

BIOLOGICAL & ECOLOGICAL ENGR (BEE)

BEE 101, ECOLOGICAL ENGINEERING I, 3 Credits

Introduction to engineering at OSU and the field of ecological engineering. Topics include engineering analysis and problem solving, professional ethics, the design process and teamwork.

Recommended: MTH 112

BEE 102, ECOLOGICAL ENGINEERING II, 3 Credits

Introduction to common problems and solutions in ecological engineering, emphasizing the multiplicity of approaches to constraining, analyzing, and resolving challenges of ecosystem management. Two overnight field trips to local ecological monitoring and engineering sites will be required.

BEE 103, ECOLOGICAL ENGINEERING III, 3 Credits

Programming hardware/software for sensing and control with applications in Ecological Engineering. Introduction to computational thinking strategies.

BEE 199, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.

BEE 221, FUNDAMENTALS OF ECOLOGICAL ENGINEERING, 3 Credits

Introduction to the concepts and practice of ecological engineering. Covers chemical behavior and cycling in the environment, chemical kinetics, and unit processes of conventional treatment systems. Topics are applied to develop ecological treatment alternatives that meet the needs of human societies.

BEE 222, ECOLOGICAL ENGINEERING COMPUTATION, 2 Credits

Develops programming skills in Python, including basic programming tasks, data analysis, data visualization, and optimization, with applications in Ecological Engineering. Builds computational thinking skills.

BEE 270, ECOLOGY FOR ENGINEERS, 3 Credits

The study of ecology in the context of engineering. Develops an understanding of the patterns associated with species distribution in the natural world. Examines the theories of competition, predation, disease and mutualism that help explain the functioning of biological communities. Discusses interactions between abiotic and organismal factors, the environment, and ecological properties and processes.

BEE 299, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.

BEE 311, ECOLOGICAL FLUID MECHANICS, 4 Credits

Fluid properties, fluid statics, fluid motion, conservation of mass, momentum and energy for incompressible fluids, dimensional analysis, ecological engineering applications. Lec/rec.

Prerequisite: (PH 212 with C or better or PH 212H with C or better) and (MTH 254 [C] or MTH 254H [C]) and (ENGR 211 [C] or ENGR 211H [C])

BEE 312, ECOHYDRAULICS, 4 Credits

Theory and design of hydraulic systems for ecological engineering applications. Lec/rec.

Prerequisite: BEE 311 with C or better or CE 311 with C or better or CHE 331 with C or better or CHE 331H with C or better

BEE 313, ECOHYDROLOGY, 4 Credits

Provides a quantitative description of fundamental ecohydrologic processes, the interactions of between water and the atmosphere, soils, and plants, as well as techniques for estimating the movement of water in the though ecosystems.

Prerequisite: BEE 312 with C or better and BEE 320 [C]

BEE 320, BIOSYSTEMS ANALYSIS AND MODELING, 4 Credits

An introduction to simulation modeling and analysis of a variety of biological and ecological systems. Systems approaches to describing ecological systems.

Prerequisite: BEE 222 with C or better and (MTH 256 [C] or MTH 256H [C])

Recommended: MTH 256

BEE 322, ECOLOGICAL ENGINEERING THERMODYNAMICS AND TRANSFER PROCESS, 4 Credits

A study of the transport processes of fluid flow, heat transfer and mass transfer applied to biological organisms and ecological systems.

Prerequisite: BEE 320 with C or better

BEE 361, ECOLOGICAL ENGINEERING LABORATORY, 3 Credits

Introduction to modern measurement methods for ecological and environmental applications includes sensors and systems for measuring soil, water and atmospheric properties. No final exam; field trip required. Lec/lab.

Prerequisite: BEE 312 with C or better

BEE 362, ECOLOGICAL ENGINEERING MICROBIAL PROCESSES, 3 Credits

Applies ecological engineering principles to the modeling, analysis and design of microbial processes in the environment.

Prerequisite: BEE 320 with C or better or ENVE 322 with C or better

BEE 399, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 16 credits.

BEE 401, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

BEE 405, READING AND CONFERENCE, 1-16 Credits

Equivalent to: BRE 405

This course is repeatable for 16 credits.

BEE 407, SEMINAR, 1-16 Credits

Departmental seminars. Graded P/N.

Equivalent to: BEE 407H, BRE 407

This course is repeatable for 16 credits.

BEE 407H, SEMINAR, 1-16 Credits

Departmental seminars. Graded P/N.

Attributes: HNRS – Honors Course Designator

Equivalent to: BEE 407

This course is repeatable for 16 credits.

