BRAE 151 CAD for Agricultural Engineering (1)
Introduction to basic elements of computer aided drafting and design with AutoCAD software. Focus on 2-D and 3-D drawings, design of building and mechanical components. 1 lecture, 1 laboratory.

BRAE 124 Small Engines (2)
Operating principles of series internal combustion engine. Maintenance and trouble-shooting applications of small power units. 1 lecture, 1 laboratory.

BRAE 128 Careers in Bioresource and Agricultural Engineering (2)
Introduction to careers associated with BioResource and Agricultural Engineering, and Agricultural Systems Management. Professional engineering registration process. 1 lecture, 1 laboratory.

BRAE 129 Laboratory Skills and Safety (1)
Basic laboratory skills in the use of safety glass, personal protective equipment and techniques, laboratory tools, computers, and other equipment. 1 lecture, 1 laboratory.

BRAE 133 Engineering Design Graphics (2)
Introduction to the use of AutoCAD software for creating and modifying engineering drawings. 3 lectures, 1 laboratory.

BRAE 141 Agricultural Machinery Safety (3)
Evaluation of safe tractor and equipment operation. 1 lecture, 1 laboratory.

BRAE 142 Agricultural Mechanics (2)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 143 Power and Machinery (4)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 121 Agricultural Mechanics (2)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 128 Careers in Bioresource and Agricultural Engineering (2)
Introduction to careers associated with BioResource and Agricultural Engineering, and Agricultural Systems Management. Professional engineering registration process. 1 lecture, 1 laboratory.

BRAE 129 Laboratory Skills and Safety (1)
Basic laboratory skills in the use of safety glass, personal protective equipment and techniques, laboratory tools, computers, and other equipment. 1 lecture, 1 laboratory.

BRAE 133 Engineering Design Graphics (2)
Introduction to the use of AutoCAD software for creating and modifying engineering drawings. 3 lectures, 1 laboratory.

BRAE 141 Agricultural Machinery Safety (3)
Evaluation of safe tractor and equipment operation. 1 lecture, 1 laboratory.

BRAE 142 Agricultural Mechanics (2)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 143 Power and Machinery (4)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 151 CAD for Agricultural Engineering (1)
Introduction to basic elements of computer aided drafting and design with AutoCAD software. Focus on 2-D and 3-D drawings, design of building and mechanical components. 1 lecture, 1 laboratory.

BRAE 152 3-D Solids Modeling (1)
Introduction to 3-dimensional solids modeling using state-of-the-art software. Model generation and modification of associative properties, assembly modeling, extrusions and revolutes. 1 laboratory.

BRAE 200 Special Problems for Undergraduates (1–4)
Individual investigation, research, studies or surveys of selected problems. 8 units, with a maximum of 4 units per quarter. 1 laboratory.

BRAE 201 Enterprise Project (1–4) (CR/NC)
Individual investigation, research, studies or surveys of selected problems. 8 units, with a maximum of 4 units per quarter. 1 laboratory.

BRAE 203 Agricultural Systems Analysis (3)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 213 Bioengineering Fundamentals (2) GE B2
Treatment of the engineering applications of biology. 2 lectures. 1 laboratory.

BRAE 216 Fundamentals of Electricity (4)
Application of electricity in BioResource and Agricultural Engineering. 4 lectures. 1 laboratory.

BRAE 219 Principles of Irrigation (4)
Development of practical skills in carpentry and light construction. 3 lectures, 1 laboratory.

BRAE 223 Agricultural Structures Planning (4)
Planning of structures required in production systems. 3 lectures, 1 laboratory.

BRAE 226 Principles of Irrigation (4)
Land grading design, operation, management, and evaluation of irrigation methods. 3 lectures, 1 laboratory.

BRAE 231 Agricultural Building Construction (3)
Development of practical skills in carpentry and light construction. 3 lectures, 1 laboratory.

BRAE 234 Introduction to Mechanical Systems in Agriculture (4)
Introduction to the use of basic tools and techniques in the maintenance and repair of agricultural equipment. 3 lectures, 1 laboratory.

BRAE 240 Agricultural Engineering Laboratory (1)
Individual projects. Total credit limited to 4 units. 1 laboratory.

