forest landscapes. CROSSLISTED as FES 455/HORT 455 and FES 555/HORT 555.
Equivalent to: FES 555, FOR 555
Recommended: FOR 350 or FES 350 or HORT 350
Available via Ecampus

HORT 556, PHYSIOLOGY AND PRODUCTION OF BERRY CROPS, 4 Credits
Physiology and production systems of blueberries, red and black raspberries, blackberries, and other berry crops. Emphasis on plant growth and development; flower and fruit development; cultivars; pruning and training systems; irrigation; harvesting; nutrient management; and conventional and organic production systems.
Available via Ecampus

HORT 563, SEED BIOLOGY, 3 Credits
Information about reproductive development of plants such as pollination and fertilization, which is important for the initiation of seed formation, will be provided. Embryo and endosperm development as well as accumulation of seed storage materials, which are major events during seed development, will be covered, as well as the dormancy and germination mechanisms in mature seeds. Lectures and discussions (presentations required for graduate students). Offered even years. Lec/lab. CROSSLISTED as CROP 463/HORT 463 and CROP 563/HORT 563.
Equivalent to: CROP 563, HORT 363

HORT 580, CASE STUDIES IN CROPPING SYSTEMS MANAGEMENT, 4 Credits
Decision cases involving the production of field and horticultural crops; individual and group activities; discussion of the decision-making process. Multiple field trips required. A field trip fee will be charged. CROSSLISTED as CROP 480/HORT 480 and CROP 580/HORT 580.
Equivalent to: CROP 580
Recommended: CROP 300 or HORT 300
Available via Ecampus

HORT 581, HORTICULTURE PRODUCTION CASE STUDIES, 4 Credits
Field-based case studies investigate production issues encountered in horticultural crops; individual and group activities; discussion of processes for troubleshooting, decision-making and management recommendations; assessment of economic, practical and logistical feasibility. Prior knowledge of plant physiology, soils, entomology, and plant nutrition are required. Multiple field trips required. A field trip fee will be charged.
Recommended: HORT 301

HORT 599, SPECIAL TOPICS, 0-16 Credits
This course is repeatable for 16 credits.

HORT 601, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.
HORT 603, DISSERTATION, 1-16 Credits
This course is repeatable for 999 credits.
HORT 605, READING & CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
HORT 606, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.
HORT 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.
HORT 608, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.
HORT 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

Leadership (LEAD)
LEAD 242, PERSONAL LEADERSHIP DEVELOPMENT, 3 Credits
Examines content related to leadership traits, styles, and effective leadership tactics. An introductory course designed to create awareness and develop the employability skills necessary for participants to be productive contributors in their school, home, community and profession.
Equivalent to: AG 242
Available via Ecampus

LEAD 342, *TEAM AND ORGANIZATIONAL LEADERSHIP, 3 Credits
Examines the planning, implementation and evaluation of organizations, and challenges students in the development of effective communication, group dynamics, conflict management, teambuilding and problem solving. Students will explore the development of successful teams, multiple roles within teams, improving group performance, group decision making, how to manage conflict in teams, enhancing diversity in teams, creating a culture of creativity and innovation, and the evaluation of teams.
Attributes: CPSI – Core, Pers, Soc Proc & Inst
Equivalent to: AG 342
Available via Ecampus

LEAD 401, LEADERSHIP RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.
LEAD 405, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus
LEAD 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.
LEAD 409, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 410, LEADERSHIP INTERNSHIP, 1-16 Credits
Students apply what they have learned through both the leadership theory and trait/skill development portion of the Leadership minor.
This course is repeatable for 16 credits.
Available via Ecampus

LEAD 442, LEADERSHIP SKILLS FOR CAREER SUCCESS, 3 Credits
Focuses on the development and refinement of the following leadership skills: utilizing diversity, team building, project management, program planning models, working with difficult people, conflict management, leading change, establishing an effective network, organizational strategies, and emotional intelligence.
Equivalent to: AG 442
Available via Ecampus

LEAD 443, LEADERSHIP THROUGH CONVERSATIONS, 3 Credits
Engages students in the exploration of conversations as a component of leadership. Students will engage in topics related to developing effective conversations, listening, conversation styles, group dynamics, digital communication, meetings as conversations and interviewing skills.
Equivalent to: AG 442
Available via Ecampus

LEAD 444, LEADERSHIP MINOR CAPSTONE, 2 Credits
Capstone course for students completing the Leadership minor. Students will reflect on what they have learned through the Leadership minor and how to apply that learning in the context of their future careers.
Equivalent to: AG 444
Recommended: (AG 242 or LEAD 242) and (AG 342 or LEAD 342)

LEAD 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 502, INDEPENDENT STUDY, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 506, SPECIAL PROBLEMS/SPECIAL PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 507, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.
LEAD 509, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.
LEAD 510, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.

LEAD 542, LEADERSHIP SKILLS FOR CAREER SUCCESS, 3 Credits
Focuses on the development and refinement of the following leadership skills: utilizing diversity, team building, project management, program planning models, working with difficult people, conflict management, leading change, establishing an effective network, organizational strategies, and emotional intelligence. Equivalent to: AG 542
Available via Ecampus

LEAD 543, LEADERSHIP THROUGH CONVERSATIONS, 3 Credits
Engages students in the exploration of conversations as a component of leadership. Students will engage in topics related to developing effective conversations, listening, conversation styles, group dynamics, digital communication, meetings as conversations and interviewing skills. Equivalent to: AG 543
Available via Ecampus

LEAD 580, LEADING AUTHENTICALLY: FOUNDATIONS OF LEADERSHIP, 3 Credits
The foundational course for students in graduate leadership coursework. Students will explore leadership theories to develop an understanding of how to be an authentic leader. Students will analyze and apply course content in relation to their own personal leadership experiences and gain perspectives and tools to influence their future.

LEAD 581, LEADING OTHERS: ENHANCING TEAM AND ORGANIZATIONAL PERFORMANCE, 3 Credits
A foundational course for group, team, and organizational leadership. Throughout this course, you will become familiar with the necessary conditions for designing effective teams and work groups, best practices and processes needed for maximum productivity, strategies to resolve common issues in teams, and methods to evaluate team performance.

LEAD 582, LEADING CHANGE: LEADING, MOTIVATING, AND EMPOWERING OTHERS, 3 Credits
Examines and synthesizes leadership content to form a personal and professional foundation for being remarkable. Drawing on 15 different being remarkable qualities, students will be challenged to develop and apply the skills needed for leadership success.

Plant Breeding and Genetics (PBG)

PBG 199, SPECIAL TOPICS, 1-16 Credits
Equivalent to: PBG 199H
This course is repeatable for 16 credits.

PBG 199H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: PBG 199
This course is repeatable for 16 credits.

PBG 299, SPECIAL TOPICS, 1-16 Credits
Equivalent to: PBG 299H
This course is repeatable for 16 credits.

PBG 299H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: PBG 299
This course is repeatable for 16 credits.

PBG 399, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

PBG 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

PBG 403, THESIS, 1-16 Credits
Graded P/N.
This course is repeatable for 99 credits.

PBG 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: PBG 405H
This course is repeatable for 16 credits.

PBG 405H, READING AND CONFERENCE, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: PBG 405
This course is repeatable for 16 credits.

PBG 407, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

PBG 409, TEACHING PRACTICUM, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

PBG 410, INTERNSHIP, 1-12 Credits
Offered via Ecampus only.
This course is repeatable for 12 credits.