BEE 410, ECOLOGICAL ENGINEERING INTERNSHIP, 1-12 Credits

Internship in ecological engineering to provide students with an opportunity to apply course work and theory to the real world. Requires internship opportunity identification by student.

This course is repeatable for 12 credits.

BEE 411, GLOBAL ENVIRONMENTAL CHANGE: USING DATA TO INFORM DECISIONS, 3 Credits

Empowers students interested in global change research to focus on the interactions between changes in human land use and climate. Using an innovative online data and mapping tool called Data Basin, students will explore topics accessing the highest quality datasets available in an all-in-one platform.

Prerequisite: FE 257 with C or better

Available via Ecampus

BEE 415, PROFESSIONAL DEVELOPMENT, 1 Credit

Preparation for student professional careers. Students will interact with and hear seminars from professionals working in the ecological engineering field to learn from their experiences.

Corequisites: BEE 469

BEE 433, IRRIGATION SYSTEM DESIGN, 4 Credits

Principles of soil physics and plant water use applied to irrigation system design. Design of gravity, pressurized, and trickle irrigation systems, improving on-farm water management, performance characteristics of pumps and other irrigation equipment. Lec/lab. Offered alternate years.

Prerequisite: BEE 312 with C or better or CE 313 with C or better

Equivalent to: BRE 433

BEE 438, ECOLOGICAL SYSTEMS ANALYSIS, 4 Credits

An introduction to sustainability with a focus on case studies that are relevant to biological and ecological engineers. An introduction to tools that perform technical feasibility analysis, economic viability analysis, environmental risk assessment, resource sustainability assessment and life cycle assessment (LCA). Course will consist of theory and case studies highlighting the use of LCA methods to assess sustainability.

Prerequisite: ENGR 391 with C or better or ENGR 391H with C or better

BEE 439, IRRIGATION PRINCIPLES AND PRACTICES, 4 Credits

Survey of irrigation systems, system configurations, factors that influence irrigation efficiency, crop water requirements, energy requirements, pumps, irrigation scheduling. For non-engineers. Lec/lab/rec.

Prerequisite: MTH 111 with C or better

Equivalent to: BRE 439

BEE 446, RIVER ENGINEERING, 4 Credits

Multipurpose river use; natural physical processes in alluvial rivers; channel modification practices; river structures; design practices; impact of river modification; problem analysis; and impact minimization. Offered alternate years.

Prerequisite: BEE 312 with C or better or CE 313 with C or better

Recommended: CE 313

BEE 458, NONPOINT SOURCE POLLUTION ASSESSMENT AND CONTROL, 3 Credits

Problem solving in nonpoint source pollution. Methods for evaluating the extent, rate, timing, and fate of Non-Point Source (NPS) pollutants in agricultural and urban environments.

Prerequisite: BEE 313 with C or better or CE 412 with C or better

Available via Ecampus

BEE 468, BIOREMEDIATION ENGINEERING, 4 Credits

Examines strategies for using a variety of biological processes for treating municipal, agricultural and industrial contaminants. Lec/lab.

Prerequisite: BEE 221 with C or better or ENVE 322 with C or better

Available via Ecampus

BEE 469, ^ECOLOGICAL ENGINEERING DESIGN I, 4 Credits

Engineering design processes for ecological engineering applications, including specifications, performance criteria, timelines, and project logistics, principles and practices of working in engineering teams. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisite: BEE 322 with C or better

Recommended: ENGR 391 or ENGR 391H

BEE 470, ECOLOGICAL ENGINEERING DESIGN II, 4 Credits

Engineering design processes for ecological engineering applications, including specifications, performance criteria, timelines, and project logistics, principles and practices of working in engineering teams.

Prerequisite: BEE 469 with C or better

BEE 472, INTRODUCTION TO FOOD ENGINEERING PRINCIPLES, 5 Credits

Fundamental engineering principles for scientists and non-process engineers. Topics include fluid flow, mass and energy transfer, and material and energy balances. Directed at food scientists and other majors who need or would like a working knowledge of food engineering principles.

Prerequisite: MTH 112 with C- or better and (MTH 227 [C-] or MTH 251 [C-] or MTH 251H [C-]) and PH 201 [C-]

Equivalent to: BEE 452

BEE 473, INTRODUCTION TO FOOD ENGINEERING PROCESS DESIGN, 3 Credits

Fundamental engineering process design principles for food scientists and non-process engineers. Directed at those who need or would like a working knowledge of applied food engineering process design. Lec/rec.

