

COURSE NUMBERING SYSTEM

Courses are listed alphabetically by course symbol. Each department entry contains a list of **faculty members**, including designation of the **department head**, and a description of the courses.

System of Course Numbers

All course numbers consist of four digits, of which the first (left) digit indicates the level of preparation required and the fourth (right) digit indicates the number of semester hours. The two middle digits are reserved for the departments to distinguish one course from another. A fourth digit of zero (0) means that credit is variable to be fixed in consultation with the professor: example, **ACC 4000, Directed Individual Study**.

Courses that are in close sequence, such as two semesters of a survey course or a sequence of numbers for a seminar in a particular field may be listed with a hyphen (-) between the two four digit numbers: example, **PSS 4711-4731. Seminar**.

Where the same course is offered on both undergraduate and graduate levels, two numbers are used to designate the two levels of credit; example, **HI 4703/6703. England to 1485**. Students enrolled for graduate credit will be required to complete assignments above and beyond those students enrolled for undergraduate credit.

Course Numbers

1001-2999

3001-4999

4000

5011-5999

6011-6999

8011-8999

9011-9999

7000

8000-8009

9000-9009

Level of Credit*

Lower division courses
Undergraduate credit only
Upper division courses
Undergraduate credit only
Directed Individual Study
Undergraduate credit only
Fifth year undergraduate
or Professional courses
Courses for graduate credit
only

Directed Individual Study
Graduate credit only
Master's level research and
thesis
Doctor's level research and
dissertation

* Courses numbered 2000 or higher were upper division courses until Spring semester 1996.

COURSE DESCRIPTIONS in ALPHABETICAL ORDER by COURSE SYMBOL

Department of AGRICULTURAL and BIOLOGICAL ENGINEERING

Office: 100 Agricultural and Biological Engineering Center

Professors Gilbert (Head), Cathcart, Pote, and Smith;
Associate Professors Bumgardner, To and Thommason;
Assistant Professor Elder and Fernando

Biological Engineering

ABE 1911. Engineering in the Life Sciences. (1) (Open to freshmen and sophomores or first-semester transfer students only). One hour lecture. Introduction to agricultural and biological engineering; survey of the engineering profession; elementary analysis of biological systems; creative engineering and design and synthesis.

ABE 2421. Analytical Methods. (1) (Prerequisite: MA 1613). Two hours laboratory. The application of biostatistics to real experimental problems with emphasis on experimental design, sampling distribution, statistical hypotheses and decision rules.

ABE 2990. Special Topics in Agricultural and Biological Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ABE 3303. Transport in Biological Engineering. (3) (Prerequisite: PH 2233 and CSE 1213 or CSE 1233 or equivalent). Three hours lecture. Principles of steady state and unsteady state energy and mass transfer as applied to biological systems.

ABE 3413. Bioinstrumentation I. (3) (Prerequisite: PH 2223 or consent of instructor). Two hours lecture. Two hours laboratory. Applied circuit analysis, electrodes and transducers, stress and strain, temperature measurements, human physiology, digital and programmable instrumentation.

ABE 3813. Biophysical Properties of Materials. (3) (Prerequisite: PH 2213). Two hours lecture. Two hours laboratory. Physical properties of biological products and materials. Primary emphasis on measurement and evaluation of dimensional, mechanical, rheological, transport, thermal, electrical, and optical properties.

ABE 4000. Directed Individual Study. Hours and credits to be arranged.

ABE 4111/6111. Biological Engineering Principles Laboratory. (1) (Corequisite: ABE 4812). Three hours laboratory. The theory and practice of applying engineering principles and approaches for solving problems in the design of biological systems. The student develops a design for a project in biological engineering.

ABE 4122/6122. Biological Engineering Practices Laboratory. (2) Six hours laboratory. The student constructs, tests, and evaluates a biological engineering design.

ABE 4313. Biological Treatment of Nonpoint Source Pollutants. (3) Three hours lecture. Fundamental principles and design of biologically based treatment systems used to remove pollutants and protect receiving waters from agricultural and urban/suburban storm water runoff.

ABE 4323. Physiological Systems in Biomedical Engineering. (3) (Prerequisites: BIO 1504 or equivalent; EM 3313 or equivalent; ABE 3813; ABE 4803 or equivalent). Three hours lecture. Mathematical description and modeling of the behavior of physiological systems significant to biomedical engineers.

ABE 4423/6423. Bioinstrumentation II. (3) (Prerequisite: ABE 3413 or graduate standing). Two hours lecture. Two hours laboratory. Theory; application of automated measuring and control systems in biological sciences. Includes design/use of transducer interfaces; electronic signal conditioning; data logging; microprocessor based systems.

ABE 4483/6483. Introduction to Remote Sensing Technologies. (3) (Prerequisite: Senior or graduate standing, or consent of instructor). Three hours lecture. Electromagnetic interactions, passive sensors, multispectral and hyperspectral optical sensors, active sensors, imaging radar, SAR Lidar, digital image processing, natural resource applications. (Same as ECE 4423/6423 and PSS 4483/6483).

ABE 4513/6513. Dynamics of Aging. (3) (Prerequisite: BIO 1123 or BIO 1504 or consent of instructor). A broad based systematic, quantitatively oriented introduction to the dynamics of aging. Systems physiology of aging in relation to biomedical engineering.

ABE 4523/6523. Biomedical Materials. (3) (Prerequisites: One of the following: ABE 3813 or CHE 3413 or ME 3403). Three hours lecture. Emphasis is on applications, composition, testing, and biocompatibility of biomedical materials used in implant devices. This course may be used for honors credit.

ABE 4533/6533. Rehabilitation Engineering (3) (Prerequisites: Senior standing in College of Engineering). Three hours lecture. An introduction to rehabilitation engineering emphasizing applications of technology in prosthetics; orthotics, mobility, and sensory augmentation. This course may be used for honors credit.

ABE 4613/6613. Biomechanics. (3) (Prerequisites: EM 2413 and EM 2433). Three hours lecture. Force, motion, and deformation analysis of organisms and biological structures. Mechanical modeling techniques unique to biological materials.

ABE 4624/6624. Experimental Methods in Materials Research. (4) (Prerequisites: CHE 3413 or ABE 3813 or ME 3403 or consent of instructor). Three hours lecture. Three hours laboratory. Introduction to research methodologies commonly used in the evaluation of treatments, and mechanical testing. (Same as CHE 4624/6624 and ME 4624/6624).

ABE 4803/6803. Biosystems Simulation. (3) Three hours lecture. Spring semester. Application of engineering analysis, modeling and simulation to biological systems.

ABE 4812/6812. Principles of Engineering Design. (2) (Prerequisite: senior standing in engineering). Two hours lecture. Emphasizing the use of mathematics, mechanics, and systems analysis in the design of

engineering systems in agricultural, biomedical, food processing and forestry areas.

ABE 4911. Engineering Seminar. (1) (Prerequisite: Consent of instructor). One hour lecture. Discussion of current engineering developments and their relation to agriculture and the life sciences.

ABE 4990/6990. Special Topics in Agricultural and Biological Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ABE 7000. Directed Individual Study. Hours and credits to be arranged.

ABE 8000. Thesis Research/Thesis. Hours and credits to be arranged.

ABE 8314. Corrosion of Biomedical Implants. (4) (Prerequisite: Graduate Standing). Three hours lecture & three hours laboratory. Basic concepts of electronics, especially related to corrosion. Development of corrosion mechanisms and evaluation of corrosion susceptibility of implant metals/alloys in dentistry and orthopaedics.

ABE 8501-8531. Journal Reviews in Biomedical Engineering. (1) One hour lecture. Current Journal articles relevant to Biomedical Engineering topics are read and reviewed.

ABE 8801. Clinical Experience for Biomedical Engineering. (1) (Prerequisites: Graduate standing in the Biomedical Program and permission of the instructor.) Three hours experiential learning. This course will provide graduate students with exposure, understanding and insight into the clinical environment and/or treatment modalities of clinical (human and/or animal) patients.

ABE 8911-8931. Agricultural and Biological Engineering Seminar. (1) Discussion of research needs, review of literature, and development of research work plans.

ABE 8990. Special Topics in Agricultural and Biological Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ABE 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

Agricultural Engineering Technology and Business

ABE 1073. Agricultural Mechanics. (3) One hour lecture. Four hours laboratory. Developing skills in hot and cold metal work; welding, carpentry practices, painting and finishing wood, concrete and concrete masonry; and basic electric wiring.

ABE 1863. Engineering Technology in Agriculture. (3) Three hours lecture. Introductory course emphasizing use of fundamentals for solving problems related to soil and water management, electrical power and control, agricultural machinery, and environmental control.

ABE 2063. Introduction to Agricultural Engineering Technology. (3) (Prerequisite or corequisite: MA 1313. Open to freshman or first-semester transfer students only). Three hours lecture. Curricula and career objectives. Quantitative and analytical assessment of the physical system in agriculture and natural resources.

ABE 2173. Internal Combustion Engine Technology. (3) Two hours lecture. Three hours laboratory. Principles of operation of gasoline,

diesel and LP gas engines; engine types; ignition, fuel, valve, and cooling systems; transmission; power trains; power measurement; and tune-up.

ABE 2263. Agricultural Surveying and Drainage. (3) Two hours lecture. Three hours laboratory. Basic surveying measurements and equipment use. Surveys for drainage and erosion control measures, principles of water control for soil conservation and drainage.

ABE 2873. Land Surveying. (3) (Prerequisite: MA 1323 or equivalent). Two hours lecture. Three hours laboratory. Fundamentals of measurements and traverse computations. Public land surveys. Surveying practice in traverse and topographic surveys.

ABE 3513. The Global Positioning System and Geographic Information Systems in Agriculture and Engineering. (3) (Prerequisite: MA 1313 and MA 1323, or equivalent). Two hours lecture. Four hours laboratory. Basic theory and hands-on application of global positioning system (GPS) technology/hardware, and geographic information systems (GIS) software, for precise positioning in agriculture and engineering.

ABE 3700. Internship in Gin Management and Technology. (1-6) (Prerequisite: Minimum of junior standing or permission of instructor). Credits to be arranged. Work experience in approved cotton gins for Agricultural Engineering Technology and Business majors with an emphasis in Gin Management and Technology.

ABE 4163/6163. Machinery Management for Agro-Ecosystems. (3) (Prerequisite: Junior standing or consent of instructor). Two hours lecture. Two hours laboratory. Basic principles of operation and management of agricultural, landscape, and turf power machinery; selection of machinery based on power requirements, economy, and suitability for Agro-Ecosystems.

ABE 4263/6263. Soil and Water Management. (3) (Prerequisite: ABE 2873. Students with credit in ABE 2263 will not receive credit in this course). Two hours lecture. Three hours laboratory. Introduction to soil and water management principles; elementary hydrology, basic fundamentals of erosion control, surface and subsurface drainage, and water control for irrigation.

ABE 4383/6383. Building Construction. (3) (Prerequisites: EG 1143, junior standing.) Three hours lecture. An introduction to building terms, construction materials, structural components, construction methods, and mechanical systems pertaining to residential and commercial structures.

ABE 4453/6453. Cotton Ginning Systems and Management. (3) Three hours lecture. An in-depth exposure to the modern cotton ginning industry, including the basics of the operation of a cotton gin and management of the ginning process.

ABE 4473/6473. Electrical Applications. (3) Two hours lecture. Two hours laboratory. Fundamental electricity, wiring, and control of agricultural operations. Includes use of computer tools, instruments, safety, and hardware.

ABE 4483/6483. Introduction to Remote Sensing Technologies. (3) (Prerequisite: Senior or graduate standing, or consent of instructor). Three hours lecture. Electromagnetic interactions, passive sensors, multispectral and hyperspectral optical sensors, active sensors, imaging radar, SAR Lidar, digital image processing, natural resource applications. (Same as ECE 4423/6423 and PSS 4483/6483).

ABE 4961. Seminar. (1) (Prerequisite: Consent of instructor). One hour lecture. Review of current literature dealing with the technical problems in the agricultural industry.

SCHOOL OF ACCOUNTANCY

Office: 381 McCool Hall

Professors Hollingsworth (Director), Daughtrey, McNair and Milam;
Associate Professors Addy, Herring, and Rigsby;
Assistant Professors Boone, Lehman, and Stammerjohan.

ACC 1203. Basic Industrial Accounting. (3) Three hours lecture. Emphasis on the fundamentals of financial and cost accounting essential for interpreting accounting reports. Designed primarily for engineering students. (Not open to students who have had 3 semester hours in accounting or who are accounting or business majors.)

ACC 2013. Principles of Financial Accounting. (3) Three hours lecture. Financial accounting fundamentals including accounting cycle, accounting systems, cash flow, assets, liabilities, equity, and forms of business organizations. Honors section available through invitation only.

ACC 2023. Principles of Managerial Accounting. (3) (Prerequisite: ACC 2013). Three hours lecture. Managerial accounting fundamentals including interpretation and use of management reports, cost behavior, cost accumulation, budgeting, financial statement analysis, responsibility accounting. Honors section available through invitation only.

ACC 2990. Special Topics in Accounting. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ACC 3003. Accounting Information Systems I. (3) (Prerequisite: ACC 2023). Three hours lecture. Using computerized information systems, including word processing, spreadsheet, database, network, and Internet software. Documenting accounting information system processes and establishing effective internal controls.

ACC 3013. Cost Accounting. (3) (Prerequisite: ACC 3003). Three hours lecture. Cost accounting principles and techniques as applied to job order and continuous process types of industry; determination of unit costs; preparation of cost reports.

ACC 3023. Intermediate Accounting I. (3) (Prerequisite: ACC 2023). Three hours lecture. Financial accounting and reporting related to the development of accounting standards, financial statements, income

measurement, cash, receivables, inventory, property, plant, and equipment, intangibles, and investments.

ACC 3033. Intermediate Accounting II. (3) (Prerequisite: ACC 3023). Financial accounting and reporting related to liabilities, leases, pensions, income taxes, stockholder's equity, accounting changes, errors, cash flows, and earnings per share.

ACC 3053. Accounting Information Systems II. (3) (Prerequisite: ACC 3003). Three hours lecture. Designing and using accounting information systems in both computerized general ledger and database processing environments.

ACC 3203. Financial Statement Analysis. (3) (Prerequisite: ACC 2031 or equivalent, ACC 2023). Three hours lecture. For non-accounting majors. A study of financial statements from an external users perspective; an analysis of statements for purposes of determining loan and investment potential.

ACC 4000. Directed Individual Study. (Prerequisites: ACC 2023 and consent of Director of School of Accountancy). Hours and credits to be arranged.

ACC 4013. Income Tax I. (3) (Prerequisite: ACC 2013). (Not open to PACC students). Three hours lecture. An analysis of the Federal Income Tax Law with emphasis on its application to the individual taxpayer.

ACC 4023/6023. Advanced Accounting. (3) (Prerequisite: ACC 3033). (Not open to PACC students). Three hours lecture. Financial accounting and reporting related to consolidations, partnerships and international business issues.

ACC 4033. Auditing. (3) (Prerequisite: ACC 3053). (Not open to PACC students). Three hours lecture. Fundamentals of auditing, including evaluating controls, assessing risk, designing audit programs, statistical sampling, professional ethics, and collecting evidence for financial, internal, operational, and compliance audits.

ACC 4043/6043. Municipal and Governmental Accounting. (3) (Prerequisite: ACC 2023). (Not open to PACC students). Three hours lecture. Accounting theory and practice applied to governmental units, state operated schools and colleges; classification and use of funds; fiscal procedures; budgetary control; financial statements; reports.

ACC 4053/6053. International Accounting. (3) (Prerequisite: ACC 2023). (Not open to PACC students). Three hours lecture. A study of the international dimension of accounting as it relates to multinational corporations and the international environment.

ACC 4063/6063. Income Tax II. (3) (Prerequisite: ACC 4013). (Not open to PACC students). Three hours lecture. Discussion of the Federal Income Tax treatment of taxpayers other than individuals and the treatment of property transfers which are subject to Federal and State gift and death taxes.

ACC 4203/6203. Accounting Internship. (3) (Prerequisites: Senior standing and approval by the Internship Director prior to the internship). A minimum of eight consecutive weeks consisting of forty hours per week of professional experience in audit, tax and other accounting related areas.

ACC 4990/6990. Special Topics in Accounting. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ACC 7000. Directed Individual Study. Hours and credits to be arranged.

ACC 8013. Seminar in Financial Accounting Theory. (3) (Prerequisite: ACC 4023). Examination of the theoretical concepts, definitions, and models espoused in the accounting literature and relevant to analyzing various contemporary issues in financial accounting and reporting.

ACC 8023. Advanced Managerial Accounting. (3) (Prerequisite: ACC 3013). Three hours lecture. The study of the theoretical conceptual and technical issues in planning, control and decision making.

ACC 8033. Business Assurance Services. (3) (Prerequisite: ACC 4033). Three hours lecture. Financial statement auditing practices, in-

cluding professional standards, ethical responsibilities, legal liability, and reporting requirements.

ACC 8043. Fraud Examination. (3) (Prerequisite ACC 3053 and ACC 4033). Three hours lecture. Developing and executing a program of procedures to detect errors and frauds using information generated by computerized accounting systems.

ACC 8053. Professional Accounting Policy and Research. (3) (Prerequisites: ACC 3033). Three hours lecture. Integrative course examining recent trends and developments in public accounting. Various problems and cases in financial reporting issues, ethics, and other accounting topics.

ACC 8063. Research in Tax Practice and Procedures. (3) (Prerequisite: ACC 4013). Three hours lecture. Preparation of tax protests, tax planning; use of tax services; client representation; structure of Internal Revenue Service; and research problems in taxation.

ACC 8073. Taxation of Corporations and Shareholders. (3) (Prerequisite: ACC 4013). Examination of federal income tax laws as applied to corporations and shareholders with an emphasis of how research issues deal with these topics.

ACC 8083. Federal Estate and Gift Taxation. (3) (Prerequisite: ACC 4013). An examination of the Federal Estate and Gift tax laws with an emphasis on how to research issues dealing with these topics.

ACC 8093. Taxation of Partnerships, S Corporations, Trusts, and Estates. (3) (Prerequisite: ACC 4013). Three hours lecture. An examination of the income taxation of partnerships, S corporations, trusts, and estates with an emphasis on how to research issues dealing with these topics.

ACC 8103. Income Taxation of Natural Resources. (3) (Prerequisite: ACC 4013). Three hours lecture. An examination of federal income tax laws as applied to oil and gas, solid minerals, timber, and selected topics in farming.

ACC 8112. Financial Statement and Management Accounting Report Analysis for Decision Making. (2) (Prerequisite: ACC 8303 or equivalent). Two hours lecture. Analysis of financial statements and internal accounting reports to help management make decisions.

