

430. Soil Fertility and Fertilizers
Winter. Summer of even-numbered years. 5(4-1) 210.

Assessment of the fertility of soils and alteration of fertility by the use of fertilizers, lime, manure, and cropping systems. The role of colloids in ion fixation and exchange. Soil and tissue tests. The history, technology, and use of fertilizers.

442. Soil Microbiology
(481.) Spring. 3(2-4) MPH 200 or 401. Interdepartmental with and administered by the Microbiology and Public Health Department.

Major groups of microorganisms of importance in soils are studied with emphasis on ecological, biochemical, and physical aspects.

470. Soil Classification and Mapping
Fall, Spring; Summer of odd-numbered years. 4(0-8) 210 or approval of department.

Classification of soils. Interpretation of profiles in relation to land utilization for farm crops, fruits, forestry, highway-airfield engineering, county and township planning, urban development and wildlife. Preparation of land use reports based upon soil maps of assigned areas.

480. Soil Geography and Land Use of the World
Winter. 4(4-0) 210 or approval of department.

Survey of the great soil groups and their use throughout the world, their location, significant characteristics, how they are and can be utilized, and the relation of each to food and population increase.

810. Advanced Studies in Soil Science
Fall, Winter, Spring, Summer. 1 to 5 credits. May re-enroll for a maximum of 6 credits. Approval of department.

Areas of study include chemistry, fertility, geography, management, microbiology, micropedology, organic soils, physics, and physical chemistry.

820. Seminar
Fall, Winter, Spring. 1(1-0) May re-enroll for a maximum of 3 credits.

840. Soil Physics
Fall. 5(3-6) 430; CEM 162 or approval of department.

Physical properties of soil (texture, structure, consistency, aeration, water, temperature, etc.), their quantitative measurement, and relation to plant growth, and agronomic and engineering practices.

850. Soil Chemistry
Winter. 5(3-6) 430; CEM 162, 383; or approval of department.

Chemistry of mineral weathering and soil formation, ion activities, ionic exchange and equilibrium reactions, soil pH, specific elements and their chemical analysis, and availability of nutrients to plants.

860. Soil Biochemistry
Spring of even-numbered years. 4 credits. 850; MPH 442.

Biochemical transformations of mineral nutrients and of natural and exotic organic materials in soils, considered in relation to chemical, physical and ecological systems in the complex soil environment.

870. Origin and Classification of Soils
Winter. 4(3-2) 470, 840, or approval of department.

Genesis, morphology and classification of major soils of the world. Relationships among soils in natural and cultural landscapes. How soil properties affect their use, management and conservation. Land classifications for various purposes.

880. Soil Geography and Land Use in the United States
Winter. 4(4-0) 470 or approval of department.

Study of representative soils of the United States—their character, environmental relationships, present and potential utilization.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

930. Soil Fertility
Spring. 4(4-0) 850 or approval of department.

Fundamental concepts in soil fertility and nutrient uptake by plants; history and development of field plot and greenhouse techniques; research methods in soil fertility; and origin, utilization and management of organic soils.

945. Structure and Identification of Clays
Winter of odd-numbered years. 4(3-4) 840, 850 or approval of department.

Structures and properties of clays and their interpretation. Methods of studying clays including X-ray diffraction, differential thermal analysis, infrared absorption and other chemical and physical techniques.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

SOUTH ASIAN LANGUAGES

See Linguistics and Oriental and African Languages.

SPANISH

See Romance Languages.

STATISTICS AND PROBABILITY STT

College of Natural Science

Courses are classified as follows:

Courses with the last two digits more than 40 require minimum prerequisites of MTH 215.

Courses with the last two digits less than 40 require fewer mathematics prerequisites. Introductory courses are further classified as follows:

121, 123—sequence for Business Administration students.

201—survey course.

421, 422, 423—minimal sequence for students planning to use statistical methods in their research.

441, 442, 443—minimal sequence in theory of statistics. Qualified students should take the 861, 862, 863 sequence instead.