Equivalent to: BEE 453

Recommended: BEE 472 or BEE 572

BEE 481, ^ECOLOGICAL ENGINEERING DESIGN I, 4 Credits

Explores engineering design processes for ecological engineering applications, including specifications, performance criteria, timelines, and project logistics, principles and practices of working in engineering teams. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisite: BEE 322 with C or better

Equivalent to: BEE 469

BEE 482, ECOLOGICAL ENGINEERING DESIGN II, 3 Credits

Designs engineering processes for ecological engineering applications, including specifications, performance criteria, timelines, and project logistics, principles and practices of working in engineering teams.

Prerequisite: BEE 481 with C or better

BEE 483, ECOLOGICAL ENGINEERING DESIGN III, 2 Credits

Designs engineering processes for ecological engineering applications, including specifications, performance criteria, timelines, and project logistics, principles and practices of working in engineering teams

Prerequisite: BEE 482 with C or better

BEE 499, SPECIAL TOPICS, 0-16 Credits

Equivalent to: BEE 499H, BRE 499

This course is repeatable for 16 credits.

BEE 499H, SPECIAL TOPICS, 1-16 Credits

Attributes: HNRS – Honors Course Designator

Equivalent to: BEE 499

This course is repeatable for 16 credits.

BEE 501, RESEARCH, 1-16 Credits

Equivalent to: BRE 501

This course is repeatable for 16 credits.

BEE 503, THESIS, 1-16 Credits

Equivalent to: BRE 503

This course is repeatable for 999 credits.

BEE 505, READING AND CONFERENCE, 1-16 Credits

Equivalent to: BRE 505

This course is repeatable for 16 credits.

BEE 506, PROJECTS, 1-16 Credits

Equivalent to: BRE 506

This course is repeatable for 16 credits.

BEE 507, SEMINAR, 1 Credit

Section 1: Graduate Student Orientation Seminar to acquaint new graduate students with graduate school and departmental requirements, policies and expectations, and departmental research programs.

Section 2: Graduate Research Publication Seminar to expose students to requirements for successful proposals and publication of research results. Section 3: Oral Presentation Improvement—A highly participatory educational effort designed to improve performance in presenting research reports, technical papers and in responding to oral examination questions. Graded P/N.

Equivalent to: BRE 507

This course is repeatable for 99 credits.

BEE 511, GLOBAL ENVIRONMENTAL CHANGE: USING DATA TO INFORM DECISIONS, 3 Credits

Empowers students interested in global change research to focus on the interactions between changes in human land use and climate. Using an innovative online data and mapping tool called Data Basin, students will explore topics accessing the highest quality datasets available in an all-in-one platform.

Available via Ecampus

BEE 512, PHYSICAL HYDROLOGY, 3 Credits

Principles of hydrologic processes and the integration of these processes into the hydrologic cycle. Topics include atmospheric processes, precipitation and runoff, storm response in streamflow on a watershed scale, and major concepts in groundwater systems.

Equivalent to: BRE 512

Recommended: One year of calculus.

Available via Ecampus

BEE 522, DATA ANALYSIS AND VISUALIZATION USING PYTHON, 3 Credits

Foundation course in computational thinking and computational skills relevant to data analysis and visualization of environmental data.

BEE 525, STOCHASTIC HYDROLOGY, 3 Credits

Introduction to fundamental concepts that are needed for stochastic modeling of hydrologic processes in presence of nonstationarity and uncertainty. CROSSLISTED as BEE 525/CE 525.

Prerequisite: CE 512 with C or better or BEE 512 with C or better

Equivalent to: CE 525

BEE 529, BIOSYS MODELING TECHNIQUES, 3 Credits

Development of mathematical models of biological and ecological systems; linear and nonlinear systems analysis; stochastic modeling and random processes; model solution and analysis techniques.

BEE 533, IRRIGATION SYSTEM DESIGN, 4 Credits

Principles of soil and plant water use applied to irrigation system design. Design of gravity, pressurized, and trickle irrigation systems, improving on-farm water management, performance characteristics of pumps and other irrigation equipment. Lec/lab. Offered alternate years.

Equivalent to: BRE 533

Recommended: ENGR 332

BEE 538, ECOLOGICAL SYSTEMS ANALYSIS, 4 Credits

An introduction to sustainability with a focus on case studies that are relevant to biological and ecological engineers. An introduction to tools that perform technical feasibility analysis, economic viability analysis, environmental risk assessment, resource sustainability assessment and life cycle assessment (LCA). Course will consist of theory and case studies highlighting the use of LCA methods to assess sustainability.

Recommended: ENGR 391 or ENGR391H

BEE 540, ENVIRONMENTAL TRANSPORT PROCESSES, 3 Credits

Mixing and transport processes in the environment.