ACC 8113. Advanced Individual Taxation. (3) (Prerequisite: ACC 4013 or consent of instructor). Three hours lecture. An in-depth analysis of taxation of individuals with an emphasis on how to research issues dealing with these topics.

ACC 8203. Advanced Accounting Analysis for Decision Making. (3) (Prerequisite: ACC 2023). Three hours lecture. Application of accounting principles and concepts to alternative business possibilities as an aid to management decision making.

ACC 8303. Survey of Accounting. (3) Prerequisite: Graduate Standing). Three hours lecture. Introduction to financial and managerial accounting; including accounting process, cash flow, elements, business organizations, analysis of management reports and financial statements, cost planning and control.

ACC 8990. Special Topics in Accounting. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ACC 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

ACC 9013. Seminar in Financial Accounting. (3) (Prerequisite: ACC 8013). Review and analysis of historical and current research in financial accounting theory. Emphasis on developing critical analytical skills for evaluating financial accounting research.

ACC 9023. Seminar in Management Accounting Research. (3) (Prerequisite: ACC 8023.) Three lecture/discussion. A survey of the theory and practice of management accounting research.

ACC 9033. Seminar in Accounting Research. (3) (Prerequisite: Consent of the instructor) Evaluation and analysis of academic research strategies and methodologies, emphasis on (1) understanding and evaluating empirical research results and (2) formulating and writing research proposals.

Department of ANIMAL and DAIRY SCIENCES

Office: 4025 Wise Center

Professors Althen, Boyd, Kiser, and Rogers; Associate Professor Rude;

Assistant Professors Evans, Fairbrother, Nicodemus, Ryan, A. Smith, T. Smith, St. Louis, and Willard

Instructor Shields

ADS 1114. Animal Science. (4) Fall and spring semester. Three hours lecture. Two hours laboratory. Fundamental principles and practical application of livestock, dairy, and poultry science.

ADS 1132. Western Equitation. (2) Fall and spring semester. One hour lecture. Two hours laboratory. Principles of horsemanship and management and training of western pleasure horses.

ADS 2102. Equine Conformation and Performance Evaluation. (2) Spring Semester. Four hours laboratory. Individual evaluation

of horses with an in-depth study of anatomy and its relationship to function, plus methods used in evaluating performance classes.

ADS 2122. Advanced Equine Evaluation. (2) Fall Semester. (Prerequisite: ADS 2102 or consent of instructor). Four hours laboratory. Advanced evaluations of equine conformation and performance classes. Develop more extensive oral reason presentations to defend conformation and performance placings.

ADS 2211. Equine Behavior and Training. (1) (Prerequisite: ADS 1132 and consent of instructor). Two hours laboratory. Equine behavior and application of psychology principles for training horses. Systematic approaches to horse training emphasizing learning principles and training methods for specific equine activities.

ADS 2990. Special Topics in Animal and Dairy Science. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ADS 3142. Meats Judging I. (2) Spring semester. Four hours laboratory. Grading and judging meat carcasses and cuts, study of packing house operation. (Same as FST 3142)

ADS 3213. Performance Analysis of Meat Animals. (3) Fall Semester. One hour lecture. Four hours laboratory. Productive evaluation of livestock as meat animals directly related to carcass value and economics of production.

ADS 3232. Horse Science. (2) Spring semester. Two hours lecture. Breeding, feeding, management, and training of horses.

ADS 3233. Introduction to Therapeutic Riding. (3) (Prerequisite: ADS 1132 or consent of instructor). Three hours lecture. An introductory course to therapeutic horseback riding discussing the therapeutic riding team, facilities and equipment, standards and accreditation, and special needs of the rider.

ADS 3312. Livestock Management Practices. (2) Fall and spring semester. (Prerequisites: ADS 4123, ADS 4113, ADS 4323 or current semester enrollment). Four hours laboratory. Modern techniques used in proper vocational management of beef cattle, sheep, swine, and horses.

ADS 3813. Dairy Cattle Appraisal. (3) One hour lecture. Four hours laboratory. Phenotypic appraisal; breed programs; performance record systems.

ADS 4000. Directed Individual Study. Hours and credits to be arranged. Approval by Department Head only.

ADS 4113/6113. Swine Science. (3) Fall semester. (Prerequisites: ADS 4213, ADS 4613 and ADS 4123). Three hours lecture. Feeding, management, breeding, production, and marketing of swine.

ADS 4123/6123. Animal Breeding. (3) Fall semester. (Prerequisite: PO 3103). Three hours lecture. The basis for genetic improvement of livestock, including the study of variation, heritable characteristics, mating systems and methods of estimating breeding values. (Same as GNS 6123.)

ADS 4212/6212. Livestock Evaluation. (2) Spring semester. (Prerequisite: ADS 3213). Four hours laboratory. Evaluation of individuals and representative groups of livestock from the standpoint of the breeder, the market, and the consumer.

ADS 4213/6213. Livestock Nutrient Requirements and Formulation of Rations. (3) Fall semester. Application of knowledge of feedstuffs and nutrient requirements in ration formulation for all classes of livestock.

ADS 4221. Animal and Dairy Sciences Senior Seminar. (1) Fall semester. One hour lecture. Review and oral presentation of animal science research and related production problems.

ADS 4222/6222. Sheep Science. (2) Fall semester. (Prerequisite: Junior or senior standing). Two hours lecture. Breeding, feeding, management, and marketing of sheep for lamb and wool production.

ADS 4232/6232. Advanced Livestock Evaluation. (2) Fall semester. (Prerequisite: ADS 4212/6212). Four hours laboratory. Advanced study of animal evaluation in functional efficiency.

ADS 4243/6243. Composition and Chemical Reactions of Foods. (3) Spring semester. (Prerequisites: CH 1053 and CH 2503 or equivalent). Three hours lecture. Nature and chemical behavior of food constituents including proteins, lipids, carbohydrates, minerals, water, enzymes and pigments; properties of food systems as related to commercial preparation. (Same as FST 4243/6243.)

ADS 4314/6314. Meats Processing. (4) Spring semester. Three hours lecture. Two hours laboratory. Survey of the meat industry with emphasis on slaughtering, cutting, curing, cooling, care, storage and manufacturing meats and meat products. (Same as FST 4314/6314.)

ADS 4323/6323. Beef Cattle Science. (3) Spring semester. (Prerequisites: ADS 4213, ADS 4613 and ADS 4123). Three hours lecture. Breeding, feeding, management, and marketing of beef cattle.

ADS 4333/6333. Equine Exercise Physiology. (3) (Prerequisite: ADS 3232). Three hours lecture. Evaluation of research in equine exercise science. Physical, physiologic, metabolic, behavioral and locomotive adaptations of the equine athlete to athletic training.

ADS 4412. Managing Livestock Sales I. (2) Fall Semester. (Prerequisites: Instructor approval. Course must be taken in consecutive semesters with ADS 4421.) Four hours laboratory. Course in preparation, structure and management of livestock sales. Emphasis will be on cattle and horse sales. Students will prepare for and conduct sale.

ADS 4423. Animal and Dairy Sciences Internship. (3) (Prerequisite: Consent of instructor). Individual work experience with the farm animal species either in animal production, meat production or product promotion with an industry commodity representative under faculty supervision.

ADS 4611/6611. Practices in Physiology of Reproduction. (1) (Prerequisite: VS 3014 or BIO 1504). Three hours laboratory. Artificial insemination and rectal palpation of reproductive organs of cattle; semen collection, evaluation, processing and handling. (Same as PHY 7611).

ADS 4613/6613. Physiology of Reproduction. (3) (Prerequisite: BIO 3504 or VS 3014.) Three hours lecture. Anatomy and physiology; reproductive cycles; production, evaluation and preservation of gametes; gestation; endocrine regulation; managed reproduction. (Same as PHY 7613.)

ADS 4623/6623. Physiology of Lactation. (3) (Prerequisite: VS 3014 or BIO 1504). Two hours lecture. Two hours laboratory. Anatomy, physiology, and pathology of the mammary gland; nervous and hormonal control of lactation, theories of milk secretion, modern methods of milking, factors affecting lactation. (Same as PHY 6623.)

ADS 4814/6814. Dairy Farm Management. (3) (Prerequisites: ADS 3813, ADS 4123/6123, ADS 4623/6623, ADS 4611/6611, ADS 4613/6613 and NTR 4115/6115). Two hours lecture. Three hours laboratory. Planning and integrating dairy farm operations; management principles applied to dairy herd operations.

ADS 4990/6990. Special Topics in Animal and Dairy Science. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ADS 7000. Directed Individual Study. Hours and credits to be arranged.

ADS 8233. Advanced Breeding. (3) Fall semester. (Prerequisites: ADS 4123/6123 or PO 4303/6303, ST 8114). Three hours lecture. Describing, measuring and partitioning phenotypic variances and covariances. Estimating parameters, predicting response, systems of breeding, and methods of selection. (Same as GNS 8233.)

ADS 8243. Advanced Physiology of Reproduction. (3) (Prerequisite: ADS 4613/6613 or its equivalent). Three hours lecture. An advanced study of the reproductive process with emphasis on reproductive endocrinology and the physiology of germ cells. (Same as PHY 8243.)

ADS 8423. Meat Science. (3) Summer semester. (Prerequisites: CH 4513/6513 or equivalent and BIO 3304 or equivalent). Three hours lecture. Basic study of the value of meat and how this information is applied to the evaluation, processing and preservation of meat, meat products and meat by-products. (Same as FST 8423.)

ADS 8433. Bone, Muscle and Fat Deposition in Animals. (3) (Prerequisite: BCH 4613/6613). Fall semester. Three hours lecture. Study of deposition of various tissues from embryonic differentiation through maturity of animals. (Same as PHY 8433.)

ADS 8453. Statistical Genetics. (3) Spring semester. (Prerequisites: ST 8114, ADS 4123/6123). Three hours lecture. Probability and its application to genetics; partitioning of genotypic variance; covariances among relatives; regression and correlation; linear functions, variances; the analysis of variance. (Same as GNS 8453.)

ADS 8633. Homeostatic Regulation and Physiological Stress. (3) (Prerequisites: PHY 6514 and PHY 8131, 8133 or consent of instructor). Three hours lecture. An integration of the physiological mechanisms involved in the control of homeostasis in mammals is emphasized with discussion of the effect of specific stressors on these mechanisms. (Same as PHY 8633.)

ADS 8811-8821-8831. Advanced Seminar. (1) Review of literature of assigned and chosen topics in the respective field; preparation, organization, and presentation of papers.

ADS 8833. Dairy Farm Management. (3) (Prerequisites: Graduate standing and ADS 1114). Two hours lecture. Two hours laboratory. Feed crops, feeding, breeding, herd management, sanitation, and marketing of milk. (Offered only on weekend basis and as a Summer Short Course.)

ADS 8990. Special Topics in Animal and Dairy Science. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

Department of AGRICULTURAL ECONOMICS and AGRIBUSINESS

Office: 300 Lloyd-Ricks Building

Professors Turner(Head), Allen, Beaulieu, Forrest, Herndon, Laughlin, Little, Parvin, Reinschmiedt, and Spurlock;
Associate Professors Coble, Hanson and Hudson; Assistant Professors Anderson, Ibendahl, Parkhurst, Wolfe and Xia

AEC 1223. Computer Applications for Agriculturists and Life Scientists. (3) Two hours lecture. Two hours laboratory. Basic agricultural microcomputer applications and computing logic; creating reports using word processors; developing presentations on agricultural subjects using multimedia software; and agricultural calculations using spreadsheets.

AEC 2611. Seminar I. (1) One hour lecture. Planning and preparing for careers in agricultural economics and agribusiness.

AEC 2713. Introduction to Agricultural Economics. (3) Three hours lecture. Each semester. Prerequisite to other Agricultural Economics courses. Economic principles applied to production, value, prices, credit, taxation, land tenure, marketing, international trade, and related problems affecting agriculture.

AEC 2990. Special Topics in Agricultural Economics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AEC 3003. Economics of Food and Fiber Production. (3) (Prerequisite: AEC 3113). Three hours lecture. Economic principles applied to food and fiber production situations with emphasis on firm-level decision analysis.

AEC 3113. Introduction to Quantitative Economics. (3) (Prerequisites: AEC 2713, MA 1613 or MA 1463). Three hours lecture. Each semester. Introduction to techniques and procedures for the quantitative analysis of economic problems related to the production and distribution of agricultural products.

AEC 3133. Introductory Agribusiness Management. (3) Three hours lecture. Study of marketing, production, risk, and financial management in agribusiness firms. Emphasis on application of economic principles to management of agrimarketing and farm supply firms.

AEC 3213. International Trade in Agriculture. (3) (Prerequisites: AEC 2713 or EC 2123 or consent of instructor). Three hours lecture. Examination of the importance of international agricultural trade, the economic basis of trade, and the policies affecting agricultural trade.

AEC 3233. Introduction to Environmental Economics and Policy. (3) (Prerequisites: AEC 2713 or EC 2123). Three hours lecture. Examines how economic forces, in concert with other processes, influence environmental quality through private markets and public policy.

AEC 3413. Principles of Agricultural Marketing. (3) (Prerequisites: AEC 2713 or EC 2123). Three hours lecture. Describes the principles, functions, and methods of farm and food product and input marketing.

AEC 4000. Directed Individual Study. Hours and credits to be arranged.

AEC 4113/6113. Agribusiness Firm Management. (3) (Prerequisites: EC 3123 or EC 3333). Three hours lecture. Examination and study of the organization, management, and operation of agricultural business with special reference to the application of managerial principles for effective decision-making.

AEC 4123/6123. Commodity Futures Marketing. (3) (Prerequisite: AEC 3113). Three hours lecture. Discussion of the purpose, function, mechanics, analysis, and application of commodity futures markets in pricing and hedging opportunities.

AEC 4133/6133. Agricultural Marketing and Price Analysis. (3) (Prerequisites: AEC 3113 and EC 3123). Three hours lecture. Application of economic theory to agricultural prices and agricultural markets in price estimation, discovery, and determination. Emphasis on marketing management and pricing in agricultural firms.

AEC 4233/6233. Advanced Topics in Environmental Economics. (3) (Prerequisites: AEC 3233 and EC 3123) Three hours lecture. Identifies topics lying on the frontier of environmental economics; demonstrates contributions that economics can make in understanding the problems and in providing guidance on solutions.

AEC 4333/6333. Economics of Aquaculture. (3) (Prerequisite: AEC 2713 or consent of instructor). Three hours lecture. Application of economic principles to understand aquacultural production systems, with emphasis on farm management, resource allocation, industry market structure, food safety and environmental issues.

AEC 4343/6343. Advanced Farm Management. (3) (Prerequisite: Senior standing, EC 3123, and AEC 4523). Three hours lecture. Techniques and procedures used for decision-making in the farm business as related to the determination of optimum enterprise choice and resource combination in both a static and dynamic framework.

AEC 4413/6413. Public Problems of Agriculture. (3) (Prerequisite: Senior standing and EC 3123 and AEC 3113). Three hours lecture.

Major public and private problems of agriculture policies and action programs of government and individuals to deal with them; limitations encountered; appraisal of results.

AEC 4511/6511. Agricultural and Resource Legislative Policy. (1) (Prerequisites: AEC 2713 or consent of instructor). One hour lecture. Discusses agricultural policy history and development, roles of consumer, producer, and environmental groups in policy development, and congressional organization and procedures in the policy process.

AEC 4523/6523. Farm Financial Management. (3) (Prerequisites: ACC 2023, AEC 3113 and AEC 3133). Three hours lecture. Financial analysis and decision making, including farm records, marginal analysis and enterprise budgeting, financial statement analysis, capital budgeting, and financial intermediation in agriculture.

AEC 4530/6530. Agribusiness Management Internship. (1-6) (Prerequisite: Consent of instructor). Individual work experience with approved agribusiness companies for agricultural economics or agribusiness students.

AEC 4611. Seminar II. (1) (Prerequisite: Senior standing). One hour lecture. Discussion of current agricultural economics and agribusiness developments and their relation to the food and fiber sector.

AEC 4623/6623. Economics of Export and Import Traffic Management in Agriculture. (3) (Prerequisites: Senior-Graduate level standing or consent of instructor). Examination of the ocean shipping industry, import-export agricultural traffic management techniques, government regulations, documentation, and financial considerations. Spring semester.

AEC 4713/6713. Quantitative Economics. (3) (Prerequisites: AEC 3113, EC 3113, and EC 3123). Three hours lecture. Investigation of the basic mathematical methods and techniques currently used to analyze economic problems.

AEC 4723/6723. Modeling for Agricultural Management. (3) (Prerequisite: AEC 3113). Three hours lecture. Application of mathematical programming techniques to problems confronted by firms and industries involved in the production, processing, and marketing of agricultural commodities.

AEC 4733/6733. Econometric Analysis in Agriculture Economics. (3) (Prerequisite: AEC 3113) Three hours lecture. Applications of single-equation estimation techniques to problems in agriculture.

AEC 4990/6990. Special Topics in Agricultural Economics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AEC 4711. Agri-Marketing Practicum. (1) Two hours laboratory. Design and preparation of marketing plan for presentation at National Agri-Marketing Association meeting. Development of plan includes market research, budgeting, and advertising layouts.

AEC 7000. Directed Individual Study. Hours and credits to be arranged.

AEC 8000. Thesis Research/Thesis. Hours and credits to be arranged.

AEC 8122. Agribusiness Strategy Field Study. (2) (Prerequisite: MGT 8121 or equivalent). A group project-based, field study of strategic issues currently facing a participating agribusiness organization.

AEC 8123. Market Organization and Structure. (3) Three hours lecture. Spring semester. Analysis of the conduct and performance of agricultural firms under imperfect market conditions. Sources of imperfections, managerial strategies and welfare considerations under imperfect market conditions.

AEC 8143. Agricultural Production Economics. (3) (Prerequisites: EC 3123 or EC 3333 and AEC 4343/6343). Three hours lecture. Theory of production as related to agricultural production and resource use. Emphasis upon optimal organization of agricultural firms.

AEC 8153. Research Philosophy and Methodology in Economics. (3) (Prerequisite: Graduate standing or consent of instructor). Three hours lecture. A study of underlying philosophies and important methodologies in applied economic research. Case studies will focus on implications for conduct, review, and evaluation of research.

AEC 8163. Consumers, Producers, and Markets. (3) (Prerequisite: EC 3123). Three hours lecture. Focuses on economic theory related to production, consumption, and markets for products. Extension into market structure, welfare economics, and non-market goods will also be discussed.

AEC 8312. Economic and Social Environment of the Agribusiness Firm. (2) (Prerequisites: EC 8103 or equivalent). Two hours lecture.

ture. The course focuses on the economic, social/political and legal forces which shape the environment in which agribusiness firms compete.

