977. *Seminar in Selected Theoretical Issues*

Spring of odd-numbered years. 4(4-0) May reenroll for a maximum of 8 credits. SOC 845.

Issue approach to social theory. Selected themes relate to substantive problems in theory, theory construction or the work of a historical or contemporary thinker.

978. *Comparative Rural Social Organization*

Spring. 4 credits.

Structure and function of social organizations ranging from societies to small groups. The comparative approach will be used in studying phenomena involved in the transitions from agrarian to industrial societies.

981. *Comparative Sociology*

Fall. 3 or 4 credits. Doctoral student in sociology; completion of core courses.

Macro-sociological studies of societies. The relationship of the whole to the varied parts of societies, the connection between societies, and the patterns of change in different societies. The development of research with respect to the cross-cultural study of social structures, social institutions, and social systems.

982. *Comparative Social Psychology*

Winter. 3 or 4 credits. SOC 981.

Social psychological research problems involving a comparative methodology. Social psychological functions of education, mobility, mass media use, etc. Comparative study of the social psychology of modernization.

983. *Comparative Research Methods*

Spring. 3 or 4 credits. SOC 981.

Sampling problems, data collection strategies, problems of translation and concept equivalence. Management, analysis and interpretation of cross-cultural data.

991. *Seminar in Work and Organizations*

Winter. 4(4-0) May reenroll for a maximum of 8 credits. Thirty graduate credits and approval of instructor.

Selected topics in the sociology of work, occupations, and complex organizations.

999. *Doctoral Dissertation Research*

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

SPANISH

See Romance and Classical Languages.

STATISTICS AND PROBABILITY   STT

College of Natural Science

Introductory courses are further classified as follows:

315, 316--sequence for undergraduate students of Business Administration.

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.

201. *Statistical Methods*

Fall, Winter, Spring, Summer. 4(4-0) MTH 108 or MTH 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: STT 201, STT 315, STT 421.

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

290. *Special Topics in Statistics and Probability*

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 6 credits. MTH 108 or approval of department.

315. *Introduction to Probability*

Fall, Winter, Spring, Summer. 4(5-0) MTH 111. Credit may not be earned in more than one of the following: STT 201, STT 315, STT 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.

316. *Fundamentals of Statistical Inference*

Fall, Winter, Spring, Summer. 4(5-0) STT 315. Primarily for students in the College of Business. Interdepartmental with the Department of Marketing and Transportation Administration.

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

317. *Quantitative Business Research Methods*

Fall, Winter, Spring, Summer. 4(5-0) STT 315. Interdepartmental with and administered by the Department of Marketing and Transportation Administration.

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

341. *Probability for Teachers*

Spring. 4(4-0) MTH 301 or approval of department.

Primarily for majors in mathematical education. Probability theory will be studied as a mathematical structure. Although some examples of the use of the theory will be discussed (as the use of some theorems is discussed in a course in plane geometry) the major emphasis will be on understanding the structure of probability theory.

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: STT 201, STT 315, STT 421. This course and STT 422, STT 423 form a one year sequence in statistics for those without a calculus background; STT 421 provides an introduction to a few of the main ideas of probability and statistics. The course sequences STT 441-2-3 and STT 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) STT 421.

Nonparametric models, contingency table analysis, sample survey methods, simple linear regression, one-way analysis of variance.

423. *Statistics III*

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

Multiple regression. Anlysis of variance for various experimental designs, including randomized block, two and three way factorial, nested and Latin square 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, Spring. 4(4-0) STT 441; MTH 334 or concurrently.

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

443. *Probability and Statistics III: Inference*

Spring. 4(4-0) STT 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.

520. *Biostatistical and Epidemiological Reasoning*

Fall. 4(4-0) Approval of instructor. Interdepartmental with and administered by the Department of Community Health Science.

Concepts and principles from biostatistics and epidemiology to facilitate critical reading literature relevant to clinical medicine and community health. Emphasis on design and interpretation.

825. *Sample Surveys*

Fall. 3(3-0) STT 423 or STT 442 or STT 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. Nonparametric Statistics

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

Current tests of hypotheses which may be made without specification of the undelying 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

Spring. 3(3-0) EC 800, or EC 812A, MTH 334. Interdepartmental with the departments of Agricultural Economics and Economics. Administered by the Department of Agricultural Economics.

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

837. Systems Simulation

Fall. 4(4-0) MGT 833. Interdepartmental with and administered by the Department of Management.

The concept of a model, model building, characteristics of simulation models. Techniques of computer simulation. Simulation models in research and management planning/control. Validation and experimental design. Special purpose languages.

841. Linear Statistical Models

Fall of odd-numbered years. 4(4-0) STT 443 or STT 863.

