

882. Seminars in Social Work
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of school.
Seminars on selected issues, trends, programs or methods in social work.

890. Special Problems in Theory and Practice
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 18 credits. Majors or approval of school.
Individual or group study of special settings or of specific social work problems.

893. Social Gerontology
Fall. 3(3-0) Approval of school.
Aging and years of later maturity, with respect to social and personal difficulties and opportunities. Aging process, retirement, living arrangements, social relationships, community resources, and implications for social welfare.

985. Advanced Seminar in Social Work
Winter, Spring. 3(3-0) May re-enroll for a maximum of 12 credits. Multidisciplinary social science doctoral student.
Critical study of current issues and problems in social work. Students participate in selection of topics to be considered.

990. Independent Study in Social Work
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of school.
Individual study of a theoretical or applied problem in social work.

SOCIOLOGY

SOC

College of Human Medicine
College of Osteopathic Medicine
College of Social Science

150. The Individual in Modern Society
Fall, Spring. 4(4-0)
Recognition and description of social conditions which lead to individual human development. Exploration of ways in which society facilitates and fails to facilitate individual human development.

160. Contemporary Social Problems
Fall. 4(4-0)
Identification of the factors and issues involved in mankind's fight for survival in our technological society. Relationship of humanism and technology. Examination of and suggestions for dealing with problems of warfare, cybernation, human rights.

235. Criminology
(335.) Winter, Spring. 4(4-0) 241 or C J 110 or approval of school. Interdepartmental and jointly administered with the School of Criminal Justice.
Crime analysed from sociological perspective: meaning of "crime", crime statistics, and measurement, theories of crime causation, crime typologies, e.g., professional organized, violent, sex, white-collar crimes, juvenile delinquency.

241. Introduction to Sociology
Fall, Winter, Spring, Summer. 4(4-0) Sophomores.
Introduction to nature of sociological inquiry and to concepts and principles of sociology. Analysis focuses on institutional features of modern society and of structure and dynamics of social organization.

251. Social Psychology
(351.) Fall, Winter, Spring, Summer. 5(5-0) 241. Students may not receive credit in both 251 and PSY 335.
Social psychology from a sociological perspective. Relation of the individual to his social environment with special reference to group process and interaction, social structure and personality, mass phenomena, and social attitudes.

310. Social Stratification
(484.) Fall, Winter. 4(4-0) 241.
Survey of literature on the formation and changes in social class systems in modern and traditional societies. Social mobility in class, status and political orders.

311. Development of Sociological Theory
(494.) Winter, Spring. 4(4-0) 310.
Significant theoretical contributions to the development of sociological theory, both European and American.

312. Research Methods in Sociology
(492.) Fall, Spring. 5(3-2) 311; STT 201.
Elements of scientific logic; procedures and problem formation; development of concepts, hypotheses, theory; research design; sampling, measurement, data gathering; analysis, interpretation, and reporting research findings.

IDC. Refugees, Displaced Persons, Hostages, Exiles
For course description, see Interdisciplinary Courses.

321. Industrial Sociology
(421.) Winter, Spring. 4(4-0) 241.
Industrialization in Western and non-Western societies; social organization of work; internal dynamics of work plant as a social system; and labor-management relations in various cultural settings.

322. Political Sociology
(422.) Fall, Winter. 4(4-0) 241.
Political action in the United States in relation to theory and practice of democracy. Nature of social pressures, political group, politician and effect of local community situation on political activity will be considered.

323. Sociology of the Family
(423.) Winter. 4(4-0) 241.
Sociological analysis of the family, its development as a social institution, its relationship to society, and its contribution to personality.

329. Urban Sociology
(429.) Fall, Winter, Spring. 4(4-0) 241.
Urban theory and research techniques emphasizing the demography, ecology and social organization of American cities and sociological aspects of urban planning and redevelopment.

332. Behavior of Youth
(432.) Winter, Spring. 4(4-0) 241.
Sociological analysis of normal and deviant behavior of youth. Issues related to the existence of youth subcultures. Relation of social change to behavior of youth.

333. Racial and Ethnic Inequality
(433.) Winter, Spring. 4(4-0) 241.
Sociology of racial and ethnic problems in contemporary society with an emphasis on American society. Attention to specific ethnic and racial groups in terms of prejudice and discrimination with particular concern for the resolution of inequality.

353. Sex Roles
Winter. 4(4-0) 241.
A sociological inquiry into traditional and changing roles of women and men in Western societies; sex roles in economic and family institutions; variations by culture, class, ethnicity; socialization.

IDC. Survey of Sub-Saharan Africa
For course description, see Interdisciplinary Courses.

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For course description, see Interdisciplinary Courses.

400H. Honors Work
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 20 credits. Approval of department.

401. Sociology of Education
Winter, Summer. 4(4-0) 241. Interdepartmental with Education.
School as a social institution, school-community relations, social control of education, and structure of school society.