AEC 8413. Quantitative Economic Analysis. (3) (Prerequisite: MA 1613). Three hours lecture. A mathematical exploration of model building in economics and derivation of refutable hypotheses using comparative statics analysis.

AEC 8522. Decision Modeling for Agribusiness Management. (2) Two hours lecture. Application of models for improving managerial decision making. Emphasis on problem formulation and identification, solution procedures, and interpretation of results.

AEC 8532. International Agricultural Trade and Policy. (2) (Prerequisite: EC 8163). Two hours lecture. Examination of international trade theories, policies affecting agriculture, international trade, world trade negotiations, barriers to trade, and the role of agricultural trade in economic development.

AEC 8542. Agribusiness Risk Management. (2) (Prerequisite: EC 8103 or equivalent). A review of risk management concepts and techniques for managing risks faced by agribusiness firms, with emphasis on futures and options.

AEC 8611. Research Seminar I. (1) Selection of the research topic, development of the research proposal. Each semester.

AEC 8621. Research Seminar II. (1) Final preparation of the research proposal and presentation of the proposal. Each semester.

AEC 8712. Topics in Applied Economics: Production and Supply. (2) (Prerequisites: EC 8163 and EC 8133, or consent of instructor). Two hours lecture. Focuses on applying microeconomic theory to applied production-oriented problems. Emphasis is placed on using analytical tools to empirical data and reporting results.

AEC 8722. Topics in Applied Economics: Marketing and Demand. (2) (Prerequisites: EC 8163 and EC 8133, or consent of instructor). Two hours lecture. Focuses on problem-solving skills using

economic simulation techniques. Emphasis is placed on stochastic and/or dynamic applications.

AEC 8733. Topics in Applied Economics: Welfare and Policy Analysis. (3) (Prerequisites: AEC 8712 and AEC 8722, or consent of instructor). Three hours lecture. Focuses on problem-solving skills using applied econometrics. Emphasis is placed on applications of welfare economics.

AEC 8813. Advanced Production and Risk Analysis. (3) (Prerequisite: Consent of instructor). Three hours lecture. Economic theory and research applications related to production problems with emphasis on risk.

AEC 8823. The International Economy. (3) (Prerequisite: Consent of instructor). Three hours lecture. Economic theory and analysis of government policies related to international trade with emphasis on the causes and consequences of globalization.

AEC 8833. Environmental and Resources Economics. (3) (Prerequisite: Consent of instructor). Three hours lecture. Economic theory and analysis of government policies related to natural resources and the environment with emphasis on institutional frameworks within which policy decisions are made.

AEC 8843. Survey Design and Experimental Economics. (3) (Prerequisite: Consent of instructor). Three hours lecture. An exploration of economists' use of data collection techniques, such as surveys and experiments, with emphasis on analysis of non-market valuation problems.

AEC 8990. Special Topics in Agricultural Economics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AEC 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

Department of AGRICULTURAL INFORMATION SCIENCE and EDUCATION

Office: 130 Lloyd Ricks

Professors: Deeds, Gerard and Taylor (Head);
Associate Professors Browning, Jackson, Newman, Raven, Swortzel and White;

AIS 2613. Introduction to Information and Decision Science in Agro-ecosystems. (3) Three hours lecture. Introductory course to the science of helping people learn how to access, analyze, apply and amend information to solve problems in agriculture.

AIS 2990. Special Topics in Agricultural and Extension Education. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AIS 3003. Information Interpretation in Agriculture and Life Sciences. (3) (Prerequisite: ST 2113 or ST 3113). Three hours lecture. Understanding and interpreting research-based information to enable students to create, utilize and disseminate information to solve problems in agriculture and the life sciences.

AIS 3203. Introduction to Technical Writing in Agrcommunications. (3) (Prerequisite: Completion of EN 1103 and 1113 or equivalent and Junior standing). Three hours lecture. Basic principles of and techniques in communicating information relevant to agriculture/agribusiness, natural resources, and human sciences.

AIS 3324. Management of Agricultural Learning Systems. (4) (Prerequisite: AIS 2163). Three hours lecture. Three hours laboratory. Planning instruction; selecting techniques of teaching; developing lesson plans; teaching agricultural topics using the problem-solving approach; using instructional technologies; and evaluating learner progress.

AIS 3333. Professional Presentations in Agriculture and Life Sciences. (3) (Prerequisite: CO 1003). Two hours lecture. Two hours laboratory. Strategies and techniques for effective presentations in agriculture, life sciences and natural resources. Emphasis on oral and visual techniques for formal and non-formal situations.

AIS 3500. Internship in Agricultural Information Science. (1-6) (Hours and credit to be arranged and shall not exceed a total of six hours). Supervised field experiences shall center around experiences related to participation in professional activities relating to problems, methods, and skills basic to agricultural and extension education.

AIS 3803. Leadership Development in Agriculture and Life Sciences. (3) Three hours lecture. Fall semester. Dynamic interactions of personal characteristics, knowledge and expertise; interpersonal influence; professional commitment; organizational planning and goals; and power for effective leadership in agricultural professions.

AIS 4000. Directed Individual Study. Hours and credit to be arranged.

AIS 4103/6103. Objectives and Procedures of Programs in Agricultural Information Science and Education. (3) (Prerequisite: Junior standing). Three hours lecture. Identification and development of objectives; techniques used in Agricultural and Extension educational procedures; relationships with U.S.D.A., experiment stations, and other agricultural agencies.

AIS 4203/6203. Applications of Computer Technology to Agricultural Information Science and Education. (3) (Prerequisites: CSE 1013 or BIS 3713 or equivalent). Two hours lecture and two hours laboratory. Application of microcomputer technology in agricultural and extension education; data storage and retrieval; and use of canned computer programs in agricultural and educational settings.

AIS 4303/6303. Applications of Information Technologies in Agricultural Learning Systems. (3) (Prerequisites: AIS 4203/6203 or consent of instructor). Two hours lecture. Advanced applications of computer and related information technologies in agricultural learning systems; designing and developing hypermedia-based materials for formal and nonformal agricultural instructional programs.

AIS 4403/6403. Development of Youth Programs. (3) Three hours lecture. Needs and interests of youth; developing, managing, and evaluating formal and informal youth education programs; volunteer and paraprofessional staff development; securing and developing supportive resources.

AIS 4443/6443. Vo-Ed Curricula and Techniques of Teaching the Rural Disadvantaged. (3) Organizing training programs in agricultural occupations for rural disadvantaged persons; developing teaching techniques adaptable to such programs and persons. Occupational opportunities for the rural disadvantaged.

AIS 4453/6453. Cooperative Programs in Occupations Served by Agricultural Information Science. (3) Procedures and techniques in organizing and coordinating cooperative vocational education programs in agricultural occupations; application at the local level.

AIS 4503/6503. International Agricultural Education. (3) Three hours lecture. Examination of formal and non-formal agricultural education systems and related situations and processes which influence agricultural development in developing countries.

AIS 4873. Professional Seminar in Agricultural Information Science and Education. (3) (Prerequisites: Admission to Teacher Education and senior standing). Three hours lecture. Legal, professional, administrative and curricular issues in agricultural and extension education. Includes needs assessment, community involvement and problem solving to plan formal and informal programs.

AIS 4886, 4896. Student Teaching in Agriculture Information Science and Education(6,6) (Both courses to be taken concurrently). (Prerequisites: Admission to Teacher Education and senior standing). Supervised observation and directed teaching in respective field of endorsement.

AIS 4990/6990. Special Topics in Agricultural Information Science and Education. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AIS 7000. Directed Individual Study. Hours and credits to be arranged.

AIS 8000. Thesis Research/Thesis. Hours and credits to be arranged.

AIS 8203. Advanced Communication in Agricultural Information Science and Education. (3) Two hours lecture. (1 1/2 hours each). Updating of principles of communicating information in the fields of agriculture/agribusiness, natural resources, and home economics; review and updating of communications techniques.

AIS 8243. Administration and Supervision in Agricultural Information Science and Education. (3) Three hours lecture. Principles in developing and administering programs in agricultural and extension education with attention to federal-state-local relationships and supervisory procedures.

AIS 8263. Public Relations in Agricultural Information Science and Education. (3) Three hours lecture. Publics to be dealt with, public relations media; methods and techniques of establishing and maintaining desirable public relations.

AIS 8403. Directing Learning Experiences in Agricultural Information Science and Education. (3) Two hours lecture. Two hours laboratory. Theory and practice in directing learning activities. Using instructional technology. Delivering instruction for formal and non-formal groups.

AIS 8503. Program Planning and Development in Agricultural Information Science and Education. (3) Three hours lecture. Principles, theory, and practice in developing local and state programs of vocational, technical, and extension education.

AIS 8523. Teaching Out-of-School Groups in Agricultural Information Science and Education. (3) Three hours lecture. Organizing, planning, and instructing out-of-school groups in agricultural and extension education; identifying and assessing needs of clientele; and evaluating effectiveness.

AIS 8533-8543. Workshop in Agricultural Information Science and Education. (3-3) (A total of six semester hours may be earned in AIS 8533-8543). One hour lecture. Four hours laboratory. Studying current problems in agricultural and extension education; investigating and analyzing problems; preparing comprehensive reports on problems; planning for local application.

AIS 8593. History, Philosophy, and Policy of Agricultural Information Science and Education. (3) Three hours lecture. Philosophy, history, and development of Agricultural and Extension Education; implications, influences, and evaluation of forces and policies impacting Agricultural and Extension Education.

AIS 8606. Student Teaching in Agricultural Information Science and Education. (6) (Prerequisites: Admission to the graduate certification program, teacher education and student teaching). Supervised observation and directed teaching in Agricultural Information Science and Education.

AIS 8703. Evaluation of Agricultural Information Science and Education Programs. (3) Three hours lecture. Evaluation principles and procedures used in developing and analyzing vocational, technical, and extension education programs.

AIS 8803. Applying Research Methods to Agricultural Information Science and Education. (3) Three hours lecture. Principles and techniques for planning, conducting, and reporting research; development of effective design of research problems; emphasis on understanding and evaluating scientific reports.

AIS 8990. Special Topics in Agricultural Information Science and Education. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AIS 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

ANTHROPOLOGY

Office: 206 Cobb Institute of Archaeology

Professor Rafferty; Associate Professors Hogue
Assistant Professors Loewe, and Peacock.

(For departmental information, see SOCIOLOGY, ANTHROPOLOGY and SOCIAL WORK.)

AN 1103. Introduction to Anthropology. (3) Three hours lecture. The fields, theories, and methods of anthropology; man's biological and cultural development; survey of technological, economic, political, social, religious, and linguistic systems.

AN 1143. Introduction to Cultural Anthropology. (3) Three hours lecture. Introduction to the study of social, political, and economic organization, magic and religion, personality, and art.

AN 1173. Introduction to Gender Studies. (3) Three hours lecture. An introduction to theoretical concepts in Gender Studies. This course will examine the influence of the women's movement on the academic development of Gender Studies (Same as WS 1173 and SO 1173).

AN 1343. Introduction to Biological Anthropology. (3) Three hours lecture. The biological nature of man; study of human origins; fossil evidence; genetic mechanism; cultural association; comparative primate anatomy and behavior; concepts of race. **Note:** Unacceptable for Natural Science requirement in Arts and Sciences.

AN 1543. Introduction to Archaeology. (3) Three hours lecture. A survey of early cultural development throughout the world; emphasis on archaeological techniques, interpretations and theories of development.

AN 2203. Cultural and Racial Minorities. (3) (Prerequisite: Three hours in an introductory social science). Three hours lecture. Origins of minority groups and racial attitudes. Biological and cultural concepts of race and minority groups; problems of adjustment in interracial and multiethnic societies. (Same as SO 2203).

AN 2510. Archaeological Field Methods: Survey. (1-6) Credit to be arranged. Archaeological surface survey methods in field setting, including map-reading, shovel-testing, collection techniques, controlled surface collection, artifact recognition.

AN 2990. Special Topics in Anthropology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AN 3113. Societies of the World. (3) (Prerequisite: AN 1103 or its equivalent or consent of instructor). Three hours lecture. A survey of principal culture types and their distribution.

AN 3123. North American Indians. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. Ethnographic survey of the Indians of North and Mesoamerica.

AN 3133. Anthropology of Latin America. (3) Three hours lecture. A survey of societies in Latin America with an emphasis on indigenous peoples, their relationship to contemporary social and economic development.

AN 3153. African Art and Culture. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. An examination of the role of traditional art in the beliefs and customs of representative African cultures. (Same as ART 3153).

AN 3323. Contemporary Woman. (3) Three hours lecture. Introductory course for the Concentration in Women's Studies. Major topics are women's heritage, identity, culture, and vulnerabilities. (Same as SO 3323).

AN 3333. Primate Behavior. (3) Three hours lecture. In-depth study of non-human primate evolution, social behavior, and communication. Field studies and conservation efforts will be examined.

AN 3510. Archaeological Field Methods: Excavation. (1-6) Credit to be arranged. Excavation methods in field setting, including mapping, recording, recovery and proveniencing techniques, field research strategies.

AN 3513. Artifact Analysis. (3) Two hours lecture. Two hours laboratory. Introduction to artifact recognition and analysis, focusing on prehistoric and historic ceramics, stone tools and debris, glass, nails, animal bones, shell, and environmental indicators.

AN 3523. North American Archaeology. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. A survey of the prehistoric cultures of North America including the influences of the high civilizations of Mesoamerica.

AN 3533 Rise of Civilization. (3) Three hours lecture. Survey of prehistoric cultures and their contributions to the rise of civilizations in Latin America, China, Africa, India and the Middle East.

AN 3540. Archaeological Travel and Participation Program. (1-6) Participation in excavations in the Near East and related lecture program. (Same as REL 3540).

AN 3553. Near Eastern Archaeology. (3) Three hours lecture. Introduction to the contributions made by archaeological research to ancient Near Eastern history and prehistory, with special emphasis on the Syro-Palestinian area. (Same as REL 3553).

AN 4000. Directed Individual Study. Hours and credits to be arranged.

AN 4123/6123. Anthropological Theory. (3) (Prerequisite: AN 1103 or its equivalent or consent of instructor). Three hours lecture. A history of the development of anthropological theory; an analysis of contemporary theoretical formulations and approaches.

AN 4133/6133. Medical Anthropology. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. The cross-cultural study of health, sickness, and medicine from a holistic perspective emphasizing interactions between culture and biology and between biomedicine and local healing traditions.

AN 4143/6143. Ethnographic Methods. (3) (Prerequisites: AN 1103 or AN 1143 or consent of instructor). Three hours lecture. An overview of methods and techniques for conducting ethnographic research.

AN 4163/6163. Anthropology of International Development. (3) (Prerequisite: Senior standing or consent of instructor). Three hours lecture. Role of anthropology in international development including origins of the Third World, development theory, current issues in international development, case studies.

AN 4173/6173. Environment and Society. (3) (Prerequisite: AN 1103, SO 1003 or consent of instructor). Three hours lecture. A study of the interaction between human society and the environment including the social aspects of environmental problems. (Same as SO 4173/6173).

AN 4303/6303. Human Variation and Origins. (3) Three hours lecture. An examination of human origins, genetics, and other principal factors that contribute to physical variation within and between human populations.

AN 4313/6313. Human Identification. (3) Two hours lecture and three hours laboratory. Identification of each human bone and its fragments. Sex differences, age changes in bone and dentition, dermatoglyphics, blood group systems, and paleopathology will be studied.

AN 4403/6403. Introduction to Linguistics. (3) (Prerequisite: AN 1103 or its equivalent or consent of instructor). Three hours lecture. The descriptive and historical study of language; linguistic analysis and comparison; language classification; language in its social and cultural setting. (Same as EN 4403/6403).

AN 4523/6523. Public Archaeology. (3) (Prerequisite: AN 1543 or consent of instructor). Three hours lecture. Survey of cultural resource management practices, Federal and State historic preservation laws, research proposal design, significance assessments, professional ethics, employee/client relationships, and public education.

AN 4623/6623. Language and Culture. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. Examination of language as a part of culture, a source of knowledge about other aspects of culture, and a social behavior. (Same as EN 4623/6623 and SO 4623/6623).

AN 4633/6633. Sociolinguistics. (3) (Prerequisites: AN 1103 or consent of instructor). Three hours lecture. Examination of relationship between language and society, and how, when, and why people in speech communities use language varieties. (Same as EN 4633/6633 and SO 4633/6633).

AN 4990/6990. Special Topics in Anthropology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AN 7000. Directed Individual Study. Hours and credits to be arranged.

AN 8000. Thesis Research and Thesis. Hours and credits to be arranged.

AN 8103. Applied Cultural Anthropology. (3) (Prerequisites: AN 1103 or AN 1143 or consent of instructor). Three hours lecture. An overview of the application of anthropological theory and method of contemporary social problems.

AN 8203. Reading and Research in Applied Anthropology. (3) Three hours lecture. An overview of sub-disciplines within applied anthropology, including medical anthropology, development, forensics, education and cultural resource management.

AN 8216. Internship in Applied Anthropology. (6) A minimum of nine weeks of supervised professional anthropology experience in an appropriate setting.

AN 8303. Seminar in Bio-archaeology. (3) Three hours lecture. Overview of applications in bio-archaeology, including paleodemography, paleopathology, and paleonutrition.

AN 8513. Southeastern Archaeology. (3) Three hours lecture. Prehistory of Southeastern U.S. from entry of first people to European contact. Changes in technology, settlement, subsistence, demography, and environment examined using archaeological evidence.

AN 8523. Environmental Archaeology. (3) Three hours lecture. Coverage of method and theory in environmental archaeology, including elements of palynology, geoarchaeology, floral and faunal analysis, landscape ecology, historical ecology, cultural ecology, and taphonomy.

AN 8533. Readings in Archaeology: Theory. (3) Three hours lecture. Archaeological theory and its implications for practice, focusing on evolutionary archaeology but also including culture history, processual, reconstructionist, and post-processual approaches.

AN 8553. Readings in Archaeology: Applications. (3) Three hours lecture. Review of literature related to materials science in archaeology, including thin-sectioning and petrography, raw material sourcing, organic residues, dating techniques, and preservation technology.

AN 8990. Special Topics in Anthropology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AGRICULTURAL PEST MANAGEMENT

(For departmental information, see Department of ENTOMOLOGY and PLANT PATHOLOGY.)

APM 2990. Special Topics in Agricultural Pest Management. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

APM 4021. APM Senior Seminar. (1) (Prerequisite: CP 2203). One hour lecture. Fall semester. Review and discussion of co-op experiences. Includes discussion of contemporary topics in pest management and development of professional skills.