Use of linear statistical models. Curve fitting, simple and multiple regression analysis, multiple and partial correlation coefficients, the analysis of variance, simultaneous confidence intervals, more complex experimental designs.

852. Methods in Operations Research I

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

Optimization techniques and probability models with a wide variety of applications: linear programming, including special problems; network analysis, including PERT; dynamic programming; game theory; queuing theory. Acquaintance with matrices advisable.

853. Methods in Operations Research II

Spring. 3(3-0) STT 852.

Continuation of STT 852. Inventory theory; Markov chains with applications; simulation as adjunct to mathematical models; advanced topics in linear programming; non-linear programming.

861. Theory of Probability and Statistics I

Fall. 4(4-0) MTH 424 or MTH 427 or concurrently.

Discrete probability models. Random variable expectation, combinatorial analysis, conditional probability and independence, generating functions, some special discrete distributions, continuous probability models.

862. Theory of Probability and Statistics II

Winter. 4(4-0) STT 861; MTH 425 or MTH 428 or concurrently.

Continuous probability models, density transformations, some special continuous distributions, limit laws. Introduction to statistical inference, estimation of parameters, hypothesis testing.

863. Theory of Probability and Statistics III

Spring. 4(4-0) STT 862; MTH 334, MTH 426 or MTH 429 or concurrently.

Continuation of hypotheses texting, sufficiency, Rao-Blackwellization, some nonparametric methods, linear models.

864. Stochastic Models in Biology

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

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

871. Theory of Probability and Statistics I

Fall. 3(3-0) MTH 823 or STT 863 and MTH 821 or concurrently.

Probability spaces. Distribution functions. Characteristic functions. Law of large numbers, Glivenko-Cantelli theorem, central limit theorem. Some special distributions including multivariate normal. Convergences for sequences of random variables.

872. Theory of Probability and Statistics II

Winter. 3(3-0) STT 871; MTH 822 or concurrently.

Basic concepts of decision theory. Most powerful tests. Standard statisical methods for use in the binomial, Poisson and normal situation; sequential and nonparametric methods; linear models.

873. Theory of Probability and Statistics III

Spring. 3(3-0) STT 872; MTH 927 or concurrently; or approval of department.

Asymptotic distributions of some statistics. Cramer-Rao inequality. Asymptotic properties of maximum likelihood methods.

876. Statistical Inference in Economics I

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

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 departments of Agricultural Economics and Economics. Administered by the Department of Economics.

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 departments of Agricultural Economics and Economics. Administered by the Department of Economics.

Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and in applied econometric research.

886. Stochastic Processes and Technological Applications

Winter. 3(3-0) STT 441 or STT 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) STT 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. Master's Thesis Research

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

927. Theory of Measure and Integration

Spring. 3(3-0) MTH 822. Interdepartmental with and administered by the Department of Mathematics.

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.

928. Measure Theory Applications to Probability

Fall. 3(3-0) MTH 927.

Kolmogorov extension theorem. Transition measures. Conditional expectations. Uniform integrability.

929. Foundations of Decision Theory

Winter. 3(3-0) STT 928.

Statistical decision model. Principles of choice. Sufficiency, completeness, invariance, monotonicity, Bayes. Families of probability models: exponential, location-scale.

948. Mathematical Programming For Business

Spring of even-numbered years. 4(4-0) MGT 835. Interdepartmental with and administered by the Department of Management.

Large mathematical programs with special structure. Duality and decomposition. Dynamic programming; multistage decision processes and the principle of optimality. Integer programming.

949. Advanced Applied Stochastic Processes

Spring of odd-numbered years. 4(4-0) MGT 836. Interdepartmental with and administered by the Department of Management.

Selected topics from the following areas: Semi-Markov, Markov-renewal and regenerative process models; Markov and semi-Markov decision processes; decision theory, applications from production, inventory, reliability, queuing, and gaming theory.

951. Advanced Theory of Nonparametric Statistics

Fall of odd-numbered years. 3(3-0) STT 873; STT 928 or concurrently.

Possible topics include small and large sample properties of distribution free tests; robust estimation of location, scale and regression parameters; nonparametric ANOVA.

952. **Asymptotic Theory**
Spring of even-numbered years. 3(3-0)
STT 873, STT 929.
Possible topics include large sample behavior of likelihood functions; contiguity; Bahadur and Pitman efficiency of statistical procedures.

953. **Advanced Theory of Linear Statistical Models**
Fall of even-numbered years. 3(3-0)
STT 873; STT 928 or concurrently.
Possible topics include construction and analysis of linear models; regression; ridge regression; optimality criteria, relationships and merits; existence and construction of optimal designs.

954. **Sequential Analysis**
Spring of odd-numbered years. 3(3-0)
STT 873; STT 929.
Possible topics include sequential estimation, testing and design; optimal stopping.

