16. Metal Properties and Fabrication (2)
Lecture—1 hour; laboratory—3 hours. Study of metal properties and techniques for fabricating metal. Physical principles, considerations, effects of techniques on quality and appearance, and evaluation procedures. Experience in working with metal. (P/NP grading only.) GE credit: QL, SE, VL—II, III. Shafii

17. Plastic Properties and Fabrication (2)
Lecture—1 hour; laboratory—3 hours. Study of the properties of plastic materials and the fundamentals of fabrication techniques. Experience in working with common plastics, with applications to biological systems. (P/NP grading only.) GE credit: QL, SE, VL—II, III. Shafii

49. Field Equipment Operation (2)
Lecture—1 hour; laboratory—3 hours. Operation, adjustment, and troubleshooting of farm tractors and field equipment. Principles of operation, equipment terminology and uses of tilling, cultivating, thining, and planting equipment. Typical sequences in cropping practices. (P/NP grading only.) GE credit: QL, SE, VL—II, III. Shafii

52. Field Equipment Welding (2)
Lecture—1 hour; laboratory—3 hours. Prerequisite: course 16 or consent of instructor. Intermediate welding to include hand arc and gas welding. Class projects on repair and fabrication by welding. Troubleshooting and major repair of field equipment. (P/NP grading only.) GE credit: QL, SE, VL—II, III. Shafii

98. Directed Group Study (1-5)
Prerequisite: consent of instructor. (P/NP grading only.) GE credit: SE.

99. Special Study for Lower Division Students (1-5)
(P/NP grading only) GE credit: SE.

Upper Division

101. Engine Technology (3)
Lecture—2 hours; laboratory—3 hours. Prerequisite: upper division standing or consent of instructor. Principles of 2-stroke cycle, 4-stroke cycle gasoline engine construction and operation. Engine systems, performance, troubleshooting, and overhaul. GE credit: SciEng | QL, SE, VL—II, III. Rosa

110L. Experiments in Food Engineering (2)
Laboratory—6 hours. Prerequisite: Food Science and Technology 110B (may be taken concurrently). Use of temperature sensors; measurement of thermal conductivity and heat transfer in foods; refrigeration, freezing, concentration and dehydration of foods. GE credit: SciEng | QL, SE, VL—II, III. Singh

121. Animal Housing and Environment Management (2)
Lecture—2 hours. Prerequisite: Animal Science 1 or 2. Optimal structures and environments for animal growth and comfort; heat and moisture transfer principles; heating, cooling, ventilating principles and equipment; animal housing design; environmental regulations and welfare management practices. Offered in alternate years. GE credit: SciEng | SE—II, III. Zhang

142. Equipment and Technology for Small Farms (2)
Lecture—1 hour; laboratory—3 hours. Types and characteristics of farm equipment and technologies appropriate for small commercial farming. Adjustment and calibration of equipment. Selection of and budgeting for equipment. (Same course as International Agricultural Development 142.) GE credit: SciEng | QL, SE, VL—II, III. Perkins

150. Introduction to Geographic Information Systems (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Plant Sciences 210 or equivalent with consent of instructor. Priority given to College of Agricultural and Environmental Science majors. Basic concepts, principles and methods of GIS are presented. Data structures, database design, GIS data creation, GPS, and spatial analysis techniques are emphasized. Lab topics include: online data sources, aerial photogaphy, GPS data input, suitability analysis, cartography, design and graphics. Not open for credit to students who have completed Applied Biological Systems Technology 180/Plant Sciences 180 or Applied Biological Systems Technol- ogy 181N. (Same course as Hydrologic Science 130.) GE credit: SciEng | SE, VL—II, III. Greco, Upadhyaya

161. Water Quality Management for Aquaculture (3)
Lecture—3 hours. Prerequisite: Biological Sciences 18, Mathematics 16B, Chemistry 2B. Basic principles of water chemistry and water treatment processes as they relate to aquaculture systems. Offered in alternate years. GE credit: SciEng | QL, SE, VL—II, III. Perdriault

163. Aquaculture Systems Engineering (3)
Lecture—3 hours. Prerequisite: course 161. Design of aquacultural systems: design methodology, principles of fluid mechanics, site selection and facility planning, management operations, computer modeling. Offered in alternate years. GE credit: SciEng | QL, SE, VL, WE—II, III. Delwiche, Grismer