APM 4990/6990. Special Topics in Agricultural Pest Management. (1-9) Credit and title to be arranged. This course is to be used on a

limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

APM 8990. Special Topics in Agricultural Pest Management. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

COLLEGE of ARCHITECTURE

Professors James West (Dean), Berk, Fazio;
Associate Professors Barrow, Buege, Greenwood,
Lewis, McCann, Perkes, Poros;

Assistant Professors Brown, Clark, Corroto, Mathew, and Monson

ARC 1013. Architectural Appreciation. (3) Three hours lecture. Illustrated study of architecture's role in shaping the quality of man's environment. Architectural history, design theory, and process as it affects daily life. Intended for non-majors.

ARC 1536-1546. Architectural Design I-A and I-B. (6,6) (Prerequisites: Letters of Acceptance into design studio and consent of Associate Dean of Architecture). Two hours lecture. Ten hours studio. Introduction to creative process, design principles and methods. Design

projects emphasize verbal and visual communication; observing, analyzing, representing, and making of form, space, materials.

ARC 1586-1596. Honors Architectural Design 1-A and 1-B. (6,6) (Prerequisites: Letter of Acceptance into design studio and consent of Associate Dean of Architecture). Two hours lecture. Ten hours studio. Independent investigation and presentation of an approved research topic in addition to the content described under ARC 1536-1546.

ARC 2313. History of Architecture I. (3) Three hours lecture. A survey of man's effort to mold his environment from prehistory through the Early Middle Ages.

ARC 2536-2546. Architectural Design II-A and II-B. (6,6) (Prerequisite: ARC 1546 or equivalent or consent of the dean). One hour lecture. Eleven hours studio. Introduction to fundamental aspects of building including structural-spatial ordering systems. Projects emphasize linkages between people and spaces through investigation of perceptual-conceptual issues.

ARC 2586-2596. Honors Architectural Design II-A and II-B. (6,6) (Prerequisite: ARC 1546 or 1596). One hour lecture. Eleven hours studio. Independent investigation and presentation of an approved research topic in addition to the content described in ARC 2536.

ARC 2713. Passive Building Systems. (3) (Prerequisite: For architecture majors- ARC 1546 and PH 1123; for non-architecture majors- consent of instructor). Three hours lecture. Investigation of the morphological impacts of various environmental energies on building forms and systems. Included are light, climatic, structural, and ecological factors.

ARC 2723. Materials. (3) (Prerequisites: ARC 2536 and ARC 2713). Three hours lecture. Analyzing how materials and systems are designed to respond to both environmental energies and needs. Included are soils, concrete, wood, masonry, and metals.

ARC 2990. Special Topics in Architecture. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ARC 3313. History of Architecture II. (3) (Prerequisite: ARC 2313). Three hours lecture. Survey of major developments in architecture and city planning from the Fourteenth through the Eighteenth Centuries.

ARC 3323. History of Architecture III. (3) (Prerequisite: ARC 3313). Three hours lecture. Survey of major developments in American architecture and survey of major developments in European architecture during the Nineteenth and Twentieth Centuries.

ARC 3343. The Architecture of Housing. (3) Three hours lecture. An historical, social, and typological investigation of the evolution of housing as an architectural and cultural phenomenon.

ARC 3353. History and Theory of Urban Form. (3) (Prerequisite: Junior standing or consent of instructor). Three hours lecture. Investigation of the forces that influence urban form, tracing the resultant developments from the cities of classical antiquity through Western Europe to America's "edge cities."

ARC 3536-3546. Architectural Design III-A and III-B. (6,6) (Prerequisite: ARC 2546 or equivalent or consent of the dean). One hour lecture. Eleven hours laboratory. The development of building design as a synthesis of environmental concerns, behavioral responses, functional requirements, and technical systems. Studies using small and intermediate scale projects.

ARC 3556-3566. Accelerated Studies in Architectural Design III-A and III-B. (6,6) (Prerequisite: ARC 2546 or equivalent or consent of dean). One hour lecture. Eleven hours studio. Individualized studies in architectural design for students enrolled in Accelerated Studies Program.

ARC 3573. The Art/Architecture of Packaging. (3) Three hours lecture. Investigations into theories, techniques, and procedures of packaging (with emphasis on portfolio design) through traditional, mechanical, and digital means.

ARC 3583. Architectural Drawing and Representation. (3) (Prerequisite: ARC 2546 or equivalent and consent of instructor). Two hours lecture. Three hours laboratory. Advanced course in architectural drawing and visualization that builds upon the students developing skills in graphics, modeling, and digital media.

ARC 3713. Assemblages. (3) (Prerequisites: ARC 2546 and ARC 2723). Two hours lecture and one field study. Fabrication and construction are explored in the relationship between nature of materials and methods of assembly.

ARC 3723. Active Building Systems. (3) (Prerequisites: ARC 3536 or ARC 3566 and ARC 3713 or for non-architecture majors- consent of instructor). Three hours lecture. Concentrates on defining the mechanical and electrical (active) techniques available to architects for integrating thermal comfort and life safety into the built form.

ARC 3904. Architectural Structures I. (4) (Prerequisite: MA 1463 or MA 1613 and ARC 2546). Three hours lecture. Three hours laboratory. Principles of statically determinate structures and strength of materials relating to architectural construction. Wood is used as the primary construction material.

ARC 3913. Structures II. (3) (Prerequisite: ARC 3904). Three hours lecture. Continuation of structural principles relating to architectural construction. Analysis of indeterminate structures, deflection, and lateral loading. Structural steel is the primary material.

ARC 4000. Directed Individual Study. Hours and credits to be arranged with approval of College of Architecture Dean.

ARC 4313. Architectural Theory. (3) (Prerequisite: ARC 3323 or ARC 3313 and consent of instructor). Three hours lecture. A critical investigation of writings that have shaped architectural theory.

ARC 4536-4546. Architectural Design IV-A and IV-B. (6,6) (Prerequisite: ARC 3546 or equivalent or consent of dean). One hour lecture. Eleven hours laboratory. Design of architectural elements integrating building systems, social concerns, and environmental factors. Studies involve intermediate to large scale projects in realistic architectural situations.

ARC 4733. Site Planning for Architects. (3) (Prerequisite: ARC 2546). Three hours lecture. Introduces the natural ecological systems as they relate to human's impact on them, along with the natural systems' resistance to human's impact.

ARC 4903. Structures III. (3) (Prerequisite: ARC 3913). Three hours lecture. Continuation of structural principles relating to architectural construction. Soil mechanics, reinforced concrete design, footings and foundations, masonry construction, and precast concrete design.

ARC 4990/6990. Special Topics in Architecture. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ARC 5353. Philosophy of Architecture. (3) Three hours lecture and field visits. The philosophical issues of meaning, appreciation, and the distinctive characteristics of the artistic creation.

ARC 5383. Legal Aspects of Architecture. (3) Three hours lecture. Investigation and research regarding architectural issues including architectural law, contracts, litigation, case studies and other topical issues.

ARC 5443. Thesis Programming. (3) One hour lecture. Six hours laboratory. Advanced study of analytical and intuitive methods of programming, leading to development of thesis program to be used in ARC 5589.

ARC 5493. Architectural Practice. (3) Three hours lecture. Investigation into issues facing the graduate architect including: responsibilities to the community and the profession; project and business management; client relations; and delivery of services.

ARC 5523. Architects Teaching Architecture. (3) Two hours lecture. Three hours field visit. Students teach architecture and environmental quality to fourth-and-fifth grade Jackson Public School students.

ARC 5576. Architectural Design V-A. (6) (Prerequisite: ARC 4546). One hour lecture. Fifteen hours laboratory. Theory and application of architectural problems at urban scale. Investigation of social, economic, political issues effecting architectural programming and design.

ARC 5589. Architectural Thesis V-B. (9) (Prerequisite: ARC 5576). Two hours lecture. Twenty hours laboratory. Development of architectural project of complex and comprehensive nature. Emphasis upon thorough examination of all aspects of building.

ARC 5623. Studies in the Theory and Practice of Urban Design. (3) Three hours lecture. General introduction into field of urban design. Course divided into two areas of theory and practice as they relate to contemporary urban development.

ARC 5733. Process. (3) Three hours lecture, field visits. Intangible values in building and construction as arising from the nature of materials and methods of work.

ARC 7000. Directed Individual Study. Hours and credits to be arranged.

ARC 8000. Thesis Research/Thesis. Hours and credits to be arranged.

ARC 8013. Seminar in Visualization Theory. (3) (Prerequisite: Consent of the instructor). One hour lecture. Four hours laboratory. Lectures and presentation of student papers and projects related to a selected specialized topic.

ARC 8023. Seminar in Digital Design Applications. (3) (Prerequisite: Consent of the instructor). One hour lecture. Four hours laboratory. Lectures and presentations of student papers and projects related to a selected specialized topic in digital design applications.

ARC 8113. Digital Design I. (3) One hour lecture. Four hours laboratory. Application of high-performance computers and existing software in the design environment. Exploration of design processes through studies of modeling, motion, and lighting.

ARC 8123. Digital Design II. (3) (Prerequisite: ARC 8113). One hour lecture. Four hours laboratory. Customization of 3D-animation software. Emphasis on procedural modularity and automation to reduce the tedium of the modeling process and increase the attention given to design.

ARC 8143. Physically-Based Modeling. (3) One hour lecture. Four hours laboratory. Applications of existing software to generate motion studies of dynamic and physically based phenomena. Simulation of these events in a 3D-computing environment.

ARC 8233. Computational Media I. (3) Three hours studio. Application of the design process to the creation of interactive computational artifacts with an emphasis on visual literacy, aesthetics and communication theory.

ARC 8243. Computational Media II (3) Three hours studio. Continuation of ARC 8233. Emphasis is placed upon the creation of web-based "interactive illustrations", narrative form, and VRML/QTVR artifacts.

ARC 8433. Digital Compositing. (3) (Prerequisite: ARC 8513). One hour lecture. Four hours laboratory. Study of digital compositing and image processing, using software-based editing packages. Concepts

of video editing and post production in a software computing environment.

ARC 8463. Story Telling in Computer Animation. (3) (Prerequisite: Consent of the instructor). One hour lecture. Four hours laboratory. Customization of existing software/production tools for the transformation of a script into computer graphics imagery.

ARC 8643. Problem Solving in Virtual Space. (3) (Prerequisite: ARC 4523/6523). One hour lecture. Four hours laboratory. Use of virtual environment technology to solve architectural problems. Investigations of architectonic form, space, lighting, and acoustics through class research projects.

ARC 8990. Special Topics in Architecture. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

Department of ART

Office: 102 Freeman Hall

Professors Bartlett, Funderburk, Gootee, Long, Mixon, and Seckinger;
Associate Professors Chupa, De Marshe (Head) McCourt, and Ngoh ;
Assistant Professors Elsea, Harvey, Haupt, Livingston, Miller, and Runnells;
Instructor Andrews and Luck; Lecturers: Pagliaro and Poole

ART 1003. The Idea of Art. (3) (Prerequisite: Art majors only or consent of instructor). Three hours lecture. An introduction to the process, concepts, media, and history of the visual arts, including contemporary issues, idea generating, and the language of visual form.

ART 1013. Art History I. (3) Three hours lecture. The study of art from prehistoric times to the Renaissance through the architecture, sculpture, painting and minor arts of the western world.

ART 1023. Art History II. (3) Three hours lecture. Art from the Renaissance to the present studied chronologically through the architecture, painting, sculpture, and minor arts of the western world.

ART 1113. Art Appreciation. (3) Three hours lecture. An illustrated lecture course dealing with periods, styles, and personalities in painting, sculpture, and architecture. Honors section available through invitation only.

ART 1123. Design I. (3) Six hours studio. A basic study of the fundamental elements and principles of design with an emphasis on composition.

ART 1133. Design II. (3) (Prerequisite: ART 1123). Six hours studio. A continued study of the fundamental elements and principles of design with an emphasis on the theory and application of color.

ART 1153. Three-Dimensional Design. (3) (Prerequisites: ART 1123 or ARC 2536). Six hours studio. A study of the organization of the principles and elements of art as they apply to three-dimensional artwork.

ART 1213. Drawing I. (3) Six hours studio. A freehand drawing course for students interested in visual arts. Basic vocabulary for graphic notation as explored utilizing observation, black and white media, and perspective.

ART 1223. Drawing II. (3) (Prerequisite: ART 1213). Six hours studio. A continuation of ART 1213 further developing conceptual and perceptual use of drawing tools, processes and materials. Black and white, and color media explored.

ART 1303. Ceramic Art I. (3) Six hours studio. Introduction to the processes of ceramic art including hand built forms, wheel thrown pottery and glazing.

ART 2013. Painting I. (3) (Prerequisites: ART 1123 and ART 1213). Six hours studio. The fundamentals of oil paintings and composition.

ART 2023. Painting II. (3) (Prerequisite: ART 2013). Six hours studio. A study of mediums and techniques in painting in continuation of ART 2013.

ART 2033. Painting III. (3) (Prerequisite: ART 2023). Six hours studio. Intermediate painting with further emphasis on the skills and techniques of painting.

ART 2043. Painting IV. (3) (Prerequisite: ART 2033). Six hours studio. A continuation of ART 2033 to further develop skill in the use of the medium and formal organization of subject matter in painting.

ART 2203. Rendering. (3) (Prerequisite: Sophomore Standing). Six hours studio. A course dealing with the concepts, techniques, and media used in executing interior and exterior renderings.

ART 2213. Life Drawing I. (3) (Prerequisites: ART 1213 and ART 1223). Six hours studio. A drawing class with emphasis on the basic forms and proportions of the human figure.

ART 2223. Life Drawing II (3) (Prerequisite: ART 2213). Six hours studio. Further study in rendering the human figure.

ART 2233. Drawing III. (3) (Prerequisite: ART 1223). Six hours studio. A continuation of ART 1223 to develop further drawing skills, use of

mixed-media, surface variety and explorative concepts for advanced students.

ART 2303. Printmaking I. (3) (Prerequisites: ART 1123, ART 1133 and ART 1223). Six hours studio. Introduction to the basic techniques and concepts of lithography, relief printing-woodcut and linocut.

ART 2313. Ceramic Art II. (3) (Prerequisite: ART 1303). Six hours studio. Elementary glaze formulation, surface decoration, kiln firing, wheel thrown and hand built form.

ART 2403. Sculpture I. (3) (Prerequisite: ART 1123 and ART 1153 or permission of instructor). Six hours studio. Introduction to the basic concepts, materials, and processes of sculpture by exploring modeling, casting, carving and constructing.

ART 2803. Introduction to Computing for Art. (3) (Prerequisites: ART 1133 and ART 1223 or permission of instructor). One hour lecture. Four hours studio. Introduction to desktop computer hardware, operating systems, and application software in the visual arts and design.

ART 2990. Special Topics in Art. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ART 3053. Watercolor Painting. (3) (Prerequisites: ART 1133 and ART 1223). Six hours studio. The technique and use of various water-soluble painting mediums.

ART 3103. Photography I. (3) (Prerequisites: ART 1123 and ART 1213). One hour lecture. Four hours studio. The fundamentals and aesthetics of black and white photography relating to graphic design and the fine arts.

ART 3143. Italian Renaissance Art History. (3) Three hours lecture. The history of art in Italy in the fifteenth and sixteenth centuries, emphasizing the religious monuments of the period. (Same as REL 2143).

ART 3153. African Art and Culture. (3) (Prerequisite: AN 1103 or consent of instructor). Three hours lecture. An examination of the role of traditional art in the beliefs and customs of representative African cultures. (Same as AN 2153)

ART 3303. Printmaking II. (3) (Prerequisite: ART 2303). Six hours studio. Continued exploration of the print as a medium of creative expression.

ART 3313. Graphic Art Design I. (3) (Prerequisites: ART 1123, ART 1213 and ART 1223). Six hours studio. Introduction to the processes and techniques of commercial art. Beginning lettering and layout.

ART 3323. Graphic Art Design II. (3) (Prerequisite: ART 3313). Six hours studio. The execution of a series of design projects promoting an awareness of different forms of printed visual communication.

ART 3423. Color Photography I. (3) (Prerequisite: ART 3103 or permission of the instructor). One hour lecture. Four hours studio. The techniques and aesthetics of basic photographic processes in color.

ART 3443. Illustration. (3) (Prerequisites: ART 2013 and ART 3053). Six hours studio. A course introducing issues and instrumentations related to standards in the professional field of illustration emphasizing mixed-media processes.

ART 3513. Sculpture II. (3) (Prerequisite: ART 2403). Six hours studio. Further exploration of concepts and processes of sculpture, including mold making and armature building. Beginning development of personal language of expression.

ART 3603. Directed Writings in Modern Art History. (3) (Prerequisites: ART 1013 and ART 1023). Three hours lecture. History of

20th Century art with emphasis on scholarly writing, reading, and analysis of contemporary models and varieties of writing.

ART 3803. Gallery Management. (3) (Prerequisite: ART 1123 and ART 1213). One hour lecture. Four hours laboratory. The study of gallery operations, techniques of curation, artists ethics, installation procedures and gallery management of an art gallery.

ART 3873. Digital Photography. (3) (Prerequisites: ART 3103 and ART 3423 or permission of instructor). Six hours studio. The techniques and aesthetics of digital imagery emphasizing the use of traditional photographic input and output processes.

ART 4000. Directed Individual Study. Hours and credits to be arranged.

ART 4013/6013. Advanced Painting. (3) (Prerequisite: ART 2043). Six hours studio. Advanced study in painting with emphasis on the student's personal needs and interests.

ART 4083. Senior Honors Research in Art. (3) (Prerequisites: Senior standing, and consent of instructor). The application of research methods for the fine artist in contemporary society.

ART 4093. Senior Honors Thesis in Art. (3) (Prerequisites: ART 4083, or consent of instructor). (Co-requisite: enrollment in studio emphasis course). The proposal, development and execution of a project or exhibition.

ART 4103/6103. The Art of Typography and Layout I. (3) Six hours studio. The art and process of presenting written communication in graphic form.

ART 4113/6113. The Art of Typography and Layout II. (3) (Prerequisite: ART 4103/6103). Six hours studio. Advanced problems in presenting written communication in graphic form. Advanced problems as well as additional projects will be required for graduate credit.

ART 4203/6203. Photography II. (3) (Prerequisite: ART 3103 or permission of instructor). One hour lecture. Four hours studio. Advanced techniques of photographic processes in black and white with emphasis on aesthetics.

ART 4223/6223. Photography III. (3) (Prerequisite: ART 3103 or permission of the instructor). One hour lecture. Four hours studio. Alternative photographic processes in black and white with emphasis on aesthetics.

ART 4343/6343. Drawing IV. (3) (Prerequisite: ART 2233 at both levels and consent of instructor for 6343). Six hours studio. A continuation of ART 2233 to develop further skills for advanced students.