861, 862, 863—sequence for students preparing to do advanced work in statistics.

881, 882, 883—sequence in analytic probability theory and stochastic processes at graduate mathematics level.

121. Introduction to Probability
Fall, Winter, Spring, Summer. 4(3-2) MTH 111. Credit may not be earned in more than one of the following: 121, 201, 421.

Set and algebra of sets. Chance experiments, outcomes and events. Probabilities of events. Conditional probability, independent trials, Bayes' theorem. Introduction to statistical inference relevant to business decision problems.

123. Statistics in Business Decision-Making
(223.) Fall, Winter, Spring. 4(2-2) 121.

Statistical inference and decision-making under uncertainty. Summarization of information and statistical tests. Statistical decision rules and their evaluation in terms of expected cost. Risk.

201. Statistical Methods
Fall, Winter, Spring, Summer. 4(4-0) MTH 108 or 111. Primarily for students in psychology, sociology, anthropology, political science, economics, agriculture and forestry. Credit may not be earned in more than one of the following: 121, 201, 421.

Probability and statistical inference, discrete models, the binomial and hyper-geometric distributions. The central limit theorem, principles of testing of hypotheses and estimation. Applications to problems involving discrete distributions.

316. Fundamentals of Statistical Inference

Fall, Winter, Spring, Summer. 4(3-2) 121. Primarily for students in the College of Business. Interdepartmental with the Marketing and Transportation Administration Department.

Description of sample data, applications of probability theory, sampling, estimation, tests of hypotheses.

317. Quantitative Business Research Methods

Fall, Winter, Spring, Summer. 4(3-2) 316. Interdepartmental with and administered by the Marketing and Transportation Administration Department.

Application of statistical techniques to business decision-making. Topics covered include applications of linear regression and correlation, analysis of variance, selected non-parametric tests, time series, and index numbers.

351. Introduction to Statistics
Spring. 4(4-0) MTH 214.

Probability models, discrete random variables, the binomial, hyper-geometric and Poisson distributions, statistical inference based on the binomial distribution, continuous random variables, test of hypothesis and confidence intervals based on the normal distribution.

421. Statistics I
Fall, Winter, Spring, Summer. 4(4-0) MTH 108. Credit may not be earned in more than one of the following: 121, 201, 421. This course and 422, 423 form a one year sequence in statistics for those without a calculus background; 421 provides an introduction to a few of the main ideas of probability and statistics. The course sequences 441-2-3 and 861-2-3 form one year sequences in statistics for those with a calculus background. Those expecting to use statistics in their graduate research should complete one of the full year sequences.

Descriptive statistics, elementary probability and combinatorics. The binomial distribution. Random variables, their expectations and variances. The Central Limit Theorem, Estimation and inference. Simple tests based on the binomial, normal, t, chi-square and F distributions.

422. Statistics II

Fall, Winter, Spring, Summer. 3(3-0)
201 or 421.

Nonparametric tests: sign test, Wilcoxon's rank sum test, Spearman's rank correlation test, run tests. Multiple regression analysis. Least squares estimation and tests for simple linear hypotheses.

423. Statistics III

Fall, Winter, Spring, Summer. 3(3-0)
422.

Application of multiple regression analysis to analysis of variance problems. Design of experiments including randomized block designs, Latin squares, factorial designs, and balanced incomplete block designs.

441. Probability and Statistics I: Probability

Fall, Winter, Spring, Summer. 4(4-0)
MTH 215.

Mathematical probability as a basis for the theory of statistics. Discrete and continuous probability models, conditional probability and independence, random variables, central limit theorem, sampling distributions.

442. Probability and Statistics II: Inference

Winter. 4(4-0) 441; MTH 334 or
concurrently.

Estimation, confidence intervals, tests of hypotheses, linear hypotheses.

443. Probability and Statistics III: Inference

Spring. 4(4-0) 442.

Multiple linear regression, analysis of variance, goodness of fit tests, certain non-parametric tests.