181. Introduction to Geographic Information Systems (4)
Lecture—3 hours, laboratory/discussion—3 hours. Prerequisite: Agricultural Management and Range- land Resources 21 or equivalent familiarity with com- puters, Agricultural Management and Rangeland Resources 120 or the equivalent, Mathematics 16A. Management and analysis of georeferenced data. Spatial database management and modeling. Applications to agriculture, biological resource manage- ment and social sciences. Cartographic modeling. Vector and raster-based geographic information sys- tems. Not open for credit to students who have com- pleted Agricultural Management and Rangeland Resources 132. (Same course as Plant Sciences 180.) GE credit: SciEng | QL, SE, VL—II, III. Delwiche, Grismer

181N. Concepts and Methods in Geographic Information Systems (4)
Lecture/laboratory—8 hours. Prerequisite: course 180 or Agricultural Management and Rangeland Resources 180 or Landscape Architecture 50 or consent of instructor. Data representation and analysis in geographic information systems (GIS). Creation of spatial data sets from analog and digital sources such as aerial photography and maps; data structures, data management, database design, georefer- encing, georectification, surface models, analysis, and spatial data visualization. Offered in alternate years. GE credit: SciEng | QL, SE, VL—II, III. Plant

182. Environmental Analysis using GIS (4)
Lecture—2 hours; laboratory—4 hours. Prerequisite: course 180 or equivalent GIS experience and skills; general biology and/or ecology courses recom- mended. Ecosystem and landscape modeling with emphasis on hydrology and solute transport. Spatial analysis of environmental risk including eco- logical risk assessment, natural resource management. Spatial database structures, scripting, data models, and error analysis in GIS. Offered in alter- nate years. (Same course as Hydrologic Science 182.) GE credit: SciEng | QL, SE, VL—II, III. Zhang

190C. Research Conference for Advanced Undergraduates (1)
Discussion—1 hour. Prerequisite: consent of instruc- tor. Research conferences for specialized study in applied biological systems technology. May be repeated for credit. (P/NP grading only.) GE credit: SE—II, III. I, II, III.
Applied Computing and Information Systems

(College of Agricultural and Environmental Sciences)

This minor is for students interested in applying modern computer technology to management problems in agriculture, resource management, and other areas. Course work provides knowledge of the use of information technology and the methodology of applied quantitative and systems analysis. The minor is offered by the Department of Plant Sciences.

Minor Program Requirements:

<table>
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<tr>
<th>COURSE</th>
<th>UNITS</th>
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<tbody>
<tr>
<td>Applied Computing and Information Systems</td>
<td>18</td>
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Two or three of the following courses: Plant Sciences 120, 121, Animal Science 128, Engineering: Computer Science 167. [The third course may be taken in substitution for a course from either of the elective groups.]

192. Internship in Applied Biological Systems Technology (1-5)
- Internship—3-1.5 hours. Prerequisite: upper division standing; approval of project prior to period of internship. Supervised internship in applied biological systems technology. May be repeated for credit. (P/NP grading only) GE credit: SE.

197T. Tutoring in Applied Biological Systems Technology (1-5)
- Tutorial. Tutoring individual students, leading small voluntary discussion groups, or assisting the instructor in laboratories affiliated with one of the departments. Regular courses. May be repeated for credit if topic differs. (P/NP grading only) GE credit: SE.

198. Directed Group Study (1-5)
- (S/U grading only.)—I, II, III. (I, II, III.)

299. Research (1-12)
- (S/U grading only.)—I, II, III, (I, II, III.)

Graduate

233. Pest Control Practices (3)
- Lecture—2 hours; laboratory—3 hours. Prerequisite: graduate standing or consent of instructor. Practical and theoretical considerations of pest control systems and techniques. Design, selection, and use of mechanical systems for field, orchard, greenhouse, and vector control use. Biological, legal, and environmental considerations in pest control and pesticide application.—II. Giles

290C. Graduate Research Conference (1)
- Discussion—1 hour. Prerequisite: consent of instructor. Research problems, progress, and techniques in applied biological systems technology. May be repeated for credit. (S/U grading only) GE credit: SE.