ART 4403/6403. Advertising Design I. (3) (Prerequisite: ART 3323, ART 4103/6103, and consent of instructor). Six hours studio. Course requiring ideational, image making, graphic design and typographic skills to meet rigorous conceptual/visual standards pertinent to creating a brand of a company's identity.

ART 4413/6413. Advertising Design II. (3) (Prerequisite: ART 4403/6403 and consent of instructor). Six hours studio. An advanced course requiring interaction on a professional level, working with realistic agency-client situations in order to develop efficient, distinguishable and competitive promotional campaigns.

ART 4433/6433. Color Photography II. (3) (Prerequisite: ART 3423 or permission of the instructor). One hour lecture. Four hours studio. Advanced techniques of photographic processes in color with emphasis on aesthetics.

ART 4443/6443. Alternative Color. (3) (Prerequisites: ART 3103 and ART 3423 and permission of instructor). One hour lecture and four hours studio. Advanced problems in color photography utilizing the dye transfer and polaroid processes. Additional projects for graduate credit.

ART 4523/6523. Internship in Graphic Art Design. (3) (Prerequisites: ART 3313, senior standing and consent of the instructor). Supervised instruction in graphic design. Advanced problems will be required for graduate credit.

ART 4533. Ceramic Art III. (3) (Prerequisites: ART 2313). Six hours studio. Advanced problems in glaze formulation, kiln technology and wheel thrown and hand built forms.

ART 4543/6543. Art and Architecture of Japan. (3) (Prerequisite: ART 1113, 1013, 1023, or consent of instructor). Three hours lecture. Discussion of the major developments in the art and architecture of Japan.

ART 4563/6563. Art of India and Southeast Asia. (3) (Prerequisite: One of the following: ART 1113, 1013, 1023, HI 1163, REL 1103, 3453). Three hours lecture. Discussion of the major developments in the art and architecture of India and Southeast Asia, 200 B.C. to 1200 A.D.

ART 4573/6573. Critical Issues in Recent Art. (3) (Prerequisite: ART 3603 or an equivalent course on 20th century art and consent of the instructor). Three hours lecture. Discussion of major developments and issues in contemporary art, focusing on the period 1980 to present.

ART 4603/6603. Advanced Studio - Drawing. (3) May be taken for credit more than once. (Prerequisites: ART 4343 and permission of in-

structor). Six hours studio. Advanced study in drawing. Further development of studio skills. Course encourages analysis and criticism, development of personal aesthetic, and further exploration of content and expression.

ART 4613/6613. Advanced Studio - Painting. (3) May be taken for credit more than once. (Prerequisite: consent of instructor). Six hours studio. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4623/6623. Advanced Studio - Printmaking. (3) May be taken for credit more than once. (Prerequisite: consent of instructor). Six hours studio. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4633/6633. Advanced Studio - Sculpture. (3) May be taken for credit more than once. (Prerequisite: ART 3513). Six hours studio. Further development of a personal sculptural aesthetic through media of choice.

ART 4643/6643. Advanced Studio - Graphic Design. (3) May be taken for credit more than once. (Prerequisite: consent of instructor). Six hours studio. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4653/6653. Advanced Studio - Ceramics. (3) May be taken for credit more than once. (Prerequisite: consent of instructor). Six hours studio. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4663/6663. Advanced Studio - Photography. (3) May be taken for credit more than once. (Prerequisite: Consent of instructor). Six hours studio. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4673/6673. Advanced Art History. (3) May be taken for credit more than once. (Prerequisite: consent of instructor). Three hours lecture. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4693/6693. Internship in Fine Art. (3) May be taken for credit more than once. (Prerequisite: Consent of department head). Six hours laboratory. Supervised instruction and experience for professional art practice.

ART 4813/6813. Introduction to Multimedia I Design and Authoring. (3) (Prerequisite: Consent of instructor). One hour lecture, five hours laboratory. The design and authoring of interactive multimedia for fine and applied arts using desktop computers. Course encourages analysis and criticism of aesthetic and related issues.

ART 4823/6823. Multimedia II and Electronic Publishing. (3) (Prerequisite: ART 4813/6813 and consent of instructor). Six hours laboratory. Interactive multimedia and electronic publication for fine and applied arts using desktop computers. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4833/6833. Computer Animation I. (3) (Prerequisite: Consent of instructor). Six hours lecture and laboratory. An introduction to Computer Animation. Basic concepts in the building of 3D objects, color, texture mapping, lighting, ray-tracing, and the writing of motion data.

ART 4843/6843. Computer Animation II. (3) (Prerequisite: ART 4833/6833) Six hours lecture and lab. Advanced techniques and special effects: customizing directory structures in the unix environment, complex modeling techniques, animation of object attributes, and creation of motion data.

ART 4863/6863. Advanced Studio - Computer Art and Design. (3) May be taken for credit more than once. (Prerequisite: Consent of instructor). Six hours laboratory. This course develops advanced studio skills and professional practice. Course encourages analysis and criticism of aesthetic, social, ethical and related issues.

ART 4873/6873. Digital Imaging I. (3) (Prerequisite: ART 3103 and ART 2803 or consent of instructor) Six hours laboratory. Application of computer software to generate electronic images captured by traditional photographic means. Advanced problems and additional projects will be required for graduate credit.

ART 4990/6990. Special Topics in Art. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ART 6683. Introduction to Animation/Multimedia. (3) (Prerequisite: Acceptance into the MFA program in Art or the MS program in Architecture, or consent of instructor). One hour lecture. Five hours studio. Introduction to basic animation and multimedia principles and practice.

ART 6763. Sequential Art I. (3) Six hours studio. Readings on sequential art and the history of traditional and computer animation inform

students working in traditional forms and techniques of temporal composition.

ART 7000. Directed Individual Study. Hours and credits to be arranged.

ART 8013. Computer Animation III. (3) (Prerequisite: ART 6833 and ART 6843). Six hours studio. Image processing, compositing, and managing complexity with basic programming techniques for computer-generated images and animations.

ART 8023. Computer Animation IV. (3) (Prerequisites: ART 6833, ART 6843, and ART 8013). Six hours studio. Based upon readings within the historical, critical, philosophical and applied contexts of computer graphics, animation and art, students focus on content development in their work.

ART 8033. Experimental Animation. (3) (Prerequisites: ART 6873, ART 6763, ART 8043 or consent of instructor). One hour lecture. Four hours laboratory. Course exercises and individual projects extend the technical palette and visual vocabulary of the experimental animator, with emphasis on the maturation of personal vision/aesthetic.

ART 8043. Seminar in Electronic Visualization I. (3) Six hours studio. Seminar in contemporary issues critical to electronic visualization and digital media.

ART 8073. Advanced Studio: Computer Art and Design. (3) (Prerequisite: ART 6863. Must be taken with co-requisite, ART 6823, ART 6843, ART 8013, ART 8023, or ART 8103). Class assignments for this course will coincide with those assigned for Animation II, Animation

III, Animation IV, Multimedia II, Multimedia III. This class will serve as a laboratory for these classes.

ART 8083. Theory of Visual Communication. (3) Three hours lecture. Study of the theories of sign and visual communication.

ART 8103. Multimedia III. (3) (Prerequisite: ART 6813 and ART 6823 or permission of the instructor). Two hours lecture. Four hours studio. Independent assignments in interactive multimedia authoring incorporating multiple elements: content development, graphic design, image editing and compositing, digital video, sound editing.

ART 8123. Multimedia Installation and Performance. (3) (Prerequisite: ART 8103 or consent of instructor). One hour lecture. Five hours studio. Coursework relates advanced interactivity concepts in computer-based multimedia to the broader context of performance art and installation for alternate as well as gallery settings.

ART 8163. Advanced Digital Imaging. (3) Six hours studio. Application of existing software to generate electronic images captured by traditional and non-traditional photographic means.

ART 8603. Advanced Figurative Studio. (3) (Prerequisite: Six hours undergraduate life drawing courses or consent of instructor). Six hours studio. An advanced studio course in drawing, painting, and/or digital media utilizing the human figure as subject.

ART 8990. Special Topics in Art. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AIR FORCE AEROSPACE STUDIES

Office: Second Floor, Middleton Hall

Col. Powell and Capt. Sandlin

AS 1012. The Air Force Today-I. (2) Fall semester. One hour lecture. One hour practicum. Surveys Air Force's role in contemporary world. Emphasis on strategic offensive and defensive forces.

AS 1022. The Air Force Today-II. (2) Spring Semester. One hour lecture. One hour practicum. A continuation of AS 1012 with emphasis on general purpose and support forces.

AS 2012. The Development of Air Power-I. (2) Fall semester. One hour lecture. One hour practicum. Study of air power development and employment in support of national objectives and an examination of the evolution of air power concepts and doctrine.

AS 2022. The Development of Air Power-II. (2) Spring semester. One hour lecture. One hour practicum. A continuation of AS 2012 with emphasis on air power since WWII.

AS 2990. Special Topics in Aerospace Studies. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

AS 3013. Air Force Leadership Studies-I. (3) (Prerequisites: AS 1012, AS 1022, AS 2012, and AS 2022 or permission of instructor). Fall semester. Three hours lecture. Two hours practicum. An integrated management course emphasizing leadership/management concepts and skills. Examines motivational and behavioral processes, leadership com-

munication, decision making, ethics, organizational power, and managerial strategy.

AS 3023. Air Force Leadership Studies-II. (3) (Prerequisites: AS 1012, AS 1022, AS 2012, AS 2022, and AS 3013 or permission of instructor). Spring semester. Three hours lecture. Two hours practicum. A continuation of AS 3013.

AS 4013. National Security Affairs and Preparation for Active Duty-I. (3) (Prerequisites: AS 1012, AS 1022, AS 2012, AS 2022, AS 3013, and AS 3023 or permission of instructor). Fall semester. Three hours lecture. Two hours practicum. Study of U.S. National Security Policy. Examines formulation, organization, and implementation of national security. Includes ethics, civil-military interaction, technology, and Laws of War.

AS 4023. National Security Affairs and Preparation for Active Duty-II. (3) (Prerequisites: AS 1012, AS 1022, AS 2012, AS 2022, AS 3013, AS 3023, and AS 4013 or permission of instructor). Spring semester. Three hours lecture. Two hours practicum. A continuation of AS 4013.

AS 4990. Special Topics in Aerospace Studies. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

Department of AEROSPACE ENGINEERING

Office: 330 Walker Engineering Laboratories

Professors Cinnella, Edwards, Koenig, Lawrence, Newman, Jr., Rais-Rohani, Thompson, Vinnini (head);

Associate Professors Bridges, Gatlin, Janus, King, Newman III;

Assistant Professor Lacy;

Instructor Hannigan

ASE 1013. Introduction to Aerospace Engineering. (3) (Prerequisite: credit or co-registration in MA 1713). Three hours lecture. Three hours laboratory. Historical perspectives of aerospace engineering and fundamentals of aerodynamics, the standard atmosphere, computer modeling and manufacturing, information technology, programming environments, computational tools.

ASE 1023. Introduction to Flight Mechanics. (3) (Prerequisite: ASE 1013). Three hours lecture. Three hours laboratory. Introduction to airfoils, wings, and other aerodynamic shapes, elements of airplane performance, principles of stability and control, applications of computer modeling, computational tools, historical perspectives.

ASE 2013. Astrodynamics, Propulsion and Structures. (3) (Prerequisite: ASE 1023). Three hours lecture. Three hours laboratory. Introduction to space flight (astronautics), propulsion, flight vehicle structures and materials, and hypersonic vehicles, applications of computer modeling, computational tools, with historical perspectives.

ASE 2113. Flight Mechanics I—Performance. (3) (Prerequisite: EM 2413). Three hours lecture. Introduction to general aerodynamics, propulsive and structural considerations of flight mechanics,

quasi-steady flight; non-steady flight; maneuvering flight; high performance vehicles.

ASE 2990. Special Topics in Aerospace Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ASE 3123. Static Stability and Control. (3) (Prerequisites: ASE 2013, EM 2433). Three hours lecture. Longitudinal, directional, and lateral static stability and control; related aerodynamics; maneuvering flight; introduction to dynamic stability and control analysis methods; general equation of unsteady motion.

ASE 3213. Aircraft Structures I. (3) (Prerequisite: EM 3213). Three hours lecture. Introduction to structural materials and loads. Deflection analysis using energy methods, flexibility-based matrix method, and the finite element method. Influence of design on deflection and vice versa.

ASE 3223. Aircraft Structures II. (3) (Prerequisite: EM 3213). Three hours lecture. Stress analysis of elastic and inelastic structures un-

der different loading conditions. Shear flow distribution in thin-wall structures. Influence of design on stress and shear flow distributions.

ASE 3313. Incompressible Aerodynamics. (3) (Prerequisite: EM 3313). Three hours lecture. Potential theory of bodies; airfoil theory and applications; finite wing theory and applications; introduction to Navier-Stokes equations; laminar boundary layers; turbulent boundary layers.

ASE 3333. Aerothermodynamics. (3) (Prerequisites: MA 2733, PH 2213). Three hours lecture. Energy; first and second laws of thermodynamics; entropy; properties of ideal gases; mixtures; gas power cycles; one-dimensional compressible flow; introduction to heat transfer.

ASE 4000. Directed Individual Study. Hours and credits to be arranged.

ASE 4113. Aerospace Engineering Laboratory I. (3) (Prerequisites: Credit or registration in EM 3413 and ECE 3283). Six hours laboratory. Experimental techniques used in aerospace engineering; course requirements include individual research and formal research papers.

ASE 4123. Dynamic Stability and Control. (3) (Prerequisite: ASE 3123). Three hours lecture. Methods of dynamic analysis; stability of steady flight; response to actuation of the controls (open loop); closed-loop control; human pilots and handling qualities.

ASE 4133/6133. Automatic Control of Aerospace Vehicles. (3) (Prerequisite: ASE 4123). Three hours lecture. Optimization techniques; structural flexibility effects; statistical design; sample-data control systems.

ASE 4143. Astrodynamics I. (3) (Prerequisites: EM 2433, MA 3253). Three hours lecture. Particle mechanics; Keplerian mechanics; geometry of spatial orbits; orbit determination; orbits determined from relative velocity; elements of analytical dynamics.

ASE 4153/6153. Advanced Performance. (3) (Prerequisite: ASE 2013). Three hours lecture. Performance methods used for current aeronautical vehicles. Configurations considered are sailplanes, V/STOL aircraft, subsonic/supersonic transports, and fighters.

ASE 4163/6163. Introduction to Flight Test Engineering. (3) (Prerequisite: ASE 3313, ASE 4123). Three hours lecture. Introduction to the techniques of aeronautical flight test engineering. Supplements Aerospace curriculum Pitot/static systems, and introduces fixed-wing flight test engineering, data reduction, certification, flight-test risk assessment/mitigation, and flight crew-station analysis procedures.

ASE 4233/6233. Structural Dynamics. (3) (Prerequisite: EM 3413). Three hours lecture. Influence coefficients; matrix methods; Lagrange's equations of motion; divergence of an airfoil; introduction to flutter.

ASE 4243/6243. Astrodynamics II. (3) (Prerequisite: ASE 4143). Three hours lecture. Orbital mechanics, orbit determination, perturbations and numerical integration. Global positioning system, launch performance, and optimization.

ASE 4333/6333. Helicopter Aerodynamics and Performance. (3) (Prerequisite: Consent of instructor). Three hours lecture. Aerodynamics of hovering, vertical, and forward flight. Momentum and blade element methods. Performance analysis, power losses, and drag in hover, climb, and cruise.

ASE 4343. Compressible Aerodynamics. (3) (Prerequisites: ASE 3333, EM 3313). Three hours lecture. Equations of motion for multidimensional flow; oblique shock waves; Prandtl Meyer flow; internal flow; method of characteristics; linearized flows; compressible wing theory; compressible boundary layers.

ASE 4413. Aerospace Propulsion. (3) (Prerequisites: ASE 3333 and ASE 4343). Three hours lecture. Aerothermodynamics of aircraft and rocket engines; propellers; nozzles; engines; turbines; compressors; diffusers; liquid propellants, solid propellants, rocket engine design.

ASE 4423/6423. Introduction to Computational Fluid Dynamics. (3) (Prerequisite: Consent of instructor). Three hours lecture. Elementary aspects of computational fluid dynamics (CFD); review of numerical analysis and fluid mechanics as pertinent to CFD; numerical solution of selected fluid dynamic problems.

ASE 4433/6433. Fundamentals of Numerical Grid Generation. (3) (Prerequisite: Consent of instructor). Three hours lecture. Discrete representation of partial differential equations and applications of grid generation in their computer-oriented solutions; coordinate transformations, computer geometry design techniques.

ASE 4513. Aerospace Vehicle Design I. (3) (Prerequisites: ASE 3123, ASE 3313, ASE 3223). Two hours lecture. Three hours laboratory. Introduction to the principles and techniques of aerospace vehicle design. Introduction to systems engineering and requirements analysis; design optimization; layout; weight; performance.

ASE 4523. Aerospace Vehicle Design II. (3) (Prerequisite: ASE 4513). One hour lecture. Five hours laboratory. Continuation of ASE 4513. Students make use of principles and techniques covered in ASE 4513 to create a design of an aerospace vehicle.

ASE 4623. Aircraft Structures III. (3) (Prerequisite: ASE 3223). Three hours lecture. Principles of design and manufacture of aircraft structures. General theories of stability and failure with applications. Design optimization, fabrication, and testing of structural members.

ASE 4713/6713. Engineering Acoustics. (3) (Prerequisite: EM 3413 or consent of instructor). Three hours lecture. Sonics, ultrasonics, wave equation, plane and spherical waves, wave propagation in air, liquids, elastic solids, reflection phenomena, absorption, scattering, acoustic sources and sensors, engineering applications.

ASE 4721. Aerospace Engineering Laboratory II. (1) (Prerequisite: ASE 4113). Three hours laboratory. Experimental techniques used in aerospace engineering.

ASE 4990/6990. Special Topics in Aerospace Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ASE 7000. Directed Individual Study. Hours and credits to be arranged.

ASE 8000. Thesis Research/Thesis. Hours and credits to be arranged.

ASE 8313. Advanced Compressible Aerodynamics I. (3) (Prerequisite: ASE 4343 or equivalent). Three hours lecture. Derivation of complete equations for compressible fluid flow; unsteady one-dimensional flows; method of characteristics; flow about two-dimensional, and axis-symmetric shapes; integral methods.

ASE 8323. Advanced Compressible Aerodynamics II. (3) (Prerequisite: ASE 8313). Three hours lecture. Perturbation theory for wings and bodies; optimum wing and body shapes; wing-body interference; transonic flows, hypersonic flows.

ASE 8333. Physical Gasdynamics. (3) (Prerequisites: ASE 4343 and consent of instructor). Three lectures. Real gas effects, equilibrium and non-equilibrium processes in fluid dynamics. Elements of chemical thermodynamics, kinetic theory, statistical mechanics, hypersonic gasdynamics.