490. Statistical Problems

Fall, Winter, Spring. 1 to 6 credits.
Approval of department.

Individualized study adapted to the preparation and interests of the student.

803. Design of Experiments

Spring. 3(3-0) 423 or 443.

Covariance analysis; split plot designs; confounding; incomplete block designs; Youden squares; lattice designs; cubic designs; Bartlett's test for homogeneity of variances.

825. Sample Surveys

Fall. 3(3-0) 423 or 442 or 862.

Application of statistical sampling theory to survey designs involving simple random, stratified, and systematic samples; sub-sampling, double sampling; ratio and regression estimates; other topics.

826. Non-Parametric Statistics

Spring. 4(4-0) 423 or 442 or 862.

Current tests of hypotheses which may be made without specification of the underlying distribution. Rank tests and tests based on permutation of observations. Tolerance and confidence sets. Large-sample distributions. Applications to research in the social and natural sciences.

833. Mathematical Programming

(875.) Spring. 3(3-0) EC 800 or 811; MTH 334. Interdepartmental with the Agricultural Economics and Economics Departments and administered by the Agricultural Economics Department.

Linear programming. Theory of linear economic models. Topics in nonlinear programming.

852. Statistical Methods in Operations Research

Winter. 3(3-0) 441 or 861.

Formulation of statistical models for problems in organization of industrial, military, and economic operations, connections with linear programming and game theory.

861. Probability and Statistics I: Discrete Probability

Fall. 4(4-0) MTH 424 or concurrently.

Combinatorial analysis, discrete probability spaces, conditional probability and independence, Bernoulli trials, random variables, expectations, generating functions, laws of large numbers.

862. Probability and Statistics II: Continuous Probability

Winter. 4(4-0) 861; MTH 425 or concurrently.

Distribution functions, density, moment generating function, multivariate distributions, transformations, various important special distributions, central limit theorem.

863. Probability and Statistics III: Inference

Spring. 4(4-0) 862; MTH 426 or concurrently.

Introduction to methods of estimation and testing hypotheses based on probability.

864. Stochastic Models in Biology

Fall. 3(3-0) 441 or 861.

Stochastic processes. Selected topics from growth processes, epidemic theory, prey-predator models, mathematical genetics.

865. Theory of Experimental Designs

Fall. 4(4-0) 863 and MTH 831 or approval of department.

Experimentation: Cochran's theorem; review of sampling theory; simple designs and statistical analyses; factorial designs and confounding and the group theoretic aspects of these designs; geometrical problems of construction of sets of Latin and Graeco-Latin squares.

871. Statistical Decision Theory I

Fall. 4(4-0) 863; MTH 821 or concurrently.

The general statistical decision problem. Concepts of loss function, risk, admissibility, completeness, minimax and Bayes procedures and reductions due to sufficiency and invariance. The minimax and complete class theorems. Some distributions and sufficient statistics.

872. Statistical Decision Theory II

Winter. 4(4-0) 871; MTH 822 or concurrently.

Exponential families, complete sufficient statistics. Invariant statistical decision problems. Estimation of parameters and testing statistical hypotheses.

873. Statistical Decision Theory III

Spring. 4(4-0) 872; MTH 927 or concurrently; or approval of department.

Continuation of hypotheses testing, the two-sample problem, confidence sets, and the general linear hypothesis. Multiple decision problems.

876. Statistical Inference in Economics I

Fall. 3(3-0) 443 or 863; EC 812 or 801; or approval of department. Interdepartmental with the Agricultural Economics and the Economics Departments and administered by the Economics Department.

Review and extension of single-equation regression models. Properties of least-squares estimators under alternative specifications. Problems of analyzing nonexperimental data. Errors in variable, autoregressive and heteroscedastic models.

877. Statistical Inference in Economics II

Winter. 3(3-0) EC 876 or approval of department. Interdepartmental with the Agricultural Economics and Economics Departments and administered by the Economics Department. Specification interpretation and estimation of simultaneous equation models. Nonlinear models. Bayesian approach to estimation problems. Recent developments in econometrics.