298. Group Study (1-5)
- (S/U grading only.)

299. Research (1-12)
- (S/U grading only.)

Professional

317. Teaching Agricultural Mechanics (2)
- Lecture—1 hour; laboratory—3 hours. Prerequisite: a course in physics; 6 units related to agricultural mechanics; enrolled in Agricultural Education Teacher Credential Program. Preparation of the teacher to plan, organize, and conduct an agricultural mechanics program in secondary schools. Development of and presentation of lesson plans and teaching aids. Review of subject matter in metal fabrication, power and machinery and agricultural structures areas.—I. (I) Perkins

Applied Mathematics (A Graduate Group)

Group Office. 1130 Mathematical Sciences Bldg. 530-752-8130
studentServices@math.ucdavis.edu; http://math.ucdavis.edu/grad/ggam

Faculty. The Group includes approximately 90 faculty members, of whom about one-third are in the Department of Mathematics. Membership comprises chemists, biologists, physicists, geologists, statisticians, computer scientists, and engineers. Research interests include biology, atmospheric sciences, mechanics, solid and fluid dynamics, optimization and control, theoretical chemistry, computer and engineering sciences, mathematical physics, signal and image processing, harmonic analysis, numerical analysis and nonlinear partial differential equations. A complete list of faculty and their research areas are available at http://math.ucdavis.edu/grad/ggam/faculty.

Graduate Study. Students prepare for careers where mathematics is applied to problems in the physical and life sciences, engineering, and management. The degree requirements consist of rigorous training in applied mathematics, including course work and a research dissertation under the direction of a member of the Graduate Group in Applied Mathematics. The M.S. degree provides preparation for further study in applied mathematics or an application area, or for a career in industry or public service. The Ph.D. degree provides preparation for a career in research and/or teaching, or in industrial or national research laboratories. For further information, please contact studentServices@math.ucdavis.edu or 530-752-8130.

New applicants are admitted to the fall quarter only.

Preparation. The program admits qualified students with a bachelor's degree in mathematics, physics, chemistry, engineering, economics, the life sciences and related fields. General and advanced mathematics GRE scores are required, and applicants should display evidence of strong quantitative skills. Undergraduate courses should include calculus (including vector calculus), linear algebra, and ordinary differential equations. Advanced calculus (introduction to real analysis) is strongly recommended. Additional background in probability, partial differential equations, and/or numerical analysis is a plus. The ability to program in a high-level computer programming language (e.g., C, Fortran, MAT-LAB, Python, R, etc.) is assumed.

Graduate Advisers. Contact the Student Services Office at 530-752-8130 or by email at studentServices@math.ucdavis.edu.

Courses. For a list of the courses in applied mathematics and mathematics, see Mathematics, on page 390.

Applied Physics

See Physics, on page 466.

Aquaculture

See Animal Biology, on page 150; Animal Science, on page 153; Applied Biological Systems Technology, on page 164; and Wildlife, Fish, and Conservation Biology, on page 544.

Arabic

See Classics, on page 198.

Art History

(College of Letters and Science)
Department Office. 101 Art Building 530-752-0105; http://arthistory.ucdavis.edu

Faculty
- Katharine Burnett, Ph.D., Associate Professor
- Lynn Roller, Ph.D., Professor
- Diana Strazdes, Ph.D., Associate Professor
- Hegnaw Waterpaw, Ph.D., Associate Professor
- Emeriti Faculty
- Mary H. Feng, Ph.D., Professor Emerita
- Robert J. Grigg, Ph.D., Professor Emeritus
- Seymour Howard, Ph.D., Professor Emeritus
- Jeffrey Ruda, Ph.D., Professor Emeritus
- Dianne Sachko Macleod, Ph.D., Professor Emerita

The Major Program
- Art History studies the changing visual expression of values, beliefs and experiences across diverse cultures and over time. It provides training in historical, social and aesthetic understanding, critical thinking, scholarly research, and lucid, thoughtful analysis and writing. More than any other discipline art history sharpens its students’ visual acuity and deepens their visual literacy. In so doing, it prepares them to face the increasingly complex visual world we find ourselves in today.

The Program
- The major begins with a series of courses that surveys major landmarks in the history of visual culture, art and architecture in Asia, Europe, and the United States. More advanced lecture courses and seminars focus on particularly important periods and issues. Students are encouraged to personalize their training with internships, independent study, and focused upper-division study. Top students considering graduate study are encouraged to engage in more advance study in the Honors program.

Career Options
- A major in Art History develops critical thinking and the integration of research, interpretation and understanding. It provides an excellent liberal arts basis for professions as far ranging as advertising, law, medicine, politics and business. The major prepares students for advanced study in Art History, Architecture, Museum Studies and Cultural Studies. It also serves as the foundation for careers in teaching, arts, administration, museums,