ASE 8343. Incompressible Viscous Laminar Flow. (3) (Prerequisite: Consent of instructor). Three hours lecture. Incompressible Navier-Stokes equations; properties and exact solutions; laminar boundary layer equations; two- and three-dimensional solutions; time-dependent solutions; approximate solutions; boundary layer control.

ASE 8353. Turbulent Flow. (3) (Prerequisite: ASE 8343). Three hours lecture. Origins of turbulence; stability statistical theory of turbulence; isotropic and non-isotropic turbulence; equations of turbulent flow; turbulent boundary layer; free turbulent flow.

ASE 8363. Computational Heat Transfer. (3) (Prerequisite: Consent of instructor). Three hours lecture. Application of numerical techniques to elliptic and parabolic problems in engineering heat transfer and fluid flow. Discretization techniques; linearization; stability analysis. (Same as ME 8363).

ASE 8413. Computational Fluid Dynamics I. (3) (Prerequisite: Consent of instructor). Three hours lecture. Review of relevant numerical analysis; one dimensional methods; compressible inviscid methods, Euler Equation methods, inviscid-viscous interaction methods; current literature.

ASE 8423. Computational Fluid Dynamics II. (3) (Prerequisite: ASE 8413 or equivalent). Three hours lecture. Compressible viscous methods; Navier-Stokes equation methods; turbulence models; incompressible methods; panel methods; finite element methods, current literature.

ASE 8533. Advanced Numerical Grid Generation. (3) (Prerequisite: ASE 4433/6433 or consent of instructor). Three hours lecture. Structured-unstructured hybrid composite grid configurations, truncation error analysis, direct-indirect grid generation methods, grid refinement, adaptive gridding.

ASE 8990. Special Topics in Aerospace Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

ASE 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

Department of **BIOCHEMISTRY** and **MOLECULAR BIOLOGY**

Office: 402 Dorman Hall

Professors Boyle (Head), Luthe, Ma, Reichert, Willeford, Wilson and Wood;
Assistant Professors Braasch, Jung, Li and Peng

BCH 1001. Introduction to Biochemistry. (1) One hour lecture. A course to acquaint the beginning students with the overall concepts of biochemistry and molecular biology. Current research will be described. Offered every year.

BCH 2990. Special Topics in Biochemistry. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BCH 3613. Elementary Biochemistry. (3) (Prerequisite: CH 2503). Three hours lecture. A terminal course which deals with a study of the structural and metabolic relationships of carbohydrates, lipids, protein, nucleic acids, enzymes, and vitamins.

BCH 3901. Senior Seminar. (1) (Prerequisite: BCH 4613/6613). Each student will prepare and present a formal paper based on independent study of the literature and undergraduate research investigations.

BCH 4000. Directed Individual Study. Hours and credits to be arranged.

BCH 4414/6414. Protein Methods. (4) (Prerequisite: Coregistration in BCH 4603/6603). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of protein biochemistry.

BCH 4603-4613/6603-6613. General Biochemistry. (3-3) (Prerequisites: CH 4523/6523 or consent of instructor). Three hours lecture. BCH 4603/6603 must be completed before student may enroll in BCH 4613/6613. Detailed studies of the structure and metabolism of carbohydrates, lipids, proteins, nucleic acids, enzymes, and coenzymes.

BCH 4623/6623. Biochemistry of Specialized Tissues. (3) (Prerequisite: Coregistration in BCH 4613/6613). A continuation of BCH 4613/6613 to include a study of specialized tissues, hormones, acid-base balance in animals and other physiological parameters of biochemistry.

BCH 4713/6713. Molecular Biology (3) (Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of basic molecular process such as synthesis of DNA, RNA, and protein in both prokaryotic and eukaryotic cells. Offered fall semester. (Same as GNS 6713).

BCH 4804/6804. Molecular Biology Methods. (4) (Prerequisite: Coregistration in BCH 4613/6613). Two hours lecture. Four hours laboratory.

laboratory. A comprehensive course to teach the student the modern methods of molecular biology. (Same as GNS 4804/6804).

BCH 4990/6990. Special Topics in Biochemistry. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BCH 7000. Directed Individual Study. Hours and credits to be arranged.

BCH 8000. Thesis Research/Thesis. Hours and credits to be arranged.

BCH 8101. Seminar. (1) Review of current literature; individual presentation of research or classical topics.

BCH 8243. Molecular Biology of Plants. (3) (Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of plant development at the molecular level. Emphasis will be placed on the influence of nucleic acid metabolism on plant development.

BCH 8633. Enzymes. (3) (Prerequisites: BCH 4613/6613). Three hours lecture. A study of enzymes; their purification, classification, kinetics and mechanisms.

BCH 8643. Molecular Genetics. (3) (Prerequisites: PO 3103, or BIO 3103, and Coregistration in BCH 4613/6613). Three hours lecture. Study of the gene and its expression with emphasis on structure and function in higher organisms. (Same as GNS 8643).

BCH 8654. Intermediary Metabolism. (4) (Prerequisite: BCH 4613/6613). Four hours lecture. An advanced in-depth study of anabolic and catabolic pathways involved in cellular metabolism. Bioenergetics and control mechanisms will be emphasized.

BCH 8990. Special Topics in Biochemistry. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BCH 9000. Dissertation Research/Dissertation. (1-9) Hours and credit to be arranged.

Department of **BIOLOGICAL SCIENCES**

Office: 130 Harned Biology Building

Professors Altig, Brown, Buddington, Chambers*, Champlin, Diehl, Dorough, Downer (Head), McDaniel, St. Cyr Coats, Sullivan, and Wise;
Associate Professors Thibaudeau and Williams
Assistant Professors Courcelle, Pinchuk, Price, Rooney, Taylor, and Welborn
Instructors Fuquay, Holder and Williamson.

BIO 1001. Biology Laboratory. (1) Three hours laboratory. Accompanies BIO 1033. May be used also as AP credit to satisfy one hour Biology, Botany, or Zoology laboratory. Selected exercises to illustrate fundamental concepts of biology.

BIO 1004. Anatomy and Physiology. (4) Three hours lecture. Two hours laboratory. For non-science majors. The structure and function of the human body with special emphasis on the muscular, nervous, circulatory, respiratory, digestive, urinary and reproductive systems. (Fall and Spring).

BIO 1023. Plants and Humans. (3) Two hours lecture. Two hours laboratory. For non-science majors. Students may not have credit for both BIO 1023 and BIO 1203 nor for both BIO 1023 and BIO 1033, nor for both BIO 1023 and general biology courses transferred from other institutions. A survey of botany intended to introduce students to the world of plants, particularly emphasizing their relationships with humans and society. (Fall and Spring).

BIO 1033. Biological Science. (3) Three hours lecture. Students may not have credit for both BIO 1033 and BIO 1023, nor for both BIO 1033 and BIO 1123. Basic principles and modern concepts pertaining to levels of biological organization from cell to biosphere and life forms of biological kingdoms.

BIO 1123. Animal Biology. (3) Two hours lecture. Two hours laboratory. For non-science majors. Students may not have credit for both BIO 1123 and BIO 1504. Basic understanding of life processes, diversity, inheritance, reproduction, ecology, and evolution. (Fall and Spring).

BIO 1203. Plant Biology. (3) Two hours lecture. Three hours laboratory. (Students may not have credit for both BIO 1023 and BIO 1203.) An introduction to the biology of flowering plants. Topics include plant physiology, anatomy and morphology, development, genetics and evolution. (Offered each semester).

BIO 1213. Survey of Plant and Fungi Kingdoms. (3) Two hours lecture. Three hours laboratory. A survey of algae, bryophytes, vascular plants, and fungi, with emphasis on morphology, internal anatomy, life cycles, fossil record, and evolutionary relationships. (Spring).

BIO 1301. Perspectives in Medical Technology. (1) One hour lecture. A survey of all aspects of medical technology. (Fall).

BIO 1504. Principles of Zoology. (4) Three hours lecture. Three hours laboratory. For science majors. Students may not have credit for both BIO 1123 and BIO 1504. Introduction to animal biology, including genetics, embryology, physiology, cell biology, ecology and behavior. (Fall and Spring).

BIO 2004. Human Anatomy. (4) Three hours lecture. Three hours laboratory. The study of the structure of the human body. The gross and microscopic anatomy of each organ system will be presented. (Fall and Spring).

BIO 2014. Human Physiology. (4) Three hours lecture. Three hours laboratory. Survey of physiological systems and principles and their interrelationship in humans. Designed for paramedical and pre-nursing students and dietetic majors. (Spring).

BIO 2103. Cell Biology. (3) (Prerequisites: 6 hours of biology, CH 1223). Three hours lecture. A comparative study of cell structure among plant, animal and bacterial systems. (Fall/spring).

BIO 2213. Survey Plant Kingdom. (3) Two hours lecture. Two hours laboratory. A survey of algae, bryophytes, vascular plants, and fungi, with emphasis on morphology, internal anatomy, life cycles fossil record, and evolutionary relationships. (Spring).

BIO 2503. Environmental Quality. (3) (Prerequisite: One course in biology). Three hours lecture. Relevance of ecological principles to environmental problems and relationships of humans with their environment with emphasis on preservation of environmental quality. (Fall)

BIO 2990. Special Topics in Biology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BIO 3013. Professional Writing for Biologists. (3) (Prerequisite: Junior/Senior standing in BIO, MIC, or MDT, or consent of instructor). Three hours lecture. Refinement of writing skills for more effective communications. Assignments to include routine and specialized correspondence, technical reports, and speech preparation and delivery. (Fall/Spring).

BIO 3103. Genetics I. (3) (Prerequisites: MA 1313. BIO 1504 or BIO 1203, or equivalents). (Same as PO 3103 and GNS 3103).

BIO 3104. Ecology. (4) (Prerequisite: BIO 1504). Three hours lecture. Three hours laboratory. A general survey of ecological principles and concepts pertaining to plants and animals with reference to ecosystem structure and function, and interactions among ecosystem components. (Fall).

BIO 3113. Marine Biology. (3) (Prerequisite: BIO 1504 or equivalent.) Three hours lecture. An introduction to marine environments, the diversity of life in the different marine habitats and human utilization of marine resources. (Spring)

BIO 3303. Parasitology. (3) (Prerequisite: BIO 1504 or equivalent). Two hours lecture. Three hours laboratory. A survey of parasitology to include parasites of importance to the health of humans and domestic animals. (Fall).

BIO 3304. General Microbiology. (4) (Prerequisites: CH 1053 or CH 1223). Two hours lecture. Four hours laboratory. For science majors. Fundamentals; techniques in staining and culture of microorganisms. (Fall and spring).

BIO 3404. Bacterial Cultivation. (4) (Prerequisites: BIO 3304 and CH 4513 or coregistration in CH 4513). Two hours lecture. Four hours laboratory. A continuation of 3304. General principles of microbiology with emphasis on cultivation of bacteria. (Fall and Spring).

BIO 3504. Comparative Anatomy. (4) (Prerequisite: BIO 1504). Two hours lecture. Six hours of laboratory. The vertebrate animals; relationships of organs and systems; and their phylogenetic significance. (Fall).

BIO 3514. Invertebrate Zoology. (4) (Prerequisite: BIO 1504). Three hours lecture. Three hours laboratory. Invertebrate organisms with emphasis on structure, function, taxonomy, phylogeny and life histories. (Spring, odd years).

BIO 3524. Biology of Vertebrates. (4) Two hours lecture, three hours laboratory. Evolution, systematics, ecology and behavior of vertebrates. Laboratory includes classification of major groups, identification of species, field trips, and experiments in behavior and physiological ecology. (Spring).

BIO 4000. Directed Individual Study. Hours and credits to be arranged.

BIO 4011. Senior Thesis in Biological Sciences. (1) (Prerequisites: BIO 4013 with a grade of B or better and consent of department head and thesis committee). Writing of the undergraduate thesis under the direction of the major advisor.

BIO 4013. Senior Research in Biological Sciences. (3) (Prerequisites: Senior standing, consent of department head, 3.00 GPA in biology courses, and major in biological sciences). Conduct original research for eventual writing of undergraduate thesis.

BIO 4100. Med Tech Clinicals. (3-19) (Prerequisite: consent of instructor). Medical Technology Clinical Internship.

BIO 4103/6103. Experimental Genetics. (3) (Prerequisites: BIO 3103 or consent of instructor). Six hours laboratory. Mechanisms of transmission of genetic information with first-hand experience in inducing such mechanisms from experimental data. Emphasis is on lab. (Fall and Spring).

BIO 4113/6113. Evolutionary Biology. (3) Three hours lecture. Historical development of evolutionary theory; variation and natural selection in populations; speciation; current concepts of phylogeny and systematics. (Fall).

BIO 4114/6114. Cellular Physiology (4) (Prerequisites: Seven hours of zoology and two semesters of organic chemistry). Three hours lecture. Three hours laboratory. A study of the morphology and function of the cell. (Fall). (Same as PHY 6114).

BIO 4133/6133. Human Genetics. (3) (Prerequisite: BIO 1504 or consent of instructor). Three hours lecture. Principles of Mendelian and molecular genetics as applied to humans. Description and causes of human genetic diseases and other anomalies. (Same as GNS 4133/6166).

BIO 4163/6163. Bryology. (3) (Prerequisites: BIO 1203 and BIO 2213). One hour lecture. Four hours laboratory. Taxonomy of bryophytes: collection and identification of local hepatics and mosses. (Spring, even years).

BIO 4203/6203. Taxonomy of Spermatophytes. (3) (Prerequisites: BIO 1203 and BIO 2213). Two hours lecture. Three hours laboratory. Classification and nomenclature of seed plants; introductory methods of collection; laboratory studies of representative plant families. (Fall and Spring).

BIO 4204/6204. Plant Anatomy. (4) (Prerequisites: BIO 1203 and BIO 2213). Two hours lecture. Four hours laboratory. Structure and development of cell types, tissues, roots, stems, leaves, flowers, and fruits of seed plants, with emphasis on angiosperms. (Fall, even years).

BIO 4213/6213. Plant Ecology. (3) (Prerequisite: BIO 4203). Two hours lecture. Three hours laboratory. Plant behavior in relation to environment; developmental variations; successional trends; stabilization of plant communities. (Fall).

BIO 4214/6214. General Plant Physiology. (4) (Prerequisites: BIO 1203 and CH 1213). Three hours lecture. Three hours laboratory. Chemical and physical activities of the plant; absorption; transpiration; mineral nutrition; photosynthesis; translocation; growth processes. (Fall).

BIO 4223/6223. Freshwater Algae. (3) (Prerequisites: BIO 1203). Two hours lecture. Three hours laboratory. Cytology, morphology, physiology, reproduction and ecology of major groups of freshwater algae; laboratories emphasize identification of common freshwater algal genera.

BIO 4303/6303. Bioinstrumentation. (3) (Prerequisite: BIO 4304/6304). Two hours lecture. Two hours laboratory and demonstrations. Theory and practical application of electrical, optical and other instruments employed in microbiology and medical technology. (Spring).

BIO 4304/6304. Quantitative Methods I. (4) Three hours lecture. Two hours laboratory. Application of mathematical and statistical techniques to problem solving in the laboratory. (Fall).

BIO 4314/6314. Quantitative Methods II. (4) (Prerequisite: BIO 4304/6304). Two hours lecture. Four hours laboratory. Theory and application of selected clinical laboratory methods. (Spring).

BIO 4324/6324. Soil Microbiology. (4) (Prerequisite: BIO 3304). Three hours lecture. Three hours laboratory. Soil microorganisms and their importance in ammonification, nitrification, and other biological processes. (Spring). (Same as PSS 4314)

BIO 4404/6404. Environmental Microbiology. (4) (Prerequisite: BIO 3304). Two hours lecture. Four hours laboratory. Terrestrial, aquatic, and subsurface microbial ecosystems. Microbiology of water and wastewater treatment, solid waste disposal, land farming, impact of hazardous waste, and environmental reclamation. Spring/odd years.

BIO 4405/6405. Pathogenic Microbiology. (5) (Prerequisite: BIO 3304). Three hours lecture. Four hours laboratory. The microorganisms producing disease in man and lower animals; means of transmission; protection against disease. (Fall and Spring).

BIO 4413/6413. Immunology. (3) (Prerequisite: BIO 3304 and CH 4513). Three hours lecture. Survey of the functions of the immune system. Emphasis on mammalian immunology, including T- and B-cell interactions in humoral and cell mediated immunity. (Fall).

BIO 4414/6414. Microbiology of Foods. (4) (Prerequisite: BIO 3304). Two hours lecture. Four hours laboratory. Isolation and classification of the microorganisms associated with spoilage of commercial and domestic preserved foods. Same as FST 4414/6414. (Spring).

BIO 4433/6433. Principles of Virology. (4) (Prerequisites: BCH 4603 and BIO 3103 or equivalents). Three hours lecture. Principles of viral infectivity, multiplication, and chemical constitution.

BIO 4442/6442. Bacterial Genetics Laboratory. (2) (Prerequisite: BCH 4603, BIO 3304 and concurrent enrollment in BIO 4443/6443). Four hours laboratory. The genetic and molecular manipulation of bacteria and their viruses.

BIO 4443/6443. Bacterial Genetics. (3) (Prerequisites: BCH 4603, BIO 3304 or consent of instructor). Three hours lecture. The genetics of bacteria and their viruses including: replication, rearrangement, repair, transfer, regulation, and methods of manipulation and analysis of DNA. (Fall)

BIO 4463/6463. Bacterial Physiology. (3) (Prerequisites: BIO 3404 and BCH 4603). Three hours lecture. Structure and function relationships and major aerobic and anaerobic metabolic pathways in microorganisms. (Fall).

BIO 4502/6502. Toxicology. (2) (Prerequisite: 8 hours biological sciences and 8 hours chemistry [cell biology/physiology and biochemistry recommended]). Two hours lecture. An introduction to the field of toxicology, including discussion of absorption, metabolism mode of action (acute and chronic), environmental effects, and toxicity testing.

BIO 4503/6503. Vertebrate Histology. (3) (Prerequisite: BIO 1504). Two hours lecture. Three hours laboratory. Study of the microscopic anatomy, structure, and function of major cell types and tissues. (Fall).

BIO 4504/6504. Comparative Vertebrate Embryology. (4) (Prerequisite: BIO 1504). Two hours lecture. Six hours laboratory. The em-

bryology of the vertebrates; the fertilization of the egg; stages of cleavage and the development of organs and systems. (Spring).

BIO 4513/6513. Ichthyology. (3) (Prerequisite: BIO 1504 or equivalent). Two hours lecture. Three hours laboratory. Structure, evolution, classification, and life histories of fishes of the world with emphasis on North American freshwater forms. (Fall).