BRAE 247 Forest Surveying (2)
Use and care of maps, staff compass, surveying tools, total stations, and GPS receivers. Keeping field notes, measurements by tape. Closed and open traverse by compass and total stations. 2 lectures, 1 laboratory.
BRAE 342 Principles of Bioresource Engineering (4)
Theory and applications of bioprocess technology in biological and agricultural systems. Engineering properties of biological materials and organisms. Basic unit operations, fluid mechanics and heat/mass transfer as applied to bioprocess technology. Special requirements of agricultural and biological processes. 3 lectures, 1 laboratory. Prerequisite: BRAE 128, BRAE 232, BRAE 236, CHEM 125, PHYS 132, BIO 213 and BRAE 213 or ENGR 213, or MCR 221.

BRAE 332 Agricultural Safety (3)
Principles of agricultural safety. Accident causation and prevention, hazard identification and abatement, laws and regulations. Machinery, electrical, chemical, livestock, shop and fire safety. Safety program development. 2 lectures, 1 activity. Prerequisite: Junior standing.

BRAE 328 Measurements and Computer Interfacing (4)
Transducers and engineering measurements in agricultural engineering. Covering transducer characteristics, signal processors and controllers, instrumentation techniques, and the use of the computer in the measurement and control of typical engineering problems. 3 lectures, 1 laboratory. Prerequisite: EE 321, EE 361, a computer programming course.

BRAE 311 Irrigation Theory (3)
 Plant-water-soil relations using evapo-transpiration, plant stress, soil moisture deficiency, frequency and depth of irrigation, salinity, infiltration, drainage and climate control. 3 lectures. Prerequisite: BRAE 236, or BRAE 340.

BRAE 301 Hydraulic and Mechanical Power Systems (4)
Selection, application and use of hydraulic components and mechanical power transmission equipment. Use of standardized circuit design procedures. 3 lectures, 1 laboratory. Prerequisite: PHYS 121 or PHYS 141. Change effective Spring 2011.

BRAE 302 Servo Hydraulics (4)
Application of microcomputers and programmable logic controllers to hydraulic, pneumatic and mechanical systems. Theory, instrumentation and sensors used in process and control systems used in agricultural equipment. 3 lectures, 1 laboratory. Prerequisite: BRAE 216 or BRAE 324 and BRAE 234 or BRAE 301.

BRAE 312 Hydraulics (4)
Static and dynamic characteristics of liquids, flow in open and closed channels, uniform and nonuniform flow, flow measurement, pumps. 3 lectures, 1 laboratory. Prerequisite: PHYS 132, ME 211.

BRAE 323 Irrigation Water Management (4)  GE Area F
Soil-plant-water relationships; evapotranspiration; irrigation schedules; salinity and drainage; irrigation efficiency. Water measurement; soil moisture measurement; irrigation systems and practical constraints affecting scheduling. California water supply and budget; water rights; local, state and federal water institutions; California water issues. 3 lectures, 1 laboratory. Prerequisite: Junior standing, completion of GE Area A1, A3, and Area B, including Math 118 or better. Fulfills GE Area F.

BRAE 324 Fabrication Systems (4)
Fabrication systems including cutting, sawing, shearing, bending, welding, grinding, cleaning, painting and proper safety procedures. Experimental projects to include team design and construction, presentation, organization, and evaluation. 2 lectures, 2 laboratories. Prerequisite: BRAE 343.

BRAE 345 Aerial Photogrammetry and Remote Sensing (3)
Object recognition, three-dimensional equipment, and interpretation of aerial photographs. Print alignment, stereoscopic viewing, scales, elevation determination, and application. Orthophotos and their relationship to Geographic Information Systems (GIS). Application of aerial photos to regional studies. 2 lectures, 1 laboratory. Prerequisite: BRAE 119.

BRAE 331 Internship in BioResource and Agricultural Engineering (1–12)  (CR/NC)
Students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing professional and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only. Prerequisite: Consent of internship instructor.

BRAE 348 Energy for a Sustainable Society (4)  GE Area F
Study of how the transition can be made from fossil fuels to renewable energy sources including hydro, biomass, solar, wind, and energy conservation. Environmental, economic, and political consequences of a renewable energy-based sustainable society. 3 lectures, 1 activity. Prerequisite: Junior standing and completion of GE Area B. Fulfills GE Area F.

