### 899. *Research*

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

Research for thesis at the master's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, pathology, phycology, physiology, and taxonomy.

### 918. *Advanced Genetics*

*Winter of odd-numbered years. 3(3-0) Approval of department.*

Role of the gene in differentiation and development, with special emphasis upon the genetic mechanisms responsible for the control of phenogenesis.

### 920. *Advanced Plant Taxonomy*

*Spring of even-numbered years. 4(4-0) 824, ZOL 441.*

Consideration of the recent scientific developments affecting plant classification.

### 930. *Advanced Plant Ecology*

*Winter of odd-numbered years. 3(2-4) Approval of department.*

Fundamental theories and modern research horizons.

### 951. *Advanced Plant Physiology I*

*Fall of even-numbered years. 3(3-0) Approval of department.*

Selected topics concerning absorption and inorganic nutrition.

### 952. *Plant Physiology and Biochemistry I*

*Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with and administered by the Biochemistry Department.*

Selected topics concerning photosynthesis and related processes.

### 953. *Advanced Plant Physiology II*

*Spring of odd-numbered years. 3(3-0) Approval of department.*

Selected topics concerning the chemistry, physiology and mechanism of action of plant growth hormones.

### 954. *Advanced Plant Physiology III*

*Fall of odd-numbered years. 3(3-0) Approval of department.*

Selected topics from environmental physiology.

### 955. *Plant Physiology and Biochemistry II*

*Winter of even-numbered years. 3(3-0) Approval of department. Interdepartmental with and administered by the Biochemistry Department.*

Metabolic pathways of unique significance to plants.

### 956. *Advanced Plant Physiology IV*

*Spring of even-numbered years. 3(3-0) Approval of department.*

Factors influencing vegetative and reproductive physiology.

### 999. *Research*

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

Research for dissertation at the doctor's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, paleobotany, pathology, phycology, physiology, and taxonomy.

## BUILDING CONSTRUCTION

*See Packaging*

## BUSINESS LAW, INSURANCE AND OFFICE ADMINISTRATION BIO

### College of Business

### 201. *Shorthand I*

*Fall, Winter, Spring, Summer. 3(4-0) 234 or 1 term typewriting.*

Gregg shorthand theory, dictation and transcription for students with no previous training.

### 202. *Shorthand II*

*Fall, Winter, Spring, Summer. 3(3-1) 201, 234 or 1 term shorthand and typewriting.*

Development of theory and transcription competency, speed building.

### 234. *Typewriting I*

*Fall, Winter, Spring, Summer. 2(2-2) Approval of department.*

Mastery of keyboard; building speed and accuracy; elementary typewriting problems.

### 235. *Typewriting II*

*Fall, Winter, Spring. 2(2-2) 234 or approval of department.*

Improvement of speed and accuracy; arrangement of business letters, tabulation and manuscripts; production typewriting.

### 236. *Advanced Typewriting*

*Fall, Winter, Spring, Summer. 3(3-1) 235 or 1½ to 2 years typewriting.*

Instruction in specialized typewriting problems to develop high-level competency.

### 304. *Advanced Shorthand*

*(204.) Fall, Winter, Spring. 3(3-1) May re-enroll for a maximum of 6 credits. 202, 235.*

Continuation of 202.

### 308. *Secretarial Administration I*

*Winter, Spring. 4(4-0) 236, 304. Sophomores.*

Development of proficiency in transcription skills.

### 309. *Secretarial Administration II*

*Fall, Winter, Spring. 4(4-2) 236, Sophomores.*

Machine dictation-transcription; duplication and copying processes; machine calculations; records management.

### 326. *Business Writing*

*Fall, Winter, Spring, Summer. 4(4-0) Juniors.*

Study and analysis of business and industrial communication problems; extensive instruction and practice in writing.

### 341. *Survey of Business Law*

*Fall, Winter, Spring, Summer. 4(4-0) Juniors. Not open to business administration students.*

Historical development of the law; courts, court procedures and civil remedies, torts, crimes; contracts, agency, sales, negotiable instruments, real and personal property, including bailments and liens. Textbook and lecture rather than case approach.

### 350. *Principles of Risk and Insurance*

*(AFA 350, 296.) Fall, Winter, Spring, Summer. 4(3-0) Juniors or approval of department.*

Risk and risk meeting methods with emphasis on the insurance mechanism. Fundamental principles, legal relationships, types of carriers and organization principle types of coverage and industry regulation.

### 370. *Administrative Office Management*

*Fall, Winter, Spring, Summer. 3(3-0) Juniors.*

Analysis of office function and relationship to business organization; information handling and data processing; office design and layout; responsibilities of office administrators.