BIO 4514/6514. Animal Physiology. (4) (Prerequisites: Ten hours of zoology and organic chemistry). Three hours lecture. Three hours laboratory. Function and interrelationship of the systems of the body. (Spring). (Same as PHY 6514).

BIO 4523/6523. Mammalogy. (3) (Prerequisite for undergraduates: BIO 3524 or equivalent). Two hours lecture. Three hours laboratory. Evolution, systematics, and ecology of mammals, with emphasis on North American groups. (Fall).

BIO 4543/6543. Ornithology. (3) (Prerequisites: Eight hours of zoology). Two hours lecture. Three hours laboratory. Recent and fossil avifauna of the world; its origin, distribution, classification, and biology. (Spring).

BIO 4713/6713. Field Botany for Teachers. (3) (Prerequisite: Three hours of biology). Two hours lecture. Three hours laboratory. Plants in their natural habitats with emphasis on identification, ecological associations, life histories and importance to man and other organisms. (Summer). **Note:** Will not satisfy any Arts and Sciences core requirement.

BIO 4990/6990. Special Topics in Biology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BIO 8011. Seminar. (1) One hour. Required once of each on-campus M.S. or Ph.D. student. Formal oral presentation of current topics in biology.

BIO 8013. Scientific Writing for Biological Scientists. (2) Three hours lecture. Preparation of the journal article, thesis, and dissertation; searching the literature; scientific illustration; oral presentation of a scientific paper. (Spring).

BIO 8103. Advanced Ecology. (3) (Prerequisite: Bio 3104). Two hours lecture. Three hours laboratory. Selected topics with special references to bioenergetics, population and human ecology; with student research project. (Fall, odd years).

BIO 8104. Experimental Molecular Biology. (4) (Prerequisite: Consent of instructor). One hour lecture. Six hours laboratory. Practical experience with the molecular analysis of gene function.

BIO 8113. Biogeography. (3) Three hours lecture. Study of the geographic distribution of life. Emphasis placed on climatic, geologic, and human influence, dispersal mechanisms and evolutionary history. (Fall, even years).

BIO 8123. Physiological Ecology. (3) (Prerequisite: One semester of physiology or consent of instructor). Three hours lecture. An advanced study of physiological and metabolic adaptations of animals to variable factors in the environment. (Spring, even years).

BIO 8213. Plant Water and Mineral Relations. (3) (Prerequisite: BIO 4214). Three hours lecture. Membrane structure and functions; plant and soil water relationships; absorption; translocation; transpiration; ion transport and mineral nutrition. (Spring).

BIO 8223. Plant Metabolism. (3) (Prerequisites: BIO 4214 and organic chemistry). Three hours lecture. Photosynthesis, respiration, nitrogen metabolism, and other metabolic processes. (Fall).

BIO 8403. Advanced Microbial Physiology. (3) (Prerequisite: BIO 4463 or the equivalent). Three hours lecture. Discussion of current concepts regarding the molecular basis of prokaryotic macromolecular biosynthesis and cell division and susceptibility of such processes to inhibition by antibiotics. (Spring, odd years).

BIO 8453. Advanced Virology. (3) (Prerequisite: Cell Biology or equivalent). Three hours lecture. Literature survey in virus research. (Spring, odd years).

BIO 8463. Advanced Bacterial Genetics. (3) (Prerequisites: BCH 4713 or BIO 4443, or consent of instructor). Three hours lecture. Discussion of current concepts of genetic transfer and regulation in various bacteria. Emphasis will be on use of genetics as an experimental tool. (Fall, even years.)

BIO 8990. Special Topics in Biology. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

Off Campus

The courses listed below are offered during the year of clinical training at affiliate hospitals. (See list of affiliate hospitals.)

Offered during the Summer at Gulf Coast Research Laboratory.

BIO 4336/6336. Marine Invertebrate Zoology II. (6) (Prerequisite: Sixteen hours of zoology and junior standing). Same as GCRL Zoology 361B. All phyla from Ollusca through protochordates are covered in this course.

BIO 4345/6345. Marine Ecology. (5) (Prerequisite: Sixteen hours of biology including general botany and invertebrate zoology). Same as GCRL Zoology 452. A consideration of the relationships of marine organisms to their environment.

BIO 4526/6526. Marine Aquaculture. (6) (Prerequisites: General zoology, invertebrate and vertebrate zoology, or consent of instructor). Same as GCRL Zoology 464. A course designed to acquaint advanced biology students with the science of marine aquaculture.

BIO 4602. Urinalysis. (2) (Prerequisite: Completion of all preprofessional requirements). One hour lecture. Two hours laboratory. A study of urine as a diagnostic tool. (Spring).

BIO 4606. Clinical Microbiology. (6) (Prerequisite: Completion of all preprofessional requirements). Three hours lecture. Six hours laboratory. Isolation and identification of micro-organisms from clinical specimens. Includes bacteriology, virology, mycology and parasitology. Second summer term.

BIO 4608. Hematology. (8) (Prerequisite: Completion of all preprofessional requirements). Four hours lecture. Eight hours of laboratory. Normal and abnormal blood and bone marrow cells. Coagulation mechanisms. (Spring).

BIO 4612. Special Topics. (2) (Prerequisite: Completion of all preprofessional requirements). Four hours lecture or laboratory. An assigned project as determined by the needs or interests of the student. (Spring).

BIO 4614. Serology and Immunology. (4) (Prerequisite: Completion of all preprofessional requirements). Two hours lecture. Four hours laboratory. A study of the immune system of the human body. Diagnostic procedures using antigen-antibody reactions. (Fall).

BIO 4616. Immunohematology. (6) (Prerequisite: Completion of all preprofessional requirements). Three hours lecture. Six hours laboratory. Blood group serology, compatibility testing, and identification of atypical antibodies. Transfusion practices and blood group immunogenetics. First summer term.

BIO 4618. Clinical Chemistry. (8) (Prerequisite: Completion of all preprofessional requirements). Four hours lecture. Eight hours laboratory. Normal and abnormal human body chemistry. Emphasis on instrumentation. (Fall).

BIO 7000. Directed Individual Study. Same as GCRL Zoology 561. Hours and credits to be arranged. Directed Individual Study courses usually require prerequisites of BIO 4326/6326.

BIO 8000. Thesis research/Thesis. Same as GCRL Zoology 561. Hours and credits to be arranged.

BIO 9000. Dissertation Research/Dissertation. Same as GCRL Zoology 561. Hours and credits to be arranged.

BUSINESS INFORMATION SYSTEMS

(For departmental information, see DEPARTMENT of MANAGEMENT and INFORMATION SYSTEMS.)

BIS 1013. Introduction to Business Computer Systems. (3) Two hours lecture. Two hours laboratory. An overview of information systems. Integrating computer hardware, software, data, personnel, and procedures is stressed. Instruction in personal productivity packages and the Internet is provided. (Credit will not be granted for this course and CSE 1013 or BIS 3713.)

BIS 1733. Visual Basic Applications. (3) (Prerequisite: a grade of B or above in BIS 1013). Three hours lecture. Introduction to procedural, event and object-oriented programming to develop business and e-commerce applications.

BIS 1753. Introduction to Business Applications Using COBOL. (3) (Prerequisite: a grade of B or above in BIS 1733 or graduate standing). Three hours lecture. Structured program design for business applications. Data editing, table handling, and file processing with sequential and random access files will be stressed.

BIS 2990. Special Topics in Business Information Systems. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BIS 3233. Management Information Systems. (3) (Prerequisite: BIS 1013). Three hours lecture. A survey of the components, functions, and processes of Information Systems as they relate to managing modern organization for increased efficiency and competitiveness.

BIS 3523. Advanced Languages I. (3) (Prerequisites: a grade of "B" or above in BIS 1753, or graduate standing). Three hours lecture. Current and advanced business programming topics. In-depth experience in programming in one or more current state-of-the-art languages.

BIS 3713. Electronic Information Systems. (3) (Prerequisite: Junior Standing and six hours of mathematics and/or statistics, or consent of instructor). Three hours lecture. Principles of business information systems using computer equipment. Business problem solving, including problem definition, flow charting, basic programming and input-output design. (Credit for this course may be earned only at the Meridian and Jackson branches of Mississippi State University. Credit will not be granted for this course and BIS 1013 or CSE 1013).

BIS 3753. Business Database Systems. (3) (Prerequisite: a grade of B or above in BIS 1753). Three hours lecture. Introduction to business database applications. Includes data modeling, design techniques, and data collection, storage, manipulation, and retrieval strategies.

BIS 4000. Directed Individual Study. Hours and credits to be arranged.

BIS 4113/6113. Business Information Systems Security Management. (3) (Prerequisite: BIS 3233 or consent of instructor). Three hours lecture. Concepts, skills, tools, and techniques involved in management of computer security as it applies to today's business environment.

BIS 4513/6513. Local Area Networks. (3) (Prerequisite: BIS 3523, or any 12 hours of programming, or graduate standing). Three hours lecture. Concepts and technology of local area networks. Experience in building and maintaining LAN hardware and software components.

BIS 4523/6523. Advanced Languages II. (3) (Prerequisites: BIS 3523). Three hours lecture. Current and advanced business programming topics. In-depth experience in programming in one or more current state-of-the-art languages.

BIS 4533. Management Support Systems. (3) (Prerequisites: BIS 3233 and BIS 4753). Three hours lecture. Theory and application of decision support, expert systems, and data mining using fifth and sixth generation computing techniques. Hands-on experience in developing management support systems.

BIS 4753. Structured Systems Analysis and Design. (3) (Prerequisite: a grade of B or above in BIS 1753). Three hours lecture. Analysis/design of computer based information systems with emphasis on problem identification, requirements structuring, and solution generation in theory and in a business project.

BIS 4763. Electronic Commerce Seminar. (3) (Prerequisite: Graduating Senior and 15 hours of BIS courses). Three hours lecture. Preparation for IS careers, management of information systems, technical skill tuning, and technology updates with emphasis on fundamentals of e-commerce technology and e-commerce business models.

BIS 4990/6990. Special Topics in Business Information Systems. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BIS 7000. Directed Individual Study. Hours and credits to be arranged.

BIS 8000. Thesis Research/Thesis. Hours and credits to be arranged.

BIS 8112. Managing Information Technology and Systems. (2) (Prerequisite: BIS 8022 or equivalent). Two hours lecture. Course includes the description, acquisition or development and use of systems

from a local and global perspective. Technology-enabled concepts are used for student assignments.

BIS 8113. Management Information Systems. (3) (Prerequisite: BIS 1013). Three hours lecture. Concepts and technology required by managers to interface with an organization's MIS functions. Impact of various MIS strategies, operations, and controls are developed and evaluated.

BIS 8122. Multimedia Presentation and Communication. (2) (Prerequisite: BIS 8022 or equivalent). Two hours lecture. Emphasis on planning and delivering business presentations enhanced by multimedia. Concepts, design, and experience in developing multimedia presentations. Exposure to interactive multimedia.

BIS 8213. Advanced Systems Analysis and Design. (3) (Prerequisites: Six hours of programming and prerequisite or co-requisite BIS 8112). Three hours lecture. Analysis/design of computer-based information systems using structured methodologies and tools. Emphasis on problem definition, data collection, requirement structuring, solution generation and system design.

BIS 8313. Advanced Database Design Administration. (3) (Prerequisites: BIS 8213, BIS 8413 and BIS 8613.) Three hours lecture. Design and management of local and distributed data resources, database design, definition, creation, maintenance, acquisition and use. Role of Database Administrator.

BIS 8413. Decision Support and Expert Systems. (3) (Prerequisites: Six hours of programming and prerequisite or co-requisite: BIS 8112). Three hours lecture. Analysis of information support systems which serve the manager/user providing quantitative and qualitative based information derived from databases and model bases.

BIS 8513. Business Telecommunications. (3) (Prerequisites: BIS 8213, BIS 8413 and BIS 8613.) Three hours lecture. The evaluation, analysis and design of information systems utilizing data communications and networking concepts and techniques. Emphasis is on business applications and related considerations.

BIS 8613. MIS Administration. (3) (Prerequisites: Six hours of programming and prerequisite or co-requisite: BIS 8112). Three hours lecture. Administration of the MIS function in the business enterprise. Emphasis on activity of managing the IS function at all levels of the firm.

BIS 8753. Information Systems Collaborative Project. (3) (Prerequisites: BIS 8213, BIS 8413 and BIS 8613; co-requisites or prerequisites: BIS 8313 and BIS 8513). Three hours lecture. Capstone experience incorporating knowledge gained in prerequisite courses. Requires team participation using appropriate tools and methodologies in assisting organizations with real-world information systems related needs.

BIS 8990. Special Topics in Business Information Systems. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BIS 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

BIS 9113. Management Information Systems (MIS) Seminar. (3) (Prerequisite: BIS 8213, BIS 8313). Three hours lecture. Penetrating review of issues, methodologies and new developments in design and operation of management information, decision support, and computer-based decision-making systems.

BIS 9213. Advanced Topics in MIS. (3) (Prerequisite: BIS 8213, BIS 8313). In-depth study of current MIS topics. Emphasis will be on project design and demonstration. Topics will change to reflect new directions in MIS.

BUSINESS LAW

(For departmental information, see MARKETING, QUANTITATIVE ANALYSIS and BUSINESS LAW)

BL 2413. The Legal Environment of Business. (3) Three hours lecture. Environmental study of legal influences, concepts, institutions, emphasizing social forces shaping business law. Introduces business students to interrelationships of law and society, jurisprudence and business.

BL 2990. Special Topics in Business Law. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BL 3223. The Law of Commercial Transactions. (3) (Prerequisite: Junior Standing). Three hours lecture. Commercial instruments in the economic process. Use of commercial and investment paper; documents of title, security instruments, notes, drafts, checks; integrated treatment of uniform statutes.

BL 4000. Directed Individual Study. (Prerequisite: Junior standing) Hours and credits to be arranged.

BL 4243/6243. Legal Aspects of Entrepreneurship. (3) (Prerequisite: BL 2413, MGT 3323, or consent of instructor). Three hours lecture. Business creation including legal aspects from permits and taxes to structure and sale with emphasis on Mississippi Law.

BL 4253/6253. Real Estate Law. (3) (Prerequisite: BL 2413 or consent of instructor). Three hours lecture. The legal principles applicable to real estate, including types of ownership and interests, mortgages, restrictions, and regulations.

BL 4263/6263. Environmental Law. (3) Three hours lecture. An introduction to how environmental law interfaces with the legal system. Overview of the major statutes, cases, and regulations pertaining to the environment.

BL 4273/6273. International Business Law. (3) Three hours lecture. An international commercial transactions course emphasizing trade, licensing and investment (contracts, financing, instruments, dispute resolution).

BL 4990/6990. Special Topics in Business Law. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer de-

veloping subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BL 8112. Law, Business Ethics, and Dispute Resolution. (2) Two hours lecture. Legal and ethical issues faced by the business firm with emphasis on prevention and resolution of disputes, including mediation, negotiation and alternative dispute resolution.

BUSINESS QUANTITATIVE ANALYSIS

(For departmental information see MARKETING, QUANTITATIVE ANALYSIS and BUSINESS LAW)

BQA 2113. Business Statistical Methods I. (3) (Prerequisite: MA 1463 and BIS 1013 or equivalent). Three hours lecture. Methods of describing numerical data; probability in business decisions; random variables; sampling distributions; introduction to estimation and hypothesis testing; computer statistical packages applied.

BQA 2990. Special Topics in Business Statistics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BQA 3113. Introduction to Business Statistical Methods. (3) (Prerequisite: MA 1463 or equivalent). Three hours lecture. Descriptive statistics; measures of central tendency, measures of dispersion, probability, discrete and continuous random variables, sampling, estimation, hypothesis testing, computer package applications. (Credit for this course may be earned only at the Meridian Campus. Credit will not be granted for this course and BQA 2113 or ST 2113).

BQA 3123. Business Statistical Methods II. (3) (Prerequisite: BQA 2113 or equivalent). Three hours lecture. Reviewing estimation and hypothesis testing; correlation and regression; chi-square tests; analysis of variance; non-parametric concepts; index numbers; time series analysis; computer statistical packages applied.

BQA 4000. Directed Individual Study. (Prerequisite: Junior standing). Hours and credits to be arranged.

BQA 4990/6990. Special Topics in Business Statistics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BQA 7000. Directed Individual Study. Hours and credits to be arranged.

BQA 8112. Business Case Analysis Using Statistics. (2) (Prerequisite: BQA 2113 and BQA 3123 or Equivalent and a knowledge of SAS). Two hours lecture. Descriptive statistics, data collection techniques estimation, hypothesis testing, analysis of variance, regression, time series, index numbers, forecasting, statistical process control applied to business case data.

BQA 8443. Statistical Analysis for Business Decision-making. (3) (Prerequisites: BQA 3123 and computer proficiency). Three hours lecture. Review of descriptive statistics, parametric inference procedures, analysis of variance, regression, nonparametric methods; business problem formulation for computer analysis using statistical packages.

BQA 8563. Business and Economic Forecasting. (3) (Prerequisite: BQA 8443 or equivalent). Three hours lecture. Overview of business and economic forecasting and its place in management decision making; evaluation of forecasting methods; time series analysis using various analytical methods and electronic computer.

BQA 8583. Quantitative Methods for Research in Business. (3) (Prerequisite: BQA 8443). Three hours lecture. Designed to familiarize the graduate student with the fundamentals of scientific research and the classical and modern quantitative methods of analysis useful in business research.

BQA 8990. Special Topics in Business Statistics. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

BQA 9533. Advanced Statistics for Business Decisions. (3) (Prerequisite: BQA 8443). Three hours lecture. Multivariate analysis; multiple regression analysis; multiple discriminant analysis; multivariate analysis of variance and covariance; factor analysis; cluster analysis.

COMMUNITY COLLEGE

(For departmental information, see INSTRUCTIONAL SYSTEMS, LEADERSHIP, and WORKFORCE DEVELOPMENT.)

CCL 8113. Community College History/Philosophy. (3) Three hours lecture. Objectives of the community college, philosophical/historical bases, changing roles, issues in higher education/workforce development/economic industry.

CCL 8123. Community College Finance. (3) Three hours lecture. Analyzes tools, methods, problems in community college financial management, revenue sources, budget preparation, risk management, purchasing, employee compensation.

CCL 8233. Community College Legal Issues. (3) Three hours lecture. In-depth analysis of the legal/policy issues pertaining to students, faculty, and administrations of community colleges.

CCL 8333. Community College Administration. (3) Three hours lecture. In-depth analysis of community college governance, structure, functions, and its relationship with external groups, state government.