BRAE 400 Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems in agriculture. Total credit limited to 8 units, with a maximum of 4 units per quarter. Prerequisite: Consent of department head.

BRAE 401 Enterprise Project Management (1–4)  (CR/NC)
Advanced experience in a bioresource/agricultural engineering or agricultural systems management project. Project leadership and management are stressed. Project participation is subject to approval by the department head and the Cal Poly Corporation Credit/No Credit grading only. Prerequisite: BRAE 201 or consent of instructor.

BRAE 402 Agricultural Systems Engineering (4)
Engineering and economic principles combined with mathematical optimization techniques to evaluate parameters in agricultural production and processing systems. Project planning techniques, linear and nonlinear modeling, response surface methodology. Professional responsibilities in Agricultural Engineering including ethics, patents, copyrights, liability. 3 lectures, 1 laboratory. Prerequisite: ECON 201/211, MATH 242 or MATH 244.

BRAE 405 Chemigation (1)
Fertilizer and chemical injection through irrigation systems. Hardware, fertilizer compounds, and distribution uniformity. Matching chemicals and equipment to specific irrigation methods. Safety. 1 laboratory. Prerequisite: BRAE 236 or BRAE 340.
BRAE 414 Irrigation Engineering (4)
Design of on-farm irrigation systems; micro, surface, and sprinkler irrigation systems; canals and pumps; economic and strategies of pipe design; pipeline protection. 3 lectures, 1 laboratory. Prerequisite: BRAE 331 or BRAE 340; BRAE 312 or course in hydraulics with a grade of C or better.

BRAE 415 Hydrology (4)
Collection, organization and use of precipitation and runoff data, flood frequency, stream gauging and use of hydrograph, principles of groundwater and flood routing, sizing and economics of soil and water conservation structures. 3 lectures, 1 laboratory. Prerequisite: Junior standing, MATH 141, and SS 121 or consent of instructor.

BRAE 418, 419 Agricultural Systems Management I, II (4) (4)
Project management of agricultural systems. Emphasis placed on a team approach to problem solution. Case studies and student projects used to explore the following topics: project leadership, project organization, communication, needs assessment, feasibility studies, cost analysis, decision making, solution implementation, and evaluation. BRAE 418: 3 lectures, 1 laboratory. BRAE 419: 2 lectures, 2 laboratories. Prerequisite: BRAE 203, AGB 301, AGB 310 and ENGL 148. For BRAE 419: BRAE 418.

BRAE 421 Equipment Engineering (3)
Design and construction of specialized agricultural components and equipment. 2 lectures, 1 laboratory. Prerequisite: BRAE 328, CE 205, ME 212.

BRAE 422 Equipment Engineering (4)
Design and construction of specialized agricultural components and equipment. 2 lectures, 2 laboratories. Prerequisite: BRAE 421.

BRAE 425 Computer Controls for Agriculture (3)
Computer activated controls as applied to agricultural machinery, agricultural structures, processing and irrigation industries. Encompassing control logic to evaluate stability behavior of systems of computer interfacing, data input and control output. 2 lectures, 1 laboratory. Prerequisite: BRAE 324, CSC 110 or CSC 119 or CSC 232.

BRAE 427 Agricultural Process Engineering (3)
Agricultural engineering principles applied to air, water, air-water mixtures, drying, heating, refrigeration, fluid flow, size reduction, fan laws and materials handling. 2 lectures, 1 laboratory. Prerequisite: BRAE 421.

BRAE 430 Finite Element Analysis (3)
Introduction to the theory of finite element analysis and its application to drainage, pipe flow, fruit and vegetable damage predictions, structural strength, heat transfer, and other agricultural engineering applications. 2 lectures, 1 laboratory. Prerequisite: CE 204, MATH 242 or MATH 244, ME 302.

BRAE 432 Agricultural Buildings (4)
Selection of buildings, storage units, and related equipment for production agriculture. Economics and functionality of various designs and construction materials. Environmental factors affecting crop storage and animal housing. 3 lectures, 1 laboratory. Prerequisite: PHYS 121, BRAE 342, BRAE 343.

BRAE 433 Agricultural Structures Design (4)
Structural analysis and design of agricultural service and processing buildings. Emphasis on use of wood, metals, and reinforced concrete in light construction. 3 lectures, 1 laboratory. Prerequisite: BRAE 232, CE 205.