PBG 430, PLANT GENETICS, 3 Credits
Introduction to the principles of plant genetics with an emphasis on the structure and function of economically important plant genomes. Equivalent to: HORT 430
Recommended: One year of biology and chemistry.
Available via Ecampus

PBG 431, PLANT GENETICS RECIATION, 1 Credit
Review and demonstration of plant genetics principles. Equivalent to: CSS 431, HORT 431
PBG 441, PLANT TISSUE CULTURE, 4 Credits
Principles, methods, and applications of plant tissue culture. Laboratory is important part of course. Topics include callus culture, regeneration, somaclonal variation, micropropagation, anther culture, somatic hybridization, and transformation. CROSSTLISTED as PBG 441 and MCB 541/PBG 541.
Equivalent to: HORT 441
Recommended: (BI 311 and BOT 331) or PBG 430 or CSS 430

PBG 450, PLANT BREEDING, 4 Credits
An introduction to the genetic improvement of self-pollinated, cross-pollinated, and asexually propagated species and the genetic principles on which breeding methods are based. Examples are drawn from a wide range of crops, including cereal grains, grasses, fruits, nuts, and vegetables; guest lecturers discuss their breeding programs. Additional topics include crop evaluation, germplasm preservation, disease resistance, and biotechnology. Lec/lab.
Prerequisite: PBG 430 with D- or better
Equivalent to: CSS 450, HORT 450
Recommended: BI 311 or PBG 430

PBG 499, SPECIAL TOPICS, 1-16 Credits
Equivalent to: PBG 499H
This course is repeatable for 16 credits.

PBG 499H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: PBG 499
This course is repeatable for 16 credits.

PBG 501, RESEARCH, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

PBG 503, THESIS, 1-16 Credits
Graded P/N.
This course is repeatable for 999 credits.

PBG 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

PBG 506, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

PBG 507, SEMINAR, 1-16 Credits
Graded P/N.
This course is repeatable for 16 credits.

PBG 508, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

PBG 509, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. CROSSTLISTED as CROP 509/ENT 509/ PGB 509/SOIL 509.
Equivalent to: CROP 509, ENT 509, SOIL 509
This course is repeatable for 9 credits.

PBG 510, INTERNSHIP, 4 Credits
Offered via Ecampus only.
This course is repeatable for 12 credits.

PBG 513, PLANT GENETIC ENGINEERING, 3 Credits
Principles, methods, and recent developments in the genetic engineering of higher plants. Offered alternate years.
Equivalent to: HORT 513
Recommended: (BI 311 and BOT 331) or (CSS 430 or CSS 530) or (HORT 430 or HORT 530) or (PBG 430 or PBG 530)

PBG 519, CURRENT TOPICS IN PLANT BREEDING AND GENETICS, 2 Credits
Provides an advanced understanding of plant breeding and genetics and their relationship to other disciplines through critical analysis of the scientific literature. Practice synthesizing information and presenting findings to peers. Instructors, topics, and specific learning objectives vary from term to term. CROSSTLISTED as HORT 519/PBG 519.
Equivalent to: HORT 519
This course is repeatable for 12 credits.

PBG 530, PLANT GENETICS, 3 Credits
Introduction to the principles of plant genetics with an emphasis on the structure and function of economically important plant genomes.
Equivalent to: HORT 530
Recommended: One year of biology and chemistry.

PBG 541, PLANT TISSUE CULTURE, 4 Credits
Principles, methods, and applications of plant tissue culture. Laboratory is important part of course. Topics include callus culture, regeneration, somaclonal variation, micropropagation, anther culture, somatic hybridization, and transformation. CROSSTLISTED as PBG 441 and MCB 541/PBG 541.
Equivalent to: HORT 541, MCB 541
Recommended: (BI 311 and BOT 331) or PBG 430

PBG 550, PLANT BREEDING, 4 Credits
An introduction to the genetic improvement of self-pollinated, cross-pollinated, and asexually propagated species and the genetic principles on which breeding methods are based. Example are drawn from a wide range of crops, including cereal grains, grasses, fruits, nuts, and vegetables; guest lecturers discuss their breeding programs. Additional topics include crop evaluation, germplasm preservation, disease resistance, and biotechnology. Lec/lab.
Equivalent to: CSS 550, HORT 550
Recommended: BI 311 or PBG 430 or PBG 530
PBG 551, BREEDING CLONAL CROPS, 1 Credit
The overall goal of the course is to gain fundamental knowledge of breeding methods for clonal crops; these methods are different from those used for seed-propagated crops. Specific examples from a wide array of plant species (tree fruits, berries, tree nuts, potato, sweet potato, cassava, cacao) will be provided to illustrate application of the fundamental knowledge. **Prerequisite:** PBG 450 with C or better or PBG 550 with C or better.

PBG 552, PLANT BREEDING AND SEED PRODUCTION IN ORGANIC SYSTEMS, 3 Credits
Genetic improvement and seed propagation of self-pollinated and cross-pollinated crops bred for and used in organic production. The philosophical basis for organic agriculture will be reviewed in the context of what breeding technologies are allowed and why. Important traits for adaptation to organic production will be described. Models for organic plant breeding and examples of such programs are provided. **Prerequisite:** PBG 530 with D or better. **Recommended:** BI 311 or PBG 430.

PBG 556, CROP PLANT DOMESTICATION, 2 Credits
Learning is based on discussion of the contemporary literature on crop plant origins and domestication. The major agronomic and horticultural crops will be covered. Topics include primary centers of domestication, traits altered by domestication, effect of genetic architecture and local ecology on domestication, and importance of genetic diversity to current plant improvement efforts.

PBG 557, PLANTS AND PATENTS, 2 Credits
Learn about different methods of intellectual property protection in agriculture with a focus on plant patents, plant variety protection and utility patents. The rights, current issues and restrictions that different types of patents allow will be presented through reading the current literature.

PBG 591, SELECTED TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

PBG 599, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

PBG 601, RESEARCH, 1-16 Credits
Graded P/N. This course is repeatable for 16 credits.

PBG 603, DISSERTATION, 1-16 Credits
Graded P/N. This course is repeatable for 999 credits.

PBG 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

PBG 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

PBG 609, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. Graded P/N. **Equivalent to:** CROP 609, ENT 609, SOIL 609. This course is repeatable for 9 credits.

PBG 620, INTRODUCTION TO MOLECULAR MARKERS, 2 Credits
Principles and methods for molecular marker discovery and analysis. Offered even years. CROSSTLISTED as MCB 620/PBG 620. **Equivalent to:** MCB 620. **Recommended:** BI 311 or PBG 430 or PBG 530 or HORT 430 or HORT 530.

PBG 621, GENETIC MAPPING AND ASSOCIATION, 2 Credits
Principles and methods for genetic map construction and genome-wide association studies. Offered even years. CROSSTLISTED as MCB 621/PBG 621. **Equivalent to:** MCB 621. **Recommended:** BI 311 or PBG 430 or PBG 530 or HORT 430 or HORT 530.

PBG 622, MAPPING QUANTITATIVE TRAIT LOCI, 1 Credit
Principles and methods for mapping genes underlying phenotypically complex traits. Offered alternate years. CROSSTLISTED as MCB 622/PBG 622. **Equivalent to:** CSS 622, MCB 622. **Recommended:** CROP 590 or CSS 590 or ST 513.

PBG 650, ADVANCED PLANT BREEDING AND QUANTITATIVE GENETICS, 3 Credits
Pedigree, bulk, single-seed-descent, doubled haploid, backcross, testcross, mass, and half-sib, S~1~, and S~2~ family breeding methods; breeding hybrids and selecting sources of alleles for developing superior hybrids; the nature and consequences of genotype by environment interactions; marker-assisted backcross and inbred line breeding; quantitative trait locus mapping; random linear models; designing and analyzing cultivar, line, and family selection experiments. Offered odd years. **Equivalent to:** CSS 650. **Recommended:** (CSS 430 or CSS 530 or PBG 430 or PBG 530 or HORT 430 or HORT 530) and (CSS 450 or CSS 550 or PBG 450 or PBG 550 or HORT 450 or HORT 550) and (ST 411 or ST 511) and (ST 412 or ST 512) and (ST 413 or ST 513).