### 395. *Principles of Urban Real Estate Administration*

*(AFA 395.) Fall, Spring. 5(5-0) AFA 391 or approval of department; EC 201.*

Concepts of urbanism, city functions and city growth. Examines physical, locational, legal, social and economic factors. Role of markets, governments and finance. Theories and techniques of valuing urban real estate.

### 396. *Personal Risks and Insurance*

*(AFA 396.) Fall, Summer. 5(5-0) 350 or Juniors in business administration.*

Personal risk analysis and personal insurance. Emphasis on life, health, automobile, fire and liability insurance. Programming personal insurance. Estate analysis and trusts. Social and economic aspects of personal insurance analyzed.

### 397. *Social Insurance Topics*

*(AFA 397.) Fall. 4(4-0) EC 200.*

Systematic study of the legal, actuarial, social and political aspects of social insurance. Federal and State programs will be analyzed. Problems, solutions and potential alternatives to be discussed.

### 400H. *Honors Work*

*Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.*

Independent and informal study in law, office administration or business communications.

### 416. *Secretarial Administration III: Seminar*

*Winter, Spring. 4(4-0) Seniors or approval of department.*

Analysis of the role of the executive secretary.

### 440. *Law and Society*

*Fall, Winter, Spring, Summer. 3(3-0) Seniors or approval of department.*

Legal reasoning and legal institutions. Court systems and court procedures. Relationships of citizen and businessman to governmental agencies. Torts, crimes.

### 441. *Contracts and Sales*

*Fall, Winter, Spring, Summer. 3(3-0) 440.*

Contracts, including concept of freedom of contract and limitations. Sales. Case study method used.

### 442. *Agency, Partnerships and Corporations*

*Winter. 3(3-0) 441.*

The law dealing with agency and business organizations. Case study method used.

### 443. Negotiable Instruments, Secured Transactions, Property

*Spring. 3(3-0) 441.*

The law of negotiable instruments, secured transactions, and property. Case study method used.

### 445. Real Estate Law

*Winter. 3(3-0) 341 or 441.*

Law of the real estate business. Combined text and case approach.

### 446. Interstate and International Business Law

*Spring. 3(3-0) 341, 440 or 441.*

Laws of contracts, sales, negotiable instruments, agency, business associations in the interstate and international spheres. Maritime contracts. International commercial arbitration. Area directed studies.

### 447. Hotel Law

*Winter, Spring. 4(4-0) 440.*

Legal aspects of the hospitality industry.

### 468. Field Studies

*Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 8 credits. Approval of department.*

Planned program of observation and work in selected business firms. Analysis and reports.

### 486. Business Risks and Insurance

*(AFA 486.) Winter, 5(5-0) 350 or Seniors in business administration.*

Business insurance as it relates to business risks and decision making. Emphasis on business exposures, coverages and problems of the risk manager.

### 487. Management of Insurance Enterprise

*(AFA 487.) Spring. 5(5-0) 350 or approval of department.*

Organizational requirements and functional operations of insurance enterprise with emphasis on methods of ratemaking, reserves, financial statement and investment requirements, loss adjustment, underwriting, and marketing. Statutory limitations on management freedom.

### 848. The Legal Environment of Business

*Winter, Summer. 4(4-0)*

Critical examination of the environment in which business operates. Analysis of the component elements of the legal environment of business and the structural framework in which law functions.

### 849. Legal Environment of International Business

*Spring, Summer. 4(4-0)*

Commercial and financial transactions in international business, foreign agencies, branches, subsidiaries. Aspects of labor relations, antitrust, taxation, and transportation as related to foreign operations. Litigation and arbitration in the international business community.

### 871. Seminar: Office Administration

*Winter, Summer. 3 credits. May re-enroll for a maximum of 6 credits. Approval of department.*

Problems, practices, and policies involved in office administration. Methods of establishing, analyzing, standardizing, and controlling administrative systems and procedures in the office.

### 878. Seminar in Business Law

*Fall, Spring. 4(4-0) May re-enroll for a maximum of 8 credits. 848 or approval of department.*

Public policy with regard to contracts, antitrust, security transactions, labor relations of the firm, viewed from the legislative, judicial, and executive vantage points.

### 884. Insurance Companies as Financial Institutions

*(AFA 884.) Winter. 4(4-0)*

Analysis of insurance company investment behavior in the capital market. Emphasis on liquidity requirements, interest rates, legal and organizational requirements affecting investment decisions. Micro and macro aspects are investigated.