420. Dynamics of Population
Fall, Winter. 4(4-0) One 300 level sociology course.
General demographic theories, especially those concerning population growth. Population distribution and density, age, sex, and ethnic composition. Emphasis on fertility, mortality, and migration and their influences on population change.

424. Sociology in Mental Health
Spring. 4(4-0) 251 or PSY 335.
Sociological theories of etiology of mental disorder; research on social epidemiology and ecology; impact of social structure; popular conceptions of mental health and deviancy; emerging ideologies of mental health disciplines.

427. Social Movements and Ideologies
Winter, Spring. 4(4-0) One 300 level sociology course.
The analysis of the collective response to situations of social tension and change that take the form of social movements and their accompanying ideologies. Both historical and contemporary cases will be examined.

428. Contemporary Communities
Fall, Spring. 4(4-0) One 300 level sociology course.
An examination of the contemporary community. Emphasis will be placed on associational and institutional organization in communities of varying complexity. Particular attention will be paid to social organizational theory as it applies to the problems of American community life.

**Descriptions — Sociology
of
Courses**

430. Sociology of Work

Winter. 4(4-0) One 300 level sociology course.

Social significance of work. Forces changing contemporary occupational structure. Factors associated with typical career patterns of occupations and professions. Social organization of occupational groups with emphasis on their ideology and politics.

431. Comparative Urban Sociology

Spring of even-numbered years. 4(4-0) 329 or approval of department.

Urban demography, ecology, and social organization viewed historically and cross-culturally and emphasizing the contemporary urbanization processes. Theory, techniques, and data of international comparative urban analysis.

434. Social Deviance and Control

Spring. 4(4-0) 235 and one 300 level sociology course.

The relationship between social structure, social control and social deviance; a survey and criticism of present social science theories in light of empirical research and application of theories to selected problem areas.

437. Rural Sociology

Fall, Spring. 4(4-0) One 300 level sociology course.

Structure, function and change in rural areas of the United States. The major social systems, social class, demographic characteristics, commodity organizations and value orientations of rural people.

438. Sociology of Developing Societies

Spring. 4(4-0) One 300 level sociology course.

Sociological elements of modernization. Process of technological change and type of programs to induce change. Emergence and accommodation of institutions to change. The changing population, family, community and ideological structures.

440. Sociology of Religion

Spring of odd-numbered years. 4(4-0) One 300 level sociology course.

Relationship to society, with particular emphasis on modern society. Religion as a social institution; its relation to stratification and to political and economic organization. Forms of religious organizations. Religious believing and the rational, empirical orientation in modern culture.

443. Personality and Social Structure

Spring. 4(4-0) 251 or PSY 335; one 300 level sociology course.

Effects of social structural variables upon personality development, adult socialization, role behavior, self image, and self evaluation.

445. Social Knowledge in the Modern World

Winter. 4(4-0) One 300 level sociology course.

A sociological examination of the continuing effort to achieve a viable basis for relating social knowledge to the modern world. The sociology of knowledge, concerned with the relation of ideas to social life will provide the framework for the course. Attention will be given to such issues as: the role of the intellectual as cultural and political critic, and as man of knowledge; the relation of empirical knowledge to cultural values and social ideologies; the uses of reason and knowledge in human affairs; and the relation of intellect to power.

448. Small Group Interaction

Winter. 4(4-0) 251 or PSY 335; one 300 level sociology course.

Properties of social interaction in small groups. Relationship between group structure and social interaction.

471. Modern American Society

Winter, Spring. 4(4-0) One 300 level sociology course.

Cultural patterns and social structures of contemporary American life. Relationship of these patterns and structures to individual and group adjustment.

473. Culture and Personality

Fall, Spring. 4(4-0) One 300 level anthropology or sociology course. Interdepartmental with the Anthropology Department.

Human nature in evolutionary and cross-cultural perspective. Special attention to relating theories of anthropology and psychology to methods of studying personality in non-Western societies.

475. Individual Research Projects

Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Nine credits in sociology and approval of department.

477. Complex Organizations

Fall. 4(4-0) One 300 level sociology course.

Bureaucracies and complex formal organizations in various institutional settings and the relationship among organizations in the community. Informal structures, internal conflict, integrative mechanisms, and the dilemmas of professional and administrative demands will be emphasized.

481. Cross-Cultural Relations in the Modern World

(466.) Winter of even-numbered years. 4(4-0) 473. Interdepartmental with the Department of Anthropology.

Relationship of native peoples to world-wide forces and reactions of native peoples to world struggle for power. Problems involved in administration of programs for non-Western societies.

485. Wealth and Poverty

Winter. 4(4-0) 310.

Distribution of income and wealth in contemporary industrial societies; relevance of wealth to prestige and political orders of societies; social consequences of public and private programs.