PBG 691, SELECTED TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

PBG 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.
Rangeland Ecology & Management (RNG)

**RNG 121, *INTRODUCTION TO WILDLAND ECOLOGY, 4 Credits***

Ecological principles will be applied to understand contemporary issues related to wildlands, specifically the rangeland biomes that comprises over 50% of the Earth’s surface (FAO, SRM, USDA ERS). Topics to be covered fall into the following categories: Fundamentals of Ecology; Animals (wildlife & livestock); Disturbance (e.g., invasive species, fire, mineral extraction, etc.); Ecosystem Goods & Services (e.g., carbon sequestration, watersheds, biodiversity, recreation, etc.). The course will largely focus on U.S. wildlands, however a portion will examine the ecology and issues of international rangelands in Africa, Eurasia, Australia, and South America. (Bacc Core Course)

**Attributes:** CPBS – Core, Pers, Biological Science

**Available via Ecampus**

**RNG 299, SPECIAL TOPICS, 1-16 Credits**

**Equivalent to:** RNG 299H

This course is repeatable for 16 credits.

**RNG 299H, SPECIAL TOPICS, 1-16 Credits**

**Attributes:** HNRS – Honors Course Designator

**Equivalent to:** RNG 299

This course is repeatable for 16 credits.

**RNG 341, RANGELAND ECOLOGY AND MANAGEMENT, 3 Credits**

Nature and management of rangelands. Integrated land use with emphasis on plant-animal-soil interactions.

**Equivalent to:** RNG 241

**Available via Ecampus**

**RNG 351, RANGE ECOLOGY I - GRASSLANDS, 3 Credits**

Principles and terminology of grassland ecology. Addresses the spatial-temporal dynamics of structure, function, and process in North American grassland ecosystems. Water, nutrient cycles and energy pathways are explored in context of the variable driving forces of climate (drought), herbivory, and fire.

**Recommended:** (BOT 313 [D-] and RNG 341 [D-])

**Available via Ecampus**

**RNG 352, RANGE ECOLOGY II - SHRUBLANDS, 3 Credits**

Introduces the ecology of shrublands using an autecological approach. Explores the effects of stressors such as temperature, drought, fire, and herbivory on plant morphology, physiology, reproduction, and growth. Covers life histories of common shrubs and descriptions of shrubland communities used to promote understanding of autecological principles.

**Recommended:** BOT 313 and RNG 341

**Available via Ecampus**

**RNG 353, WILDLAND PLANT IDENTIFICATION, 4 Credits**

Students will learn how to identify approximately 100 plant species found in wildlands of North America and Mexico. Individual plant species ecology, basic plant anatomy and identification characteristics observable only through a microscope or dissecting scope, and how to use a dichotomous key for plant ID will also be covered.

**Equivalent to:** RNG 253

**Available via Ecampus**

**RNG 355, DESERT WATERSHED MANAGEMENT, 4 Credits**

A systems-based understanding of hydrologic processes in arid and semiarid landscapes. The class is focused on gaining knowledge of multiple ecological and hydrological interactions occurring in dryland watersheds and on discussing practical methodology aimed to enhance site productivity and ecosystem resilience. Emphasis is placed on land use effects on watershed function; monitoring of soil, water, and vegetation variables; and methods of rehabilitation of degraded landscapes. The course has a strong experiential learning component through a series of ‘hands-on’ practicums and a field trip to a semiarid location in eastern Oregon. Lec/lab.

**Available via Ecampus**

**RNG 399, SPECIAL TOPICS, 1-16 Credits**

May be repeated for a total of 16 credits.

This course is repeatable for 16 credits.

**RNG 403, SENIOR THESIS, 1-16 Credits**

This course is repeatable for 16 credits.

**RNG 405, READING AND CONFERENCE, 1-16 Credits**

This course is repeatable for 16 credits.

**RNG 406, PROJECTS, 1-16 Credits**

This course is repeatable for 16 credits.

**Available via Ecampus**

**RNG 411, ADVANCED PLANT ID, 2 Credits**

Advanced rangeland plant taxonomy.

This course is repeatable for 16 credits.

**Available via Ecampus**

**RNG 421, WILDLAND RESTORATION AND ECOLOGY, 4 Credits**

Emphasis is placed on understanding the ecology of arid and semiarid ecosystems through the study of ecological processes responsible for ecosystem function. Range improvement practices for stabilizing and repairing degraded wildlands by directing autogenic recovery mechanisms are discussed. This involves manipulating plants, soil, animals and microenvironments for improved ecosystem function.

**Recommended:** Course work in soils and ecology

**Available via Ecampus**
RNG 441, RANGELAND ANALYSIS, 4 Credits
Techniques used to describe vegetation in shrub-lands, grasslands, and forests. Use of measurements in resource management. Course is field-oriented, emphasizing both theory and practice of wildland inventory methods.
Recommended: ST 351 or ST 351H
Available via Ecampus

RNG 442, RANGELAND-ANIMAL RELATIONS, 4 Credits
Domestic and wild animal use of rangelands as related to environmental factors, palatability, food habits, nutrition, physiography, and their effects on management of rangeland-animal resources.
Available via Ecampus

RNG 448, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits
Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. CROSSLISTED as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.
Equivalent to: ANS 448, CROP 448

RNG 455, RIPARIAN ECOHYDROLOGY AND MANAGEMENT, 4 Credits
A systems approach to study ecological and hydrological relationships occurring in riparian ecosystems. The class is focused on gaining knowledge of multiple connections between soil, water, and terrestrial vegetation occurring in riparian systems. Emphasis is placed on land use effects on the riparian ecologic and hydrologic function, methods of rehabilitation, and theories of the proper use of riparian ecosystems under a multiple-use philosophy (i.e., fish, wildlife, livestock, aesthetics, recreation, and silviculture).
Recommended: RNG 355
Available via Ecampus

RNG 457, HABITAT ANALYSIS 1: HABITAT USE AND MOVEMENT, 3 Credits
Effective habitat management necessitates an understanding of how animals use and move through the landscape, including rangelands. This is an advanced undergraduate and introductory graduate course designed to familiarize students with multiple techniques of assessing the influence of habitat on site selection of terrestrial animals (wild and domestic). However, topics covered in this course are broadly analogous to other ecosystems. Emphasis will be placed on analysis of habitat use (space use) and animal movement from multiple study designs.
Prerequisite: FW 251 with D- or better and RNG 341 [D-] and MTH 241 [D-] and (ST 201 [D-] or ST 351 [D-])
Available via Ecampus

RNG 458, HABITAT ANALYSIS 2: ABUNDANCE, OCCUPANCY AND DEMOGRAPHY, 3 Credits
Habitat influences abundance, occupancy, and demographic rates of wildlife. Wildlife management is often a component of land management and both benefit from land stewards that have an understanding of how habitat characteristics influence the occupancy, abundance, and performance of wildlife within an area. This is an advanced undergraduate and introductory graduate course designed to familiarize students with multiple techniques of assessing the influence of habitat on abundance, occupancy, and demographic rates of terrestrial animals.
Prerequisite: FW 251 with D- or better and RNG 341 [D-] and MTH 241 [D-] and (ST 201 [D-] or ST 351 [D-])

RNG 470, PASTORAL SYSTEMS OF THE WORLD, 4 Credits
Description and evaluation of ecosystems which support grazing animals and pastoralists. Biology, ecology and management of these landscapes will be explored through climate, soils, and plant communities and human-livestock interactions. The historic role of trade and contemporary challenges to the ecological, social and economic sustainability of pastoral systems will be examined.

RNG 490, RANGELAND MANAGEMENT PLANNING, 4 Credits
Administration and management of rangelands; planning processes involving goal setting, inventories, personnel management, environment, conflict resolution, and other constraints affecting decision-making. Use of data collected from field problems to support the execution of class plans. Field trip required. Lec/lab.
Available via Ecampus

RNG 499, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

RNG 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

RNG 503, MASTER'S THESIS, 1-16 Credits
This course is repeatable for 999 credits.