### 886. Seminar in Insurance Problems

*(AFA 886.) Spring. 4(4-0)*

Analysis of insurance problems affecting the public interest. Special emphasis on problems due to changing economic and social conditions. Insurance regulatory, financial, marketing and social problems are evaluated.

### 890. Special Problems

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

## CHEMICAL ENGINEERING CHE

## College of Engineering

### 222. Pollution of the Environment—Causes and Cures

*Spring. 3(3-0) Nonmajors; no science or technical background required.*

Pollution of air, water and land. Adulteration of foods. Overtaxing waste facilities. Depleting natural resources. Interaction of engineers, industry, government, and the public in creating and combating these problems.

### 300. Material and Energy Balances

*(201.) Fall. 3(3-0) One year general chemistry, MTH 214.*

Chemical engineering calculations. Material and energy balances in physical and chemical nonflow and flow systems. Behavior of ideal and real gas systems. Heats of reaction. Applications to chemical engineering systems.

### 311. Thermodynamics for Chemical Engineering

*(202.) Winter. 3(3-0) 361.*

First and second laws. Energy, enthalpy, entropy, free energy, the mathematics of property relationships. Energy conversion processes. Fugacity, activity, activity coefficient. Solution theories. Multicomponent phase equilibria.

### 312. Transfer Processes and Separations I

*Winter. 3(3-0) 300, MTH 215.*

Thermodynamics of fluid flow. Frictional effects for laminar and turbulent motion of compressible and incompressible fluids. Dimensional analyses and similitude. Treatment of fluid flow as a momentum transfer process.

### 313. Transfer Processes and Separations II

*Spring. 3(3-0) 312.*

Heat transfer in solids and flowing fluids. Heat transfer in condensing and boiling systems. Application to engineering equipment. Condensation, multiple effect evaporation, and radiation.

### 314. Transfer Processes and Separations III

*Spring. 3(3-0) 311, 313 or concurrently.*

Mass transfer in continuous contacting systems. Mass transfer in single-phase systems, transport analogies, interphase transfer and contacting of immiscible phases.

### 361. Chemical Thermodynamics

*Fall, Spring. 3(4-0) One year general chemistry; one year general physics; MTH 215. Interdepartmental and jointly administered with the Chemistry Department.*

Thermodynamics. Properties of gases. Laws of thermodynamics, properties of ideal and nonideal solutions, thermodynamics of chemical reactions, activities in non-ionic systems.

### 381. Chemical Engineering Analysis

*Fall, Spring. 3(3-0) Students may not receive credit in both 381 and MTH 341. MTH 215. Interdepartmental with the Mathematics Department.*

Formulation of ordinary and partial differential equations describing chemical systems. Boundary value problems, numerical methods, matrices, and applications, to chemical engineering systems.

### 415. Transfer Processes and Separations IV

*Fall. 3(3-0) 314.*

Mass transfer in stagewise processes. Countercurrent processes, fractionation, contacting efficiency, and simultaneous momentum, heat and mass transfer.

### 423. Chemical Engineering Laboratory

*(422.) Winter. 3(1-6) 415.*

Assigned laboratory problems, requiring team effort. Experimental work. involving momentum, heat and mass transfer; separation processes, such as distillation, filtration, and drying; reactor kinetics; automatic process control.

### 424. Transport Phenomena and Physical Properties Laboratory

*Spring. 3(1-6) 313 or concurrently.*

Experiments involving the transport processes and measurement of physical, chemical and thermodynamic properties of various materials. Comparison of theoretical and experimental results.

### 428. Chemical Reaction Engineering

*Fall. 3(3-0) 361 or approval of department.*

Quantitative treatment of mechanisms and rates of chemical reactions. Catalysis. Design and analysis of flow and non-flow reactors. Interpretation of laboratory kinetic data.

### 442. Polymer Science and Engineering

*Winter. 3(3-0) One year organic chemistry, 361.*

Structure of polymers. Polymerization reaction kinetics. Polymer characterization. Solution rheology. Polymer processing and fabrication. Commercial polymerization processes.

### 443. Chemical Engineering of the Solid State

*Spring. 3(3-0) CEM 461.*

Structure and properties of inorganic and organic solids. Relation of bond type and steric configuration to mechanical, electrical, thermal, optical properties. Macroscopic structure influence on physical properties. Surface phenomena. Applications.

### 446. Polymerization

*Fall. 3(3-0) One year organic chemistry, elementary physical chemistry. Interdepartmental with and administered by the Chemistry Department.*

Formation and characterization of polymers of high molecular weight will be emphasized.