878. Statistical Inference in Economics III

Spring. 3(3-0) EC 877 or approval of department. Interdepartmental with the Agricultural Economics and Economics Departments and administered by the Economics Department. Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and in applied econometric research.

881. Probability and Stochastic Processes I

Fall. 3(3-0) MTH 821 or concurrently.

Discrete probability models, dependence and independence, random variables and expectation. Exponential and uniform densities. Special densities and mixtures. Multivariate densities. Probability distributions in R^n .

882. Probability and Stochastic Processes II

Winter. 3(3-0) MTH 822 or concurrently.

Laws of large numbers, applications in analysis. Basic limit theorems. Markov processes and semi-groups. Renewal theory. Random walks in R^n .

883. Probability and Stochastic Processes III

Spring. 3(3-0) MTH 823 or concurrently.

Laplace transforms, Tauberian theorems, resolvents. Applications of Laplace transforms. Characteristic functions. Application of Fourier methods to random walks. Harmonic analysis.

886. Stochastic Processes and Technological Applications

Winter. 3(3-0) 441 or 861.

Discrete stochastic processes. Markov chains, birth and death processes, branching processes. Selected technological applications.

887. Stochastic Models in the Physical Sciences

Spring. 3(3-0) 886 or approval of department.

Selected models from the physical sciences. These may include topics from the theory of queues, the theory of dams, and branching processes in cosmic ray theory.

890. Statistical Problems

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

899. Research

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

927. Theory of Measure and Integration

Spring. 4(4-0) MTH 861. Interdepartmental with and administered by the Mathematics Department.

Introduction to the theory of integration over abstract spaces. Topics include: measure spaces;

measurable and integrable functions; modes of convergence, theorems of Egoroff, Lusin, Riesz-Fischer, Lebesgue; absolute continuity, and the Radon-Nikodym theorem; product measures and Fubini's theorem. Applications to some of the classical theories of integration and summability.

971. Advanced Theory of Statistics I
Fall. 4(4-0) 873; 981 or concurrently.

Continuation of 873; more general treatment of topics using measure theory and measure-theoretic probability.

972. Advanced Theory of Statistics II
Winter. 4(4-0) 971; 982 or concurrently.

Statistical convergence theorems. Variables and distributions in n -space. Asymptotic and exact sampling distributions. Tests of significance.

973. Advanced Theory of Statistics III
Spring. 4(4-0) 972.

Continuation of 972.

974. Multivariate Analysis
Spring. 3(3-0) 972.

The n -dimensional case in the theories of tests of hypotheses and estimation.

981. Advanced Theory of Probability I

Fall. 4(4-0) 863; MTH 927 or approval of department.

Measures on infinite product spaces and Kolmogorov's consistency theorem. Distributions and characteristic functions. Independence. Series of independent random variables.

982. Advanced Theory of Probability II

Winter. 4(4-0) 981 or approval of department.

Central limit problem: the classical limit problem, the bounded variances case, and limit laws for infinitely divisible random variables. Conditional probabilities and expectations. Martingales with discrete time.

983. Advanced Theory of Probability III

Spring. 4(4-0) 982 or approval of department.

Ergodic theory; individual and L_p ergodic theorems. Second order processes, weakly and strongly stationary processes. Foundations; separability and measurability of processes; properties of sample functions. Continuous time martingales. Processes with independent increments.

995. Advanced Topics in Statistics
Fall, Winter, Spring. Variable credit.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

STUDIO ART

See Art.

SYSTEMS SCIENCE

See Electrical Engineering and Systems Science.

TELEVISION AND RADIO T R

College of Communication Arts

271. Foundations of Broadcasting
Fall, Winter, Spring, Summer. 3(3-0)
Sophomores.

Origin, development, nature, and function of radio and television in modern society.