BEE 542, VADOSE ZONE TRANSPORT, 4 Credits

Introduction to the physical and hydraulic properties involved in flow from the soil surface to groundwater. Classical infiltration equations will be derived and presented with exact and approximate solutions. Attention is focused on application to pollutant transport and recent advances in non-ideal flow.

Equivalent to: BRE 542

Recommended: MTH 254

BEE 544, OPEN CHANNEL HYDRAULICS, 4 Credits

Steady, uniform, and nonuniform flow in natural and artificial open channels; unsteady flow; interaction of flow with river structures; and computational methods. Offered alternate years.

Equivalent to: BRE 544, CE 544

Recommended: CE 313

BEE 545, SEDIMENT TRANSPORT, 4 Credits

Principles of sediment erosion, transportation and deposition in rivers, reservoirs, and estuaries; measurement, analysis, and computational techniques. Offered even years in winter term. CROSSLISTED as BEE 545/FE 545.

Equivalent to: BRE 545, FE 545

Recommended: CE 313 or FE 330

BEE 546, RIVER ENGINEERING, 4 Credits

Multipurpose river use; natural physical processes in alluvial rivers; channel modification practices; river structures; design practices; impact of river modification; problem analysis; and impact minimization. Offered alternate years.

Equivalent to: CE 546

Recommended: CE 313

BEE 549, REGIONAL HYDROLOGIC MODELING, 3 Credits

Challenges in regional-scale water resource analysis and management with emphasis on application to production agriculture. Application of geostatistical techniques to spatially variable systems and remote sensing to large-scale water resource systems. Development of soil-water-atmosphere-plant models. Analysis of evapotranspiration estimating methods. Offered alternate years.

Equivalent to: BRE 549

Recommended: BEE 512 and MTH 256

BEE 558, NONPOINT SOURCE POLLUTION ASSESSMENT AND CONTROL, 3 Credits

Problem solving in nonpoint source pollution. Methods for evaluating the extent, rate, timing, and fate of Non-Point Source (NPS) pollutants in agricultural and urban environments.

Available via Ecampus

BEE 568, BIOREMEDIATION ENGINEERING, 4 Credits

Examines strategies for using a variety of biological processes for treating municipal, agricultural and industrial contaminants. Lec/lab.

Available via Ecampus

BEE 572, INTRODUCTION TO FOOD ENGINEERING PRINCIPLES, 5 Credits

Fundamental engineering principles for scientists and non-process engineers. Topics include fluid flow, mass and energy transfer, and material and energy balances. Directed at food scientists and other majors who need or would like a working knowledge of process engineering principles.

Recommended: MTH 112 and (MTH 227 or MTH 251 or MTH 251H) and PH 201

BEE 573, INTRODUCTION TO FOOD ENGINEERING PROCESS DESIGN, 3 Credits

Fundamental engineering process design principles for food scientists and non-process engineers. Directed at those who need or would like a working knowledge of applied food engineering process design. Lec/rec.

Equivalent to: BEE 553

Recommended: BEE 472 or BEE 572

BEE 585, METABOLIC SYSTEMS ENGINEERING, 3 Credits

Quantitative and experimental approaches for describing and engineering biological networks and an introduction to the principles and methodologies of metabolic engineering and synthetic biology.

Equivalent to: BIOE 585

Recommended: Statistics, biology, biochemistry or microbiology.

BEE 586, PROBLEM SOLVING FOR METABOLIC SYSTEMS ENGINEERING, 1 Credit

Matrix algebra and linear optimization for engineers and life scientists who lack linear algebra, linear optimization, and differential equations. Real-world analysis and optimization problems applied to the design and engineering of biological networks. Lab.

Corequisites: BEE 585

Recommended: MTH 251 and MTH 252

BEE 599, SPECIAL TOPICS, 0-16 Credits

Equivalent to: BRE 599

This course is repeatable for 16 credits.

BEE 601, RESEARCH, 1-16 Credits

Equivalent to: BRE 601

This course is repeatable for 16 credits.

BEE 603, THESIS, 1-16 Credits

Equivalent to: BRE 603

This course is repeatable for 999 credits.

BEE 605, READING AND CONFERENCE, 1-16 Credits

Equivalent to: BRE 605

This course is repeatable for 16 credits.

BEE 606, PROJECTS, 1-16 Credits

Equivalent to: BRE 606

This course is repeatable for 16 credits.

BEE 607, SEMINAR, 1-16 Credits

Graded P/N.

Equivalent to: BRE 607

This course is repeatable for 16 credits.

BEE 699, SPECIAL TOPICS, 1-16 Credits

This course is repeatable for 16 credits.