961. **Convergence of Measures and Random Variables**
Fall of odd-numbered years. 3(3-0)
STT 873; STT 928, or concurrently.
Topology of vague converence of measures. Conditions for relative compactness of a set of measures. Relationships between vague, almost sure, and in-measure convergence. Donsker's theorem and its extensions; applications to statistics.

962. **Martingales**
Winter or even-numbered years. 3(3-0)
STT 873; STT 928.
Convergence, sampling, decomposition and stopping of sub- and super-martingales. Relationship with differentiation of measures. Applications to sequential analysis and boundary crossing probabilities.

963. **Diffusion and Brownian Motion**
Spring of even-numbered years. 3(3-0)
STT 873; STT 928.
One dimensional diffusion, speed and drift measures, local time, stochastic integral, Ito's theorem.

964. **Renewal Theory and Random Walk**
Fall of even-numbered years. 3(3-0)
STT 873; STT 928 or concurrently.
Renewal events and processes, random walk, Wiener-Hopf factorization, Tauberian theorem. Renewal-Type Equations. Branching processes, birth and death processes.

965. **Second Order Processes**
Winter of odd-numbered years. 3(3-0)
STT 873, STT 928.
Stochastic processes studied by the methods of linear spaces. Sample path properties, representatives, estimation, prediction, multiplicity.

966. **Semi-Groups and Applications**
Spring of odd-numbered years. 3(3-0)
STT 873, STT 928.
Hille-Yosida theorem, processes of independent increments, infinitely divisible processes, Markov processes in several dimensions.

990. **Problems in Statistics and Probablility**
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 10 credits. STT 873.
Seminar or individual study on an advanced topic in statistics.

995. **Topics in Statistics and Probability**
Fall, Winter, Spring. Variable credit.
Nonparametric statistics, multivariate statistical analysis, statistical time series analysis, Bayesian statistics, reliability theory, stochastic approximation, design of experiments, sets of decision problems, stochastic processes, sequential analysis, other topics.

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

STUDIO ART

See Art.

SURGERY   SUR

College of Human Medicine

608. **Surgery Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 43 credits. H M 602.
An introduction to the surgical patient, stressing surgical diagnosis, pre-operative evaluation and post-operative care. Objectives are designed to help the student attain acceptable levels of surgical competence for physicians.

609. **Otolaryngology Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Common otolaryngologic disorders, emergencies, including diagnosis and treatment, and judgments concerning proper management by primary physicians.

610. **Plastic Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Principles of wound healing and tissue repair. Indications and applications of plastic procedures.

611. **Urology Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Demonstration of clinical manifestations of genito-urinary disease, investigative methods and techniques of diagnosis and management, familiarity with urologic emergencies and performance of basic urologic skills.

613. **Orthopedic Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Diagnostic and management information and skills, including emergencies, in common orthopedic problems.

614. **Neurosurgery Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
A hospital-based experience to provide the student with familiarity with the field and understanding of the contribution of neurosurgery in medicine generally.

615. **Ophthalmology Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Development of skills and knowledge in ophthalmoscopy, neuro-opthalmology, visual function, and management of problems such as glaucoma, the red eye, and trauma.

616. **Thoracic Surgery Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Problem-solving in thoracic medicine and surgery, also stressing pulmonary physiology, use of diagnostic tools and tests, and indications for surgical procedures.

618. **Anesthesiology Clerkship**
Fall, Winter, Spring, Summer. 4 to 16 credits. May reenroll for a maximum of 16 credits. H M 602.
Introduces common anesthetic agents and provides opportunity for performing anesthetic procedures under faculty supervision.

619. **General Surgery Elective Clerkship**
Fall, Winter, Spring, Summer. 4 to 16 credits. May reenroll for a maximum of 16 credits. H M 602 and SUR 608.
Experiences in clinical general surgery.

630. **Emergency Medicine Clerkship**
Fall, Winter, Spring, Summer. 4 to 8 credits. May reenroll for a maximum of 8 credits. SUR 608, PHD 608 or MED 608; H M 602. Interdepartmental with and administered by the Department of Medicine.
Pathophysiology and other basic concepts will be used to explain the development of emergent conditions. Clinical diagnosis and treatement of emergencies seen in community emergency departments will be discussed.

SYSTEMS SCIENCE

See Electrical Engineering and Systems Science.

TELECOMMUNICATION   TC
College of Communication Arts and Sciences

120. **Telecommunication Media and Society**
Fall, Winter, Spring, Summer. 3(3-0)
Nonmajors.
History, economics, public control, programming, social effects and future of telecommunication; primarily radio and television broadcasting and cable communication. Citizen responsibilities in the development of telecommunication systems and services.