BRAE 435 Drainage (4)
Relevant principles of hydrology and porous media flow. Flow nets, wells and ground water, design of simple surface and sub-surface drains. 3 lectures, 1 laboratory. Prerequisite: Junior standing, BRAE 312, BRAE 331, or BRAE 340 or SS 432 and consent of instructor.

BRAE 437 Conservation Engineering (3)
Engineering solutions of soil and water conservation problems. Applications of engineering fundamentals of hydraulics, hydrology, and soils used in the design and construction of soil and water conservation structures. 2 lectures, 1 laboratory. Prerequisite: BRAE 312, BRAE 415, SS 121, or consent of instructor.

BRAE 438 Drip/Micro Irrigation (4)
Drip/micro irrigation hardware and management. Emphasizes agricultural drip/micro irrigation with some landscape application. Filtration, emitters, chemical injection, agronomic constraints, and scheduling. Field trip(s) included. 3 lectures, 1 laboratory. Prerequisite: BRAE 239 or BRAE 340.

BRAE 439 Vineyard Water Management (4)
Management of rain and irrigation water in vineyards. Irrigation scheduling, managing water stress, climate control with irrigation methods commonly used.
BRAE 485 Cooperative Education Experience in BioResource and Agricultural Engineering (6) (CR/NC)
Part-time work experience with an approved BioResource and Agricultural Engineering firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

BRAE 495 Cooperative Education Experience in BioResource and Agricultural Engineering (12) (CR/NC)
Full time work experience with an approved BioResource and Agricultural Engineering firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

BRAE 500 Individual Study (1–3)
Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 6 units, repeatable in same term. Prerequisite: Consent of instructor.

BRAE 521 Systems Analysis of Agricultural Systems (4)
Principles and methods of creative problem solving and systems analysis as applied to the design of agricultural systems. Problem solving using the engineering design process to analyze the need, establish boundaries, and generate creative alternative solutions. Examples worked through in feasibility analysis, transportation and network problems, linear programming, project planning, human factors and ergonomics, and system analysis with an emphasis on optimum system operation. 3 lectures, 1 laboratory. Prerequisite: Consent of instructor.

BRAE 522 Instrumentation Control/Microprocessors (4)
Engineering input/output instrumentation for sensing and controlling functions through data acquisition, analysis and response to agricultural processing. 3 lectures, 1 laboratory. Prerequisite: BASIC language programming or consent of instructor.

BRAE 529 Small Farm Mechanization (3)
Principles of farm machinery used for tillage, seeding, weeding, harvesting and transport of agricultural crops. Small-scale equipment, suitable for subsistence farming in developing countries. Small tractors, hand tools, animal power, and fuel from renewable sources. 2 lectures, 1 laboratory. Prerequisite: BRAE 143 or equivalent, graduate standing, or consent of instructor.

BRAE 532 Water Wells and Pumps (4)
Water well drilling, design, and development. Pump characteristics and system head. Series and parallel operation. Design of pump intakes. Variable speed electric drives and engines. Pump testing. 3 lectures, 1 laboratory. Prerequisite: BRAE 340 or equivalent, or BRAE 312 or equivalent.

BRAE 533 Irrigation Project Design (4)
Engineering solutions and social aspects of improved water delivery to farms and canal automation. Flow measurement. Water user associations. Unsteady canal and pipeline controls. PID controls and modeling. 3 lectures, 1 laboratory. Prerequisite: BRAE 340, hydraulics/fluid mechanics.

BRAE 570 Selected Topics in BioResource and Agricultural Engineering (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 seminars. Prerequisite: Graduate standing or consent of instructor.

BRAE 571 Selected Advanced Laboratory in BioResource and Agricultural Engineering (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

BRAE 581 Graduate Seminar in BioResource and Agricultural Engineering (3)
Group study of current problems of the bioresource and agricultural engineering industry; current experimental and research findings as applied to field of bioresource and agricultural engineering. The Schedule of Classes will list topic selected. Total credit limited to 9 units. 3 seminars. Prerequisite: Graduate standing or consent of instructor.

BRAE 599 Thesis in BioResource and Agricultural Engineering (1–9)
Systematic research of a significant problem in bioresource and agricultural engineering. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units. Prerequisite: Graduate standing and consent of instructor.