272. Fundamentals of Radio Broadcasting I
Fall, Winter, Spring. 3(2-2) Sophomore Television-Radio majors.

Fundamentals of radio program production. Training in creative use of studio and control room equipment. Construction of programs. Emphasis on local station production practices. Logged broadcasting practice and experience.

273. Fundamentals of Radio Broadcasting II
Fall, Winter, Spring. 3(2-2) 272.

Fundamentals of radio program production. Students responsible for writing, directing, and performing all types of radio formats.

280. History of the Motion Picture
Fall, Winter, Summer. 3(2-2) Sophomores.

Development of the motion picture from its beginning to the present, emphasizing social background and cultural values. Screening of significant films from various periods and countries.

352. Fundamentals of Television Broadcasting I
Fall, Winter, Spring. 3(1-4) 273.

Basic orientation to the television studio, with laboratory experience in equipment operation and personnel functions.

353. Fundamentals of Television Broadcasting II
Fall, Winter, Spring. 3(1-4) 352.

Continuation of 352, with emphasis on control-room and projection-room practices. Assigned experience in closed-circuit television.

356. Radio and Television Continuity Writing
Fall, Winter, Spring. 3(3-0) 272.

Theory, analysis, and practice in the writing of station and program continuity.

383. Radio and Television Announcing
Fall, Winter, Spring. 3(2-2) Majors: 272 and 352; others: 437.

Emphasis on developing professional speech habits for radio and television. Training in various styles of delivery for microphone and camera.

386. Broadcast Promotion
Winter, Spring. 3(3-0) Six credits in television and radio or approval of department.

Purpose, creation and production of promotional ideas and material in broadcasting. Introduces the student to the promotional facet of broadcasting, relating it to increasing sales, audience size and improving public relations.

390. Cinema I
Fall. 3(2-2) Approval of department.

Survey of the film production process: concepts, techniques, procedures, problems, tools. Emphasis on production as the execution of film design.

391. Cinema II
Spring. 3(2-2) 390.

Theory and practice in film production: script, scheduling, shooting, editing, sound. Elaboration and implementation of Cinema I concepts.

398. International Broadcasting
(498.) Spring. 3(3-0) Juniors; Sophomores with approval of department.

Important national and international systems of broadcasting, their history, programming patterns and control.

433. Television Directing
Fall, Winter, Spring. 3(2-2) 353; approval of department.

Television directing methods with assigned experiences in the directing of studio productions.

437. Television Program Development
Fall, Winter, Spring, Summer. 3(2-2) Senior non-majors.

Television production planning and practices. Laboratory experience in television studio. Designed for non-majors who desire a working knowledge of the medium for application in other fields.

450. Radio Production
Winter, Spring. 3(2-2) 273.

Planning, coordinating and producing the radio program. Emphasis on documentary and studio productions utilizing original ideas and methods.

485. Radio and Television Station Management
Fall. 3(3-0) Fifteen credits in television and radio or approval of department.

Problems of station management and methods for their solution. Projects involving case studies in the management of budget, programming, facilities, sales, and community relations.

486. Radio and Television Station Programming
Fall, Spring. 3(3-0) Fifteen credits in television and radio.

Objectives and methods of planning of program schedules. Individual program formats and their relation to various types of audiences and markets.

489. Radio and Television in Education
Fall, Winter, Summer. 3(3-0) Approval of department.

Uses of broadcast media for instructional purposes, both on-the-air and in the classroom. Current usages by institutions of higher learning and public schools, including both broadcasting and closed-circuit television. Survey of research studies of the effects of educational broadcasting. Types of educational programs are evaluated. Specialists in educational radio and television participate as guest lecturers.

495. Television Staging Design
Spring. 3(2-2) 433 or approval of department.

Communicative effect of various shot compositions, camera movements, performer movements and shot sequences. Various styles of staging appropriate to different program formats. Study and execution of graphic presentations for television.

496. Broadcasting and Government
Fall, Winter. 3(3-0) Juniors.

Radio, television and film in a social context with emphasis on the legal and regulatory aspects of the media.