Department of CIVIL ENGINEERING

Office: 235 Walker Engineering Building

Professors White (head), Martin, Rendon, Sinno, and Truax;

Associate Professors Cole and Huddleston; Assistant Professors Eamon, Magbanua, and Zhang

CE 1003. Introduction to Civil Engineering. (3) Three hours lecture. Introduction to the Civil Engineering profession, career opportunities, and curriculum. Engineering problem-solving, basic computing skills and tools as used in Civil Engineering. Oral, graphic, and written communications.

CE 2214. Surveying. (4) (Prerequisite: Sophomore standing; corequisite: CSE 1213, 1233, or 1253 or equivalent). Three hours lecture. Four hours field and problem work. Fundamentals of field measurements. Theory, selection, and use of surveying instruments; theories used in the adjustment of surveys.

CE 2990. Special Topics in Civil Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

CE 3113. Transportation Engineering. (3) (Prerequisite: Grade of C or better in CE 2214). Three hours lecture. An introduction to the general modes of transportation, the planning processes associated with the modes of transportation and design of transportation facilities.

CE 3314. Construction Materials. (4) (Prerequisite: EM 2433, EM 3213 and IE 4613). Three hours lecture. Three hours laboratory. Physical and mechanical properties of basic civil engineering construction materi-

als. Significance of and reasons for testing control and specifications of materials.

CE 3414. Soil Mechanics. (4) (Prerequisites: Grade C or better in EM 2413 - EM 3213 corequisite). Three hours lecture. Three hours laboratory. Introduction to soil properties and behavior. Emphasis is placed on relating soil properties to compressibility and shear strength of soils.

CE 3523. Water Resources Engineering. (3) (Prerequisite: Grade of C or better in EM 3313; co-requisite: CSE 1213, 1233, or 1253). Three hours lecture. Hydraulics of closed conduits; groundwater hydraulics; open channel flow; reservoir and storage analysis; hydraulic structures and machinery.

CE 3603. Structural Mechanics. (3) (Prerequisite: Grade of C or better in EM 2413 and EM 3213). Three hours lecture. Analytical and graphical methods of structural analysis; stress diagrams; influence lines; deflection; methods of work, moment distribution and slope deflection.

CE 3824. Environmental Engineering. (4) (Prerequisite: Grade of C or better in EM 3313; credit or current enrollment in IE 4613). Three hours lecture. Three hours laboratory. Emphasis on water supply and treatment, wastewater treatment and disposal, air pollution control and solid waste management.

CE 4000. Directed Individual Study. Hours and Credits to be arranged.

CE 4103/6103. Pavement Design. (3) (Prerequisite: CE 3414). Three hours lecture. Analysis and design of both flexible and rigid pavement structures.

CE 4133. Geometric Design of Highways. (3) (Prerequisite: Grade of C or better in CE 3113). Three hours lecture. Highway finance, organization and planning. Economic analysis. Elements of highway and street design. Computer applications to highway engineering.

CE 4143/6143. Traffic Engineering. (3) (Prerequisite: CE 3113 and IE 4613). Three hours lecture. Human and vehicular characteristics as they affect highway traffic flow; traffic regulation, accident cause and prevention; improving flow on existing facilities; planning traffic systems.

CE 4233/6233. Control Surveys. (3) (Prerequisite: CE 3113). Two hours lecture. Four hours laboratory. Methods and procedures for performing control surveys.

CE 4243/6243. Land Surveys. (3) (Prerequisites: CE 3113). Three hours lecture. Methods of surveying and describing property with emphasis on Mississippi's public land surveys.

CE 4303/6303. Stress Analysis. (3) (Prerequisites: EM 3213 and MA 3253). Two hours lecture. Three hours laboratory. Stress and strain at a point, theories of failure, shear center, elastic instability, columns, dynamic loads and theory of measurements.

CE 4313/6313. Advanced Concrete Materials. (3) (Prerequisite: CE 3314). Three hours lecture. Modern materials and methods for construction involving portland cement concrete, mechanical properties, durability considerations.

CE 4433. Foundations. (3) (Prerequisite: Grade of C or better in CE 3314). Three hours lecture. Introduction to exploration and engineering evaluation of subsoil and groundwater conditions for selection and design of foundations for structures and earth masses.

CE 4513/6513. Engineering Hydrology. (3) (Prerequisite: CE 3523). Three hours lecture. Hydrologic processes; rainfall-runoff analysis; groundwater flow; frequency analysis; hydrologic design.

CE 4523/6523. Open Channel Hydraulics. (3) (Prerequisite: CE 3523). Three hours lecture. Continuity, energy and momentum principles in open channel flow; flow resistance; uniform and non-uniform flow; channel controls and transitions; unsteady flow routing.

CE 4533/6533. Computational Methods in Water Resources Engineering. (3) (Prerequisite: Consent of instructor). Three hours lecture. Review of relevant numerical analysis; numerical methods for kinematic wave, St. Venant, Boussinesq and depth-averaged equations; simulation of one- and two-dimensional free-surface flows.

CE 4543/6543. Advanced Reinforced Concrete. (3) (Prerequisite: CE 4633). Three hours lecture. Two-way slab systems, shear walls, retaining walls, bi-axial bending of columns, torsion, brackets and corbels. Introduction to prestressed concrete.

CE 4601. Fundamentals of Structural Design. (1) (Prerequisites: IE 4613; a grade of C or better in CE 3603; corequisite: CE 4623 or CE 4633). Three hours laboratory. Concepts of structural design common to all Civil Engineering structural design courses; advanced load analyses in structural engineering; introduction to structural design software.

CE 4603/6603. Indeterminate Structures I. (3) (Prerequisite: CE 3603). Three hours lecture. A study of the several classical methods frequently used in the analysis and design of indeterminate structures. Introduction to matrix methods of structural analysis.

CE 4623. Steel Structures. (3) (Prerequisite: Grade of C or better in CE 3603; credit or current enrollment in CE 4601). Three hours lecture. Analysis and design of metal structures, with emphasis on members and joints.

CE 4633. Concrete Structures. (3) (Prerequisite: Grade of C or better in CE 3603; credit or current enrollment in CE 4601). Three hours lecture. Theory and problems in the analysis and design of concrete structures.

CE 4653/6653. Timber Design. (3) (Prerequisite: Grade of C or better in CE 3603; credit or current enrollment in CE 4601). Three hours lecture. Engineering properties of wood. Design of wood structural members and connections. Wood structural systems.

CE 4663/6663. Matrix Methods of Structural Analysis. (3) (Prerequisite: Credit in CE 4603/6603, or consent of instructor). Three hours lecture. A unified treatment of beams, trusses, frames, and grids. Particular emphasis on stiffness methods.

CE 4673/6673. Bridge Design. (3) (Prerequisite: CE 4601 and CE 4633). Three hours lecture. AASHTO loading specifications. Designs of structural systems commonly used for bridge construction. Comprehensive design assignments for typical bridge layouts.

CE 4683/6683. Advanced Steel Design. (3) (Prerequisite: CE 4623). Three hours lecture. Design theory and practice applied to complex structural steel systems.

CE 4693/6693. Reliability of Structures. (3) (Prerequisite: IE 4613; credit or current enrollment in CE 4623 or CE 4633, or consent of instructor). Three hours lecture. Introduction to the theory of structural reliability. Topics include probabilistic measures of safety, load models, resistance models, component and system reliability, optimization of design codes.

CE 4703/6703. Construction Engineering and Management. (3) (Prerequisite: Senior standing or consent of instructor). Three hours lecture. Construction contracts and law, cost estimating, and project scheduling.

CE 4713. Forensic Engineering. (3) (Senior standing and consent of instructor). Three hours lecture. The practice of forensic engineering, litigation, arbitration and mediation, failure case studies, investigation of failure, forensic engineering procedures.

CE 4843/6843. Advanced Sanitary Analysis. (3) (Prerequisite: CE 3824). Three hours lecture. Introduction to advanced theoretical concepts in sanitary engineering analysis with special emphasis on inorganic, organic, and physical chemistry.

CE 4873/6873. Water and Wastewater Engineering. (3) (Prerequisite: Grade of C or better in CE 3824). Two hours lecture. One hour laboratory. Evaluation of municipal water and waste-water characteristics and flows; application of various unit processes/unit operations for the treatment of municipal water and wastewater.

CE 4893/6893. Hazardous Waste Management. (3) (Prerequisite: Consent of instructor). Three hours lecture. Examination of state-of-the-art technologies available for the handling treatment; storage; and disposal of hazardous waste materials.

CE 4990/6990. Special Topics in Civil Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

CE 4903/6903. Civil Engineering Comprehensive. (3) (Prerequisite: senior standing). Application of engineering principles in the planning, design and construction of civil engineering projects.

CE 7000. Directed Individual Study. Hours and credits to be arranged.

CE 8000. Thesis Research/Thesis. Hours and credits to be arranged.

CE 8133. Traffic Flow Theory. (3) (Prerequisite: Consent of instructor). Three hours lecture. An analysis of the engineering and mathematical principles of traffic flow.

CE 8433. Advanced Foundations. (3) (Prerequisite: CE 4433). Three hours lecture. A continuation of CE 3433 with emphasis on unusual soil conditions and foundations.

CE 8453. Physical Properties of Soils. (3) (Prerequisite: CE 3414). Two hours lecture. Three hours laboratory. A study of the physical properties of soil masses as related to foundation engineering.

CE 8563. Groundwater Resource Evaluation. (3) (Prerequisite: CE 3523). Three hours lecture. Groundwater movement; Darcy's law; equations of groundwater flow; confined and unconfined flow; wells and well field analysis; groundwater quality; aquifer management.

CE 8613. Advanced Design in Metals. (3) (Prerequisite: CE 4623). Three hours lecture. Principles and methods of design based on the plastic properties of steel.

CE 8623. Theory of Plates and Shells. (3) (Prerequisites: CE 4603/6603). Three hours lecture. Equations of equilibrium for plates, slabs, and shells.

CE 8643. Prestressed Concrete. (3) (Prerequisite: CE 4633). Three hours lecture. Design of prestressed concrete structures with emphasis on flexural design of beams and slabs. Description of construction materials and methods.

CE 8663. Advanced Computational Methods in Structural Analysis. (3) (Prerequisite: CE 4663/6663 or consent of instructor). Three hours lecture. Advanced computational methods used in the stiffness analysis of two- and three-dimension structures. Programming strategies and techniques used in computer software development.

CE 8683. Finite Element Analysis in Structural Engineering. (3) (Prerequisite: CE 4663/6663). Three hours lecture. Energy and elasticity principles. Development of planar three-dimensional and curved elements. Applications to plates and shells. Use of computer programs.

CE 8693. Advanced Structural Design. (3) (Prerequisites: CE 4623 and CE 4633) Three hours lecture. The analysis and design of complex structural systems. Advanced methods of analysis, including computer methods.

CE 8803. Unit Processes and Operations in Environmental Engineering I. (3) Three hours lecture. Theory and application of physical and chemical unit processes and operations available for the treatment of water and wastewater.

CE 8823. Unit Processes and Operations in Environmental Engineering II. (3) Three hours lecture. Theory and application of biological processes available for the treatment of wastewater.

CE 8843. Water Treatment Plant Design. (3) (Prerequisite: CE 3824). Three hours lecture. An in-depth consideration of criteria for the selection of water sources for a potable supply. Theory and design considerations for selecting treatment alternatives.

CE 8863. Solid Waste Management. (3) (Prerequisite: CE 3824) Three hours lecture. Define and characterize non-hazardous solid wastes and how to minimize, handle, transport, store, recycle and dispose of these materials.

CE 8893. Industrial Waste Management. (3) Three hours lecture. Delineation of industrial wastes; the regulations pertaining to them; and

the technologies applied in their being reduced, reused, recycled, treated, and disposed.

CE 8990. Special Topics in Civil Engineering. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

CE 8923. Surface Water Quality Modeling. (3) (Prerequisite: Consent of instructor). Development of the mathematical formulations describing the distribution of concentration of conservative and nonconservative pollutants in natural waters.

CE 9000. Dissertation Research/Dissertation. Hours and credits to be arranged.

Department of CHEMISTRY

Office: 118 Hand Chemical Laboratory

Professors Mead (Acting Head), Oldham, Pittman, Rabideau, Saebo, Wilson and Wipf;

Associate Professors Ambrust, Foster, Henry, Sygula and Ting;

Assistant Professors Beatty, Gwaltney, Koscho, Thomas and Young;

Instructor/Lab Coordinator: Holman; Instructor Beard

Only one course from each group may count toward degree: CH 1043, 1213; CH 1053, 1223, or 1293; CH 1221 or 1051; CH 2503 or 4513.

CH 1043. General Chemistry I. (3) Three hours lecture. The nature of chemistry and its applications. Designed for the student that will not take upper division chemistry courses. CH 1043 will satisfy chemistry prerequisites for CH 1213.

CH 1051. Experimental Chemistry. (1) Three hours laboratory. A laboratory to accompany CH 1053. Experiments designed to illustrate the practical aspects of chemistry.

CH 1053. General Chemistry II. (3) Three hours lecture. The nature of chemistry and its applications. Designed for the student that will not take upper division chemistry courses.

CH 1211. Investigations in Chemistry. (1) Three hours laboratory. Accompanies CH 1213. Student must have prior credit or concurrent enrollment in corresponding lecture course. CH 1211 must be completed before student may enroll in CH 1221. Selected experiments to illustrate the fundamentals of chemistry.

CH 1213. Fundamentals of Chemistry. (3) (Prerequisites: Placement exam or grade of C or better in CH 1043 and MA 1313 or concurrent enrollment in MA 1313, 1323 or 1713). Three hours lecture. The principles of atomic and molecular structure, energetics, dynamics, and synthesis as related to chemical systems. Designed as preparation for upper division chemistry courses. Offered each semester.

CH 1221. Investigations in Chemistry. (1) Three hours laboratory. Accompanies CH 1223. Student must have prior credit or concurrent enrollment in corresponding lecture course. CH 1211 must be completed before student may enroll in CH 1221. Selected experiments to illustrate the fundamentals of chemistry.

CH 1223. Fundamentals of Chemistry. (3) (Prerequisites: CH 1213) Three hours lecture. The principles of atomic and molecular structure, energetics, dynamics, and synthesis as related to chemical systems. Designed as preparation for upper division chemistry courses. Offered each semester.

CH 2313. Quantitative Inorganic Analysis. (3) (Prerequisites: CH 1221 and CH 1223). Two hours lecture. Three hours laboratory. An introductory course in quantitative methods of inorganic chemistry with an abbreviated laboratory including gravimetric, titrimetric and colorimetric methods.

CH 2314. Quantitative Inorganic Analysis. (4) (Prerequisites: CH 1221 and 1223). Two hours lecture. Six hours laboratory. Introduction to fundamental techniques and principles of the quantitative methods of inorganic chemistry. Gravimetric, titrimetric, and colorimetric methods.

CH 2501. Elementary Organic Chemistry Laboratory. (1) (Prerequisite: CH 1221 or CH 1051). Three hours laboratory. A laboratory course to accompany CH 2503.

CH 2503. Elementary Organic Chemistry. (3) (Prerequisite: CH 1223 or CH 1053). Three hours lecture. A terminal course in organic chemistry. Common aliphatic, aromatic, and heterocyclic compounds.

CH 2990. Special Topics in Chemistry. (1-9) Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years).

CH 3213. Inorganic Chemistry. (3) (Prerequisites: CH 2314 and MA 1713). Three hours lecture. A basic course in inorganic chemistry. Topics include periodicity, ionic interactions, systematic chemistry of the elements and solvent relations to acid-base and redox reactions.

CH 4000. Directed Individual Study. Hours and credits to be arranged.

CH 4103/6103. Chemical Literature. (3) (Prerequisite: Junior standing). Two hours lecture. Three hours laboratory. A study of sources of information in chemistry, primary and secondary, including books, journals, patents, and other printed material. Searching the chemical literature.

CH 4113. Advanced Chemistry Research Skills. (3) (Prerequisites: CH 4521, CH 4523 and consent of instructor). One hour lecture. Six hours laboratory. Laboratory intensive course on modern research methods with oral and written presentations including a discussion component of the role and ethics of scientists in society.

CH 4203/6203. Faculty Development in Secondary School Chemistry. (3) (Prerequisites: A year of chemistry plus experience as a secondary level science teacher). Two hours lecture. Three hours laboratory. A course designed for secondary school chemistry teachers. Topics covered are significant to a successful high school chemistry course.

CH 4212/6212. Advanced Inorganic Laboratory. (2) (Prerequisite: Prior credit or concurrent enrollment in CH 4213/6213). Six hours laboratory. The application of modern experimental techniques to inorganic systems.

CH 4213/6213. Advanced Inorganic Chemistry I. (3) (Prerequisite: Consent of the instructor; CH 4413/6413). Three hours lecture. Primarily the study of the elements in light of the periodic law; emphasis on coordination number, molecular complexes, and nuclear chemistry.

CH 4303/6303. Environmental Chemistry I. (3) (Prerequisites: CH 4523/6523). Three hours lecture. A systematic study of the basic concepts of environmental chemistry. Topics include air, water, soil chemistry, pollution, and environmental regulations.

CH 4351/6351. Instrumental Analysis Laboratory. (1) (Prerequisite: Concurrent registration in CH 4353/6353). Three hours laboratory. Laboratory course to accompany CH 4353/6353.

CH 4353/6353. Instrumental Analysis. (3) (Prerequisites: CH 4423/6423). Three hours lecture. Three hours laboratory. A study of capabilities and principles of operation of optical and electrical instruments, including X-ray diffraction.

CH 4404. Biophysical Chemistry. (4) (Prerequisites: PH 1123, CH 4523, MA 1723). Three hours lecture, one hour recitation. Principles of thermodynamics, solutions, electrochemistry, kinetics, transport processes, macromolecular solutions and electromagnetic properties as applied to biological systems.

CH 4411/6411. Physical Chemistry Laboratory. (1) (Prerequisite: CH 4413/6413). Three hours laboratory. Laboratory course to accompany CH 4413/6413.

CH 4413/6413. Physical Chemistry. (3) (Prerequisites: CH 1223, PH 2213 and MA 2733). Three hours lecture. A study of the quantitative and theoretical properties of elements in their various states of combination. Topics include chemical thermodynamics and kinetics, solutions of nonelectrolytes and electrolytes, solid state, surface chemistry, macromolecules, photochemistry, and statistical thermodynamics.

CH 4421/6421. Physical Chemistry Laboratory. (1) (Prerequisite: CH 4413/6413). Three hours laboratory. Laboratory course to accompany CH 4423/6423.

CH 4423/6423. Physical Chemistry. (3) (Prerequisites: CH 4413/6413). Three hours lecture. A study of the quantitative and theoretical properties of elements in their various states of combination. Topics include chemical thermodynamics and kinetics, solutions of nonelectrolytes and electrolytes, solid state, surface chemistry, macromolecules, photochemistry, and statistical thermodynamics.