RNG 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

RNG 506, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

RNG 507, SEMINAR, 1-2 Credits
This course is repeatable for 16 credits.
RNG 521, WILDLAND RESTORATION AND ECOLOGY, 4 Credits

Emphasis is placed on understanding the ecology of arid and semi-arid ecosystems through the study of ecological processes responsible for ecosystem function. Range improvement practices for stabilizing and repairing degraded wildlands by directing autogenic recovery mechanisms are discussed. This involves manipulating plants, soil, animals and microenvironments for improved ecosystem function.

Available via Ecampus

RNG 541, RANGELAND ANALYSIS, 4 Credits

Techniques used to describe vegetation in shrub-lands, grasslands, and forests. Use of measurements in resource management. Course is field-oriented, emphasizing both theory and practice of wildland inventory methods.

Recommended: ST 351

RNG 542, RANGELAND-ANIMAL RELATIONS, 4 Credits

Domestic and wild animal use of rangelands as related to environmental factors, palatability, food habits, nutrition, physiography, and their effects on management of rangeland-animal resources.

Recommended: RNG 341

Available via Ecampus

RNG 548, LIVESTOCK PRODUCTION ON PASTURE, 4 Credits

Focuses on grazing management in cultivated pastures in Oregon and other regions with similar agro-ecological conditions. Become familiar with the basic principles of pasture production, grazing management and feed planning and management in large and small ruminant production systems. Provides information on the underlying factors affecting pasture and animal production and product quality in pasture-based production systems. CROSSLISTED as ANS 448/CROP 448/RNG 448 and ANS 548/CROP 548/RNG 548.

Equivalent to: ANS 548, CROP 548

RNG 555, RIPARIAN ECOHYDROLOGY AND MANAGEMENT, 4 Credits

A systems approach to study ecological and hydrological relationships occurring in riparian ecosystems. The class is focused on gaining knowledge of multiple connections between soil, water, and terrestrial vegetation occurring in riparian systems. Emphasis is placed on land use effects on the riparian ecologic and hydrologic function, methods of rehabilitation, and theories of the proper use of riparian ecosystems under a multiple-use philosophy (i.e., fish, wildlife, livestock, aesthetics, recreation, and silviculture).

Recommended: RNG 355

Available via Ecampus

RNG 557, HABITAT ANALYSIS 1: HABITAT USE AND MOVEMENT, 3 Credits

Effective habitat management necessitates an understanding of how animals use and move through the landscape, including rangelands. This is an advanced undergraduate and introductory graduate course designed to familiarize students with multiple techniques of assessing the influence of habitat on site selection of terrestrial animals (wild and domestic). However, topics covered in this course are broadly analogous to other ecosystems. Emphasis will be placed on analysis of habitat use (space use) and animal movement from multiple study designs.

Recommended: ST 511 and ST 512

Available via Ecampus

RNG 558, HABITAT ANALYSIS 2: ABUNDANCE, OCCUPANCY AND DEMOGRAPHY, 3 Credits

Habitat influences abundance, occupancy, and demographic rates of wildlife. Wildlife management is often a component of land management and both benefit from land stewards that have an understanding of how habitat characteristics influence the occupancy, abundance, and performance of wildlife within an area. This is an advanced undergraduate and introductory graduate course designed to familiarize students with multiple techniques of assessing the influence of habitat on abundance, occupancy, and demographic rates of terrestrial animals.

RNG 577, AGROFORESTRY, 3 Credits

Theory and worldwide practice of multiple-crop low input sustainable systems involving concurrent production of tree and agricultural products. Biological, economic, social, and political factors that underlie the application of agroforestry technology. CROSSLISTED as FES 477/NR 477 and FES 577/RNG 577.

Equivalent to: FES 577, FS 577, NR 577

Recommended: Introductory course in biology.

RNG 590, RANGELAND MANAGEMENT PLANNING, 4 Credits

Administration and management of rangelands; planning processes involving goal setting, inventories, personnel management, environment, conflict resolution, and other constraints necessary for decision-making. Use of data collected from field problems to support the execution of class plans. Field trip required. Lec/lab.

RNG 599, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.

RNG 601, RESEARCH AND SCHOLARSHIP, 1-16 Credits

This course is repeatable for 16 credits.

RNG 603, PH.D. THESIS, 1-16 Credits

This course is repeatable for 999 credits.

RNG 605, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

RNG 606, PROJECTS, 1-16 Credits

This course is repeatable for 16 credits.
**RNG 607, SEMINAR, 1-2 Credits**
*This course is repeatable for 16 credits.*

**RNG 608, WORKSHOP, 1-16 Credits**
*This course is repeatable for 16 credits.*

**RNG 643, WILDLAND PLANT ECOPHYSIOLOGY, 4 Credits**
Emphasizes the physiological ecology of plants living in arid and semi-arid ecosystems. Primary class emphasis will include photosynthesis, respiration, water stress and water use efficiency, stable isotopes, root structure and function, nutrient uptake and stress, and defoliation. Offered every other winter, odd years.

**RNG 662, RANGELAND ECOLOGY, 3 Credits**
Studies ecological theory and related resource management implications in rangelands and arid wildlands. Topics include the history and development of rangeland ecology, plant demography, invasive species, plant population dynamics, disturbance theory, succession, vegetation classification and range condition assessments. Offered every other winter, even years. 

**Recommended:** Basic ecology course

**RNG 670, ECOLOGICAL INVASIVE PLANT MANAGEMENT, 2 Credits**

**RNG 699, SPECIAL TOPICS, 1-16 Credits**
*This course is repeatable for 16 credits.*

**SOIL 205, SOIL SCIENCE, 3 Credits**
Introduction to the chemical, physical and biological nature of soils. Examines how soils function in terms of plant growth, nutrient supply, the global carbon cycle, ecological habitat, and water purification. Community-based learning projects provide hands-on experience with fundamental soil science principles and the impact of human activities on soil quality and sustainability. Lec. (Bacc Core Course if taken with SOIL 206 or FOR 206)

**Attributes:** CPBL – Core, Pers, BioSci Attached Lec; CPPL – Core, Pers, PhySci Attached Lec

**Prerequisite:** SOIL 206 (may be taken concurrently) with D- or better or FOR 206 (may be taken concurrently) with D- or better

**Equivalent to:** CSS 205, CSS 305

**SOIL 206, *SOIL SCIENCE LABORATORY FOR SOIL 205, 1 Credit**
Students will gain hands-on experience with soil science concepts and applications. Laboratory exercises and field trips will help students develop proficiency in the methods/tools for analyzing soil chemistry, biology, morphology, physical properties, and soil forming factors. Skills will be taught in the context of soils’ social, economic, and environmental importance. (Bacc Core Course if taken with SOIL 205)

**Attributes:** CPBS – Core, Pers, Biological Science; CPPS – Core, Pers, Physical Science

**Corequisites:** SOIL 205

**SOIL 299, SPECIAL TOPICS, 1-16 Credits**
*This course is repeatable for 16 credits.*

**SOIL 299H, SPECIAL TOPICS, 1-16 Credits**
**Attributes:** HNRS – Honors Course Designator

**Equivalent to:** SOIL 299

**SOIL 316, NUTRIENT CYCLING IN AGROECOSYSTEMS, 4 Credits**
Nutrient forms, transformations, and cycling. Diagnosis and correction of nutrient deficiencies, pH and salinity. Impact of nutrient management practices on crop production, soil health, nutrient use efficiency, and environmental quality. Organic and inorganic fertilization. Labs include soil sampling and testing procedures, data collection on soil and plants, computer applications for soil fertility management, and field trips. Lec/lab.

**Prerequisite:** (CH 121 with D- or better or CH 231 with D- or better) and (SOIL 205 [C] or CSS 205 [C] or CSS 305 [C])

**SOIL 325, ^AG AND ENVIRONMENTAL PREDICAMENTS: A CASE STUDY APPROACH, 3 Credits**
Analyze controversial agricultural and environmental issues, synthesize information from diverse sources, and apply scientific knowledge to recommend specific courses of action to solve real world problems. Develop oral and written communication skills through individual and group work. CROSSLISTED as CROP 325/SOIL 325/SUS 325. (Writing Intensive Course)

**Attributes:** CWIC – Core, Skills, WIC

**Equivalent to:** CROP 325, SUS 325
SOIL 360, SOIL MANAGEMENT FOR ORGANIC PRODUCTION, 3 Credits
This is a skills-based soil management course that is part lecture and part student-centered learning. Significant class time will be devoted to making field-scale management decisions. The course includes individual and group work, presentation, and discussion. The intent is to prepare students for real-world application of soil management decisions in certified organic systems. Using the National Organic Program as a starting point as well as farm system descriptions with extensive long-term data sets, we will interpret soil nutrient analyses, cover cropping systems, and organic amendments, to design soil management plans for two model cropping systems (annual and perennial).
Prerequisite: (SOIL 205 with C or better and (SOIL 206 [C] or FOR 206 [C])) or CSS 205 [C]
Recommended: Introductory soil science course with lab
Available via Ecampus

SOIL 366, ECOSYSTEMS OF WILDLAND SOILS, 3 Credits
Focuses on soils that occur in relatively undisturbed ecosystems such as forests and rangelands. Topics covered include properties and processes specific to understanding and managing the soil resource in these areas. An overview of US Soil Taxonomy will also be given.
Prerequisite: SOIL 205 with D- or better or CSS 205 with D- or better or CSS 305 with D- or better
Recommended: An understanding and appreciation of environmental chemistry, biology, ecology, and physics
Available via Ecampus

SOIL 388, SOIL SYSTEMS AND PLANT GROWTH, 4 Credits
Introduces soils as providers of critical resources for plant growth. Explains how soils supply water, air, thermal energy and nutrients to plants. Shows that sustainable management of soil resources requires substantial understanding of their role in the functioning of natural, forest, and agricultural systems. Explains controls on stocks and availabilities of individual soil resources and mechanisms making these resources plant-available.
Prerequisite: ((SOIL 205 with D- or better and (SOIL 206 [D-] or FOR 206 [D-])) or CSS 205 [D-]) and (CH 121 [D-] or CH 231 [D-]) and (BOT 220 [D-] or (BI 204 [D-] or BI 205 [D-] or BI 206 [D-]) or (BI 211 [D-] or BI 212 [D-] or BI 213 [D-]) or (BI 211H [D-] or BI 212H [D-] or BI 213H [D-]) or (BI 221 [D-] or BI 222 [D-] or BI 223 [D-]) or (BI 221H [D-] or BI 222H [D-] or BI 223H [D-]))
Available via Ecampus

SOIL 395, **WORLD SOIL RESOURCES, 3 Credits
The properties, global distribution, and agricultural productivity of major world soil groups are described. Potentials for human-accelerated soil degradation are introduced for each soil group, and reasons for conflicting assessments of degradation are discussed. Offered via Ecampus only. (Bacc Core Course) (Writing Intensive Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society; CWIC – Core, Skills, WIC
Prerequisite: CH 121 with D- or better or CH 122 with D- or better or CH 123 with D- or better or CH 201 with D- or better or CH 202 with D- or better or CH 231 with D- or better or CH 231H with D- or better or CH 232 with D- or better or CH 232H with D- or better or CH 233 with D- or better or CH 233H with D- or better
Equivalent to: CSS 395
Recommended: One term of chemistry
Available via Ecampus

SOIL 399, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 401, RESEARCH, 1-16 Credits
Equivalent to: SOIL 401
This course is repeatable for 16 credits.

SOIL 403, THESIS, 1-16 Credits
Independent, original study and preparation of a senior thesis.
Equivalent to: SOIL 403
This course is repeatable for 16 credits.

SOIL 405, READING AND CONFERENCE, 1-16 Credits
Equivalent to: SOIL 405H
This course is repeatable for 16 credits.

SOIL 405H, READING AND CONFERENCE, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: SOIL 405
This course is repeatable for 16 credits.

SOIL 407, SEMINAR, 1 Credit
Equivalent to: CROP 407, HORT 407
Available via Ecampus

SOIL 408, WORKSHOP, 1-16 Credits
Evaluation and judging of soils in Oregon and other states; directed studies of soil morphology, soil survey, soil fertility, soil physics, soil chemistry, soil biology, and soil information systems.
Equivalent to: CSS 408
This course is repeatable for 16 credits.

SOIL 409, PRACTICUM, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 410, INTERNSHIP, 1-6 Credits
Professional work experience previously approved and supervised by the department, written report required.
Equivalent to: CSS 410
This course is repeatable for 12 credits.
SOIL 435, ENVIRONMENTAL SOIL PHYSICS, 3 Credits
Covers principles of soil physical properties and processes as they relate to agricultural, hydrological and environmental problems. Lec/lab. Offered odd years.
Prerequisite: CSS 205 with D- or better or CSS 305 with D- or better or SOIL 205 with D- or better
Equivalent to: CSS 435
Recommended: CH 123 and MTH 241 and PH 201
Available via Ecampus

SOIL 445, ENVIRONMENTAL SOIL CHEMISTRY, 3 Credits
Structural chemistry of clay minerals and organic matter, cation and anion exchange, and soil solution equilibria of soils. Ion exchange, mineral-solution equilibria, and adsorption reactions of silicate clays, oxides, and organic matter are emphasized. Covers the sorption behavior of environmental contaminants and the weathering reactions that govern the transport of reactive solutes through soils. Lec/rec. Offered odd years.
Equivalent to: CSS 445

SOIL 455, BIOLOGY OF SOIL ECOSYSTEMS, 4 Credits
A detailed study of the organisms that live in the soil and their activities in the soil ecosystems, soil as a habitat for organisms, taxonomy and biology of soil organisms, fundamentals of nutrient cycles, special topics in soil biology, review basis of soil microbial and ecological principles. Lec/rec/lab.
Equivalent to: CSS 455
Recommended: (CSS 305 or CSS 205 or SOIL 205). Courses in chemistry, physics, and microbiology

SOIL 466, SOIL MORPHOLOGY AND CLASSIFICATION, 4 Credits
Observation and description of soil properties in the field; writing soil profile descriptions; evaluating criteria that define features used to classify soils; using soil classification keys. Lec/lab.
Prerequisite: SOIL 205 with D- or better or CSS 205 with D- or better or CSS 305 with D- or better
Equivalent to: CSS 466
Available via Ecampus

SOIL 468, SOIL LANDSCAPE ANALYSIS, 4 Credits
Principles of soil geomorphology, soil stratigraphy, and surficial processes as applied to understanding the soil system and landscape scales. Emphasis on field observations of soils, geomorphic surfaces, and environment. Field project entails design of soil survey map units, field mapping and GIS cartographic techniques. Lec/lab. Offered even years.
Prerequisite: SOIL 466 (may be taken concurrently) with D- or better or CSS 466 (may be taken concurrently) with D- or better
Equivalent to: CSS 468
Available via Ecampus

SOIL 499H, SPECIAL TOPICS, 1-16 Credits
Attributes: HNRS – Honors Course Designator
Equivalent to: SOIL 499
This course is repeatable for 16 credits.

SOIL 501, RESEARCH AND SCHOLARSHIP, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 503, THESIS/DISSERTATION, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 506, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 507, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 508, WORKSHOP, 1-16 Credits
Evaluation and judging of soils in Oregon and other states; directed studies of soil morphology, soil survey, soil fertility, soil physics, soil chemistry, soil biology, and soil information systems.
Equivalent to: CSS 508
This course is repeatable for 16 credits.

SOIL 509, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. CROSSLISTED as CROP 509/ENT 509/PBG 509/SOIL 509.
Equivalent to: CROP 509, ENT 509, PBG 509
This course is repeatable for 9 credits.

SOIL 510, INTERNSHIP, 1-6 Credits
Professional work experience previously approved and supervised by the department, written report required.
This course is repeatable for 6 credits.

SOIL 511, SOIL: A NATURAL AND SOCIETAL RESOURCE, 3 Credits
Serves degree- and non-degree-seeking graduate learners wanting soil science knowledge but having minimal science background. Understanding soil physical, chemical, and biological properties promotes informed soil management while supporting individual to global societal values. Established curriculum facilitates graduate degrees or certificates, continuing education, professional certification, and self-improvement goals. A highly interactive social media framework supports weekly student-student and instructor-student learning interactions.
Available via Ecampus
SOIL 512, METHODS OF SOIL ANALYSIS - FIELD, 1 Credit
Recognition and quantitative description of soil properties in agroecosystems. Assessments of soil environments used for crop production in Oregon. Demonstration and practice of volumetric and bulk soil sampling techniques as well as the application of pedotransfer functions. Each participant will be responsible for analyzing at least one soil sample in the chemical level. Five-day duration with four overnight stays at campgrounds. Participants will use their own or borrowed camping equipment.
Recommended: SOIL 205 with a minimum grade of C

SOIL 514, METHODS OF SOIL ANALYSIS - LABORATORY, 2 Credits
Provide the theoretical background, as well as practical experience needed to plan, select, execute, and interpret soil chemical and physical analyses such as those typically used for nutrient management recommendations. Individual and group activities involve classroom presentations, as well as hands-on work in a teaching laboratory. Samples processed are those collected in SOIL 512, Methods of Soil Analysis - Field. Duration is five full work days.
Prerequisite: SOIL 512 (may be taken concurrently) with C or better
Recommended: SOIL 205 and successful completion of EH&S Laboratory

SOIL 515, SOIL FERTILITY MANAGEMENT, 3 Credits
Management of plant nutrients in agronomic systems; diagnosis of nutrient availability and prediction of crop response to fertilizers; interactions between nutrient response and chemical, physical and biological properties of soils.
Equivalent to: CSS 515
Recommended: CSS 315 and courses in statistics, chemistry and plant physiology.

SOIL 523, PRINCIPLES OF STABLE ISOTOPES, 3 Credits
An introduction to the theory and use of stable isotopes. Applications of stable isotopes to soil science, plant physiology, hydrology, and ecosystem studies. Offered even years.
Equivalent to: CSS 523

SOIL 525, MINERAL-ORGANIC MATTER INTERACTIONS, 3 Credits
Studies the fundamental properties of the mineral-organic interface and the mechanisms of interaction between mineral and organic soil properties.
Equivalent to: CSS 525
Recommended: CSS 305 or CSS 205 or SOIL 205

SOIL 530, ORGANIC SOIL AND CROP MANAGEMENT, 3 Credits
Overview of organic soil and crop management, organic soil system management, soil microbiology under organic systems, cropping systems, organic cereal production systems, organic forage production system, organic horticultural systems management, organic field and horticulture cropping systems; recent research and case studies. CROSSLISTED as CROP 530/SOIL 530.
Equivalent to: CROP 530
Recommended: (SOIL 525, CROP 200 and SOIL 205 or introductory biology) and completion or concurrent enrollment in AGRI 520
Available via Ecampus

SOIL 535, SOIL PHYSICS, 3 Credits
Theoretical elements of soil physical properties and processes related to agricultural, hydrological and environmental problems. Offered fall term in even years.
Equivalent to: CSS 535
Recommended: CSS 305, CSS 205, SOIL 205, MTH 241, CH 123, PH 201

SOIL 536, VADOSE ZONE HYDROLOGY LABORATORY, 1 Credit
Experimental elements of soil physical properties and processes allowing practical experience in the measurement and analysis of soil physical processes related to agricultural, hydrological and environmental problems. Weekly laboratory. Offered even years.
Equivalent to: CSS 536
Recommended: CH 123 and PH 201

SOIL 545, ENVIRONMENTAL SOIL CHEMISTRY, 3 Credits
Structural chemistry of clay minerals and organic matter, cation and anion exchange, and soil solution equilibria of soils. Ion exchange, mineral-solution equilibria, and adsorption reactions of silicate clays, oxides, and organic matter are emphasized. Covers the sorption behavior of environmental contaminants and the weathering reactions that govern the transport of reactive solutes through soils. Lec/rec. Offered odd years.
Equivalent to: CSS 545

SOIL 547, NUTRIENT CYCLING, 3 Credits
Reviews and discusses ecosystem-level biogeochemical concepts for terrestrial and freshwater ecosystems, primarily by reading and discussing classic and current literature to determine the state-of-knowledge and uncertainties associated with it. Topics include root nutrient uptake mechanisms, soil chemical and biochemical transformations in different soil and ecosystems, measuring soil solution and watershed fluxes, soil organic matter formation and structure, the meaning of sustainability, the concept of N saturation in terrestrial ecosystems, and the use of natural abundance and tracer isotopes in ecosystem biogeochemistry. While forest biogeochemical processes will be emphasized, desert, aquatic, wetland, and prairie ecosystems will also be explored. CROSSLISTED as BOT 547/SOIL 547.
Equivalent to: BOT 547, FS 547
Recommended: College-level chemistry and biology and one class in ecology (eg. BI 370) and/or soils (eg. SOIL 205)
SOIL 555, BIOLOGY OF SOIL ECOSYSTEMS, 4 Credits
A detailed study of the organisms that live in the soil and their activities in the soil ecosystems, soil as a habitat for organisms, taxonomy and biology of soil organisms, fundamentals of nutrient cycles, special topics in soil biology, review basis of soil microbial and ecological principles. Lec/rec/lab.
Equivalent to: CSS 555
Recommended: CSS 305 or CSS 205 or SOIL 205. Courses in chemistry, physics, and microbiology

SOIL 566, SOIL MORPHOLOGY AND CLASSIFICATION, 4 Credits
Observation and description of soil properties in the field; writing soil profile descriptions; evaluating criteria that define features used to classify soils; using soil classification keys. Lec/lab.
Equivalent to: CSS 566
Recommended: CSS 305 or CSS 205 or SOIL 205

SOIL 568, SOIL LANDSCAPE ANALYSIS, 4 Credits
Principles of soil geomorphology, soil stratigraphy, and surficial processes as applied to understanding the soil system at landscape scales. Emphasis on field observations of soils, geomorphic surfaces, and environment. Field project entails design of soil survey map units, field mapping and GIS cartographic techniques. Lec/lab.
Prerequisite: CSS 566 (may be taken concurrently) with C or better or SOIL 566 (may be taken concurrently) with C or better
Equivalent to: CSS 568

SOIL 599, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 601, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 603, THESIS/DISSERTATION, 1-16 Credits
This course is repeatable for 999 credits.

SOIL 605, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 606, PROJECTS, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 607, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 608, WORKSHOP, 1-16 Credits
This course is repeatable for 16 credits.

SOIL 609, PRACTICUM IN TEACHING, 1-3 Credits
Developing skills and competence in teaching under staff supervision; organization and presentation of instructional material by assisting in laboratory, recitation, and lectures. Graded P/N.
Equivalent to: CROP 609, ENT 609, PBG 609
This course is repeatable for 9 credits.

SOIL 635, ADVANCED SOIL PHYSICS, 3 Credits
Explores theoretical development of a key topic in soil physics. Topics may include evaporation from porous media, multiphase fluid movement, soil deformation, and soil salinization, with respect to either historical development, present day understanding or future needs of the field. Course structure incorporates lectures and discussion requiring intensive student participation. Offered odd years.
Prerequisite: CSS 535 with C or better or SOIL 535 with C or better
Recommended: A working knowledge of soil physics and a passing grade in a graduate-level soil physics course

SOIL 645, SOIL MICROBIAL ECOLOGY, 3 Credits
An advanced treatment of current topics in soil microbiology, with an emphasis on the ecology of soil microorganisms. Topics include the size, composition, diversity, and activity of soil microbial communities, linkage of microbial community structure to ecosystem functions, and applications of molecular biology to soil microbiology. Offered even years.
Equivalent to: CSS 645
Recommended: SOIL 455 or CSS 455 or MB 448

SOIL 684, GLOBAL BIOGEOCHEMICAL CYCLES, 4 Credits
An in-depth treatment of global biogeochemical cycles, focusing on cycles of carbon, oxygen, nitrogen, phosphorus, and sulfur in the atmosphere, hydrosphere, and lithosphere. CROSSTLISTED as GEO 684/
SOIL 684.
Equivalent to: GEO 684
Recommended: One year of college-level physics and chemistry, including introductory biology. One year of graduate coursework in soil, earth, ocean, atmospheric or forest science

SOIL 699, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

Sustainability (SUS)

SUS 102, *INTRODUCTION TO ENVIRONMENTAL SCIENCE AND SUSTAINABILITY, 4 Credits
An introduction to the science behind critical environmental issues and the biological basis of creating and maintaining sustainable ecosystems. Focus on such questions as: how do we decide what to believe about environmental issues? How do we quantify, restore, and value biodiversity? What is valid science in the global warming debate? Lec/lab. (Bacc Core Course)
Attributes: CPBS – Core, Pers, Biological Science
Equivalent to: SOIL 102
Available via Ecampus
SUS 103, *INTRODUCTION TO CLIMATE CHANGE, 4 Credits
An introduction to the principles of climate change science with an emphasis on the empirical evidence for climate change. Students will learn critical thinking skills to assess such questions as: How do we determine the processes controlling global warming? How do we predict trends in climate change? How do we calculate and understand uncertainty in these predictions? What is valid science in the global warming debate? Lec/lab. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science
Available via Ecampus

SUS 304, *SUSTAINABILITY ASSESSMENT, 4 Credits
Explores theories and application of sustainability assessment techniques and analysis methods. Practical application of globally recognized assessment protocol, including checklists, footprinting, life-cycle analysis and the indicators used to conduct these analyses. Emphasis on ecological and social indicators, although economic indicators are explored. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Available via Ecampus

SUS 325, ^AG AND ENVIRONMENTAL PREDICATIONS: A CASE STUDY APPROACH, 3 Credits
Analyze controversial agricultural and environmental issues, synthesize information from diverse sources, and apply scientific knowledge to recommend specific courses of action to solve real world problems. Develop oral and written communication skills through individual and group work. CROSSLISTED as CROP 325/SOIL 325/SUS 325. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Equivalent to: CROP 325, SOIL 325

SUS 331, *SUSTAINABILITY, JUSTICE, AND ENGAGEMENT, 3 Credits
Many sustainability crises are local, and the people most impacted tend to be groups already experiencing difference, lack of power, and discrimination. Transformational responses led by those most affected will be examined – responses that address the environmental problem while also building social and economic power for those affected. The tools and tactics used to achieve positive changes will be analyzed. (Bacc Core Course)
Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination
Equivalent to: SUS 331H
Available via Ecampus

SUS 331H, *SUSTAINABILITY, JUSTICE, AND ENGAGEMENT, 3 Credits
Many sustainability crises are local, and the people most impacted tend to be groups already experiencing difference, lack of power, and discrimination. Transformational responses led by those most affected will be examined – responses that address the environmental problem while also building social and economic power for those affected. The tools and tactics used to achieve positive changes will be analyzed. (Bacc Core Course)
Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination; HNRS – Honors Course Designator
Equivalent to: SUS 331

SUS 350, *SUSTAINABLE COMMUNITIES, 4 Credits
Introduction to the concept of sustainable communities from a multidisciplinary perspective. Instructors from a broad array of disciplines and professions. Development of holistic thinking skills and innovative solutions to complex problems. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues
Equivalent to: NR 350
Available via Ecampus

SUS 401, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

SUS 410, INTERNSHIP, 1-16 Credits
This course is repeatable for 16 credits.
Available via Ecampus

SUS 420, SOCIAL DIMENSIONS OF SUSTAINABILITY, 3 Credits
Focuses on the social aspects of sustainability, including how the environment, the economy, social life interact to create the world we live in. Explores how social institutions (school, government, business, family) contribute to sustainability and promote or discourage social and environmental justice at local and global scales. Also offered at OSU-Cascades and via Ecampus.
Available via Ecampus

SUS 499, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

SUS 512, TOPICS IN THE SCIENCE OF SUSTAINABILITY, 4 Credits
Provides a graduate-level introduction to key concepts and issues in environmental science and sustainability, targeted at business-oriented graduate and post-bacc students who do not have a science background. The course is a core requirement of the Sustainable Business certificate program offered jointly by the College of Business (COB) and the College of Agricultural Sciences’ (CAS) Sustainability Double-Degree (SDD) Program.
SUS 514, SUSTAINABILITY PLANNING AND ASSESSMENT, 4 Credits

Sustainability is fundamentally about balancing social, economic and ecological systems. This course examines a range of different methodologies for measuring and evaluating performance towards established sustainability criteria and indicators. Students will critically evaluate tools for making sustainable decisions and understand the limitations of individual assessment approaches in different contexts. Specific assessment techniques to be explored include ecological footprinting, sustainable community indicators, greenhouse gas emissions inventories, sustainability checklists, environmental management systems (ISO standards), life-cycle analysis, and business sustainability reporting. Students will leave the course with the fundamental skills required to complete sustainability assessments via globally relevant approaches.

SUS 599, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 16 credits.

Toxicology (TOX)

TOX 003, UNDERGRADUATE RESEARCH, 0 Credits

Students engage in research activities appropriate to their discipline; and through the research experience, to acquire skills, techniques, and knowledge relevant to their field of study. In consultation with a faculty mentor, students will engage in research activity, and make and execute a plan for a project.

TOX 360, *THE WORLD OF POISONS, 3 Credits

Provides a basic understanding of how we are exposed and respond to chemicals, examples of human diseases associated with toxic insult, the role of technology and the interface of society and toxicology in risk perception and legislation. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Recommended: One 3-credit course in chemistry or one 3-credit course in biology.

TOX 401, RESEARCH, 1-16 Credits

Equivalent to: AC 401
This course is repeatable for 16 credits.

TOX 405, READING AND CONFERENCE, 1-16 Credits

Equivalent to: AC 405
This course is repeatable for 16 credits.

TOX 411, FUNDAMENTALS OF TOXICOLOGY, 3 Credits

Introduction to the discipline of toxicology. Examination of the basic concepts that define how chemicals are absorbed, distributed, metabolized, and eliminated by the body. Overview of associated dose/response relations.
Prerequisite: BB 350 (may be taken concurrently) with D- or better or BB 450 (may be taken concurrently) with D- or better or BB 490 (may be taken concurrently) with D- or better

TOX 413, ENVIRONMENTAL TOXICOLOGY AND RISK ASSESSMENT, 3 Credits

Procedures for defining exposure and the use of toxicological data in defining risk assessment. Recent application of mechanistic concepts are reviewed.
Prerequisite: TOX 411 with D- or better

TOX 429, TOXIC SUBSTANCES IN FOOD, 3 Credits

Toxicology and epidemiology of human exposures to pesticides and food toxicants.
Prerequisite: BB 350 (may be taken concurrently) with D- or better or BB 450 (may be taken concurrently) with D- or better or BB 490 (may be taken concurrently) with D- or better
Equivalent to: TOX 429H

TOX 430, CHEMICAL BEHAVIOR IN THE ENVIRONMENT, 3 Credits

Applications of chemical concepts in the definition and solution of pollution problems; analytical considerations, thermodynamic factors influencing movement of chemicals, physical and metabolic transformations occurring in the environment.
Prerequisite: CH 123 with D- or better or CH 331 with D- or better

TOX 435, *GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK, 3 Credits

A multidisciplinary course that examines the scientific, social, political, economic, environmental, and ethical controversies surrounding agricultural and natural resource biotechnologies. Lec/rec. CROSSTLISTED as FES 435/TOX 435 and FES 535/MCB 535/TOX 535. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: FES 435, FES 435H, TOX 435H
Recommended: One quarter each of biology and chemistry
Available via Ecampus

TOX 435H, *GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK, 3 Credits

A multidisciplinary course that examines the scientific, social, political, economic, environmental, and ethical controversies surrounding agricultural and natural resource biotechnologies. Lec/rec. CROSSTLISTED as FES 435/TOX 435 and FES 535/MCB 535/TOX 535. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society; HNRS – Honors Course Designator
Equivalent to: BI 435, BI 435H, FES 435, FS 435, FS 435H, TOX 435
Recommended: One quarter each of biology and chemistry

TOX 455, ECOTOXICOLOGY: AQUATIC ECOSYSTEMS, 3 Credits

Focuses on transport, fate, and effects of toxic substances in freshwater ecosystems. There is special emphasis on impacts on fish.
Prerequisite: CH 331 with D- or better
TOX 480, COMPUTATIONAL TOXICOLOGY AND RISK ASSESSMENT, 3 Credits
Provides an in-depth understanding of the current systems biology paradigm for chemical risk and drug safety assessment. Learn about novel technologies in computational chemistry, molecular biology and systems biology used to develop methods for risk assessment, including approaches for chemical prioritization for screening and testing, predictive models for high-throughput hazard identification and utilization of “big data” to determine chemical mechanisms of action and toxicity pathways. Apply these approaches to specific case studies in risk analysis, environmental health and toxicology. Recommended: One year college chemistry and biology plus introductory toxicology or biochemistry.

TOX 490, ENVIRONMENTAL FORENSIC CHEMISTRY, 3 Credits
Principles of Good Laboratory Practice Standards, methodology, utility and limitations of chemical forensic methods as applied to real investigations. Recommended: One year of college chemistry and one term of organic chemistry.

TOX 499, SPECIAL TOPICS, 1-16 Credits
This course is repeatable for 16 credits.

TOX 501, RESEARCH, 1-16 Credits
This course is repeatable for 16 credits.

TOX 503, THESIS, 1-16 Credits
This course is repeatable for 999 credits.

TOX 505, READING AND CONFERENCE, 1-16 Credits
This course is repeatable for 16 credits.

TOX 507, SEMINAR, 1-16 Credits
This course is repeatable for 16 credits.

TOX 511, FUNDAMENTALS OF TOXICOLOGY, 3 Credits
Introduction to the discipline of toxicology. Examination of the basic concepts that define how chemicals are absorbed, distributed, metabolized, and eliminated by the body. Overview of associated dose/response relations. Prerequisite: BB 550 (may be taken concurrently) with C or better or BB 590 (may be taken concurrently) with C or better.

TOX 512, TARGET ORGAN TOXICOLOGY, 3 Credits
Examination of toxicological effects of chemicals at organ level. Normal physiology of the organ system is received. Prerequisite: TOX 511 with C or better.

TOX 513, ENVIRONMENTAL TOXICOLOGY AND RISK ASSESSMENT, 3 Credits
Procedures for defining exposure and the use of toxicological data in defining risk assessment. Recent application of mechanistic concepts are reviewed. Prerequisite: TOX 511 with C or better.

TOX 529, TOXIC SUBSTANCES IN FOOD, 3 Credits
Toxicology and epidemiology of human exposures to pesticides and food toxicants. Recommended: Completion or concurrent enrollment in BB 350, BB 450 or BB 490.

TOX 530, CHEMICAL BEHAVIOR IN THE ENVIRONMENT, 3 Credits
Applications of chemical concepts in the definition and solution of pollution problems; analytical considerations, thermodynamic factors influencing movement of chemicals, physical and metabolic transformations occurring in the environment. Recommended: CH 106 and CH 331 and graduate standing.

TOX 535, GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK, 3 Credits
A multidisciplinary course that examines the scientific, social, political, economic, environmental, and ethical controversies surrounding agricultural and natural resource biotechnologies. Lec/rec. CROSSLISTED as FES 435/TOX 435 and FES 535/MCB 535/TOX 535. Equivalent to: BI 535, FES 535, FS 535, MCB 535. Recommended: One quarter each of biology and chemistry. Available via Ecampus.

TOX 555, ECOTOXICOLOGY: AQUATIC ECOSYSTEMS, 3 Credits
Focuses on transport, fate, and effects of toxic substances in freshwater ecosystems. There is special emphasis on impacts on fish. Recommended: CH 331.

TOX 557, SCIENTIFIC SKILLS AND ETHICS, 3 Credits
Acquire a multitude of skills to launch and maintain productive extramurally funded careers as research scientists. Explore the ethical practices, data sharing approaches, and compliance requirements needed to conduct research. Examine the ethical use of human subjects and animals in research. Explore the changing landscape of intellectual property and commercialization policies for scientists. Introduces communication strategies for effective interactions with scientific peers, the general public and research sponsors. Equivalent to: MCB 557.
TOX 575, ADVANCED XENOBIOTIC METABOLISM AND DISPOSITION, 2 Credits

Course will focus on structure, function and regulation of specific proteins that function in uptake, distribution, metabolism, and excretion of drugs and other chemicals that are foreign to the body (xenobiotics). The course will focus on proteins which are termed Phase I and Phase II xenobiotic metabolizing enzymes and xenobiotic transporters. There will be an emphasis on Cytochrome P450 enzymes and hepatic and renal xenobiotic transporter proteins and their key roles in xenobiotic metabolism and excretion.

Recommended: TOX 512

TOX 580, COMPUTATIONAL TOXICOLOGY AND RISK ASSESSMENT, 3 Credits

Provides an in-depth understanding of the current systems biology paradigm for chemical risk and drug safety assessment. Learn about novel technologies in computational chemistry, molecular biology and systems biology used to develop methods for risk assessment, including approaches for chemical prioritization for screening and testing, predictive models for high-throughput hazard identification and utilization of “big data” to determine chemical mechanisms of action and toxicity pathways. Apply these approaches to specific case studies in risk analysis, environmental health and toxicology.

Recommended: One year college chemistry and biology plus introductory toxicology or biochemistry

TOX 590, ENVIRONMENTAL FORENSIC CHEMISTRY, 3 Credits

Principles of Good Laboratory Practice Standards, methodology, utility and limitations of chemical forensic methods as applied to real investigations.

Recommended: One year of college chemistry and one term of organic chemistry.

TOX 599, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.

TOX 601, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

TOX 603, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

TOX 605, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

TOX 607, SEMINAR, 1-16 Credits

This course is repeatable for 16 credits.

TOX 611, TESTING FOR GENOTOXICITY, 4 Credits

A lab-based course geared toward toxicology, biochemistry, biology, food science, nutrition, pharmacy and MCB students. Introduces principles and methods of several key assays used to screen for DNA damage and mutation. These tests will include the following: (i) Salmonella mutagenicity assay (Ames test), (ii) single cell gel electrophoresis (comet) assay, (iii) micronucleus assay, and (iv) PCR-based single strand conformation polymorphism (SSCP) screening for oncogene/tumor suppressor gene mutation in cancers. This 2-week, intensive lab/lecture class runs Mon-Fri in the LPSC during the first session of summer term. Each day includes laboratory work and a 2-hour lecture covering basic principles of the assays, as well as technical details of the experiment for the day.

Prerequisite: TOX 514 with C or better

Recommended: BB 400 series, prior course work on DNA repair and mutagenesis

TOX 699, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.

TOX 808, WORKSHOP, 1-16 Credits

This course is repeatable for 16 credits.