493. Selected Exercises in Social Research

Spring. 5(2-3) 312 or equivalent social science methodology course.

A laboratory course providing training in the application of social research methods, under laboratory and field situations, to problems in the major substantive areas of sociology, social psychology and anthropology.

499. Senior Seminar

Spring. 3 to 5 credits. Senior majors or approval of department.

Selected issues in sociological research and theory.

IDC. Seminar in Industrial Relations

For course description, see Interdisciplinary Courses.

810. General Social Organization

(977.) Fall. 4 credits. Majors or approval of department.

Research and literature on the structure and function of social organizations ranging from societies to small groups.

811. Research Problems and Literature in Social Psychology

(963.) Fall. 4(4-0) Majors or approval of department.

Central points of view and concepts of contemporary social psychology with emphasis upon symbolic interaction. Collective behavior, small groups, attitudes and behavior, and culture and personality.

812. Theory of Sociological Inquiry

(956.) Spring. 4(4-0) Majors or approval of department.

Critical review of some of the procedures followed by sociologists and social psychologists in their attempts to achieve reliable knowledge.

823. Organizational Behavior in Labor and Industrial Relations

Fall. 4(4-0) Approval of school. Interdepartmental with and administered by the School of Labor and Industrial Relations.

Analysis of why organizations, individuals and groups in unions, management and government act as they do in industrial relations situations with emphasis on sociological, psychological and cultural factors.

825. Seminar in Cross-Cultural Relations

Winter of odd-numbered years. 4(3-0) Approval of department. Interdepartmental with the Anthropology Department.

Analysis of the relations between superordinate and subordinate societies and between coordinate societies and cross-cultural exchange programs.

827. Social Movements and Ideologies

Spring. 3(3-0) Approval of department.

Organizational structure and supporting belief systems of groups and collectivities which desire major institutional changes in society.

837. Special Topics in Rural Sociology

Fall, Winter, Spring. 3 to 8 credits. Approval of department.

Special fields of rural sociology such as farmers' organizations, population, migration, adaptation of practices, changing ideologies, political behavior, stratification, and attitudes.

IDC. Interdisciplinary Seminar on Africa

For course description, see Interdisciplinary Courses.

840. Violence and Social Change

Fall. 3(3-0) Approval of department.

Conditions of violence in situations of conflict and change, legitimation of violence, and response to violence by institutional elites and by publics.

842. Seminar in Conflict and Change

Winter. 3(3-0) Approval of department.

Overview of the substantive and research literature in Conflict and Change; and explores possibilities for student research and involvement in the area.

- 853. Social Attitudes**
Spring. 4(4-0) Approval of department.
Origin, development, classification, and measurement. Relationship between attitudes and behavior. Students will conduct field research.
- 860. Topics in Multivariate Analysis**
Winter. 4(4-0) STT 421.
Selected topics in the areas of path analysis, factor analysis and other multivariate techniques.
- 864. Population Studies: Research Problems and Literature: Seminar**
Winter. 3 to 4 credits. May re-enroll for a maximum of 16 credits. Approval of department.
Theoretical and substantive literature relating to demographic change, and research problems of special interest.
- 866. Selected Research and Literature In Social Institutions**
Fall, Winter, Spring. Variable credit. May re-enroll with approval of department.
A review and analysis of the significant literature concerning major problems in the institutional structure of modern society. A. Economic and Industrial; B. Political; C. Religious; D. Family.
- 868. Social Organization and Administration**
Fall, Spring. 3(3-0) Approval of department.
General principles of inter and intra organizational change in the administrative process.
- 872. Seminar in Special Subject Fields**
Fall, Winter, Spring. Variable credit. Approval of department.
Special fields of study will include any area of sociology and social psychology selected.
- 875. Individual Research Projects**
Fall, Winter, Spring, Summer. Variable credits. Approval of department.
- 877. Seminar in Complex Organizations**
Winter. 4(4-0) 321 or 477 or approval of department.
Major theoretical and methodological problems in studying complex organizations. Using a comparative approach, special emphasis will be given to the design and execution of empirical research.
- 880. Individual Readings**
Fall, Winter, Spring, Summer. Variable credits. Approval of department.
- 884. Seminar in Social Stratification**
Spring. 3(3-0) Approval of department.
Theory and research in societal systems of stratification. The articulation of stratification orders to institutional structures. Research design in stratification studies.
- 895. Computer Simulation of Social Behavior**
Winter. 4(3-2) Approval of department.
Survey of research in the simulation of human behavior. Training in the basic technological and conceptual tools necessary for independent research in the area. Working in detail through an operating large simulation program to appreciate how the tools apply in practice. Designing and writing a simulation program.
- 899. Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
- 901. Educational Sociology: Seminar (901D.)**
Fall, Winter. 3 to 4 credits. Approval of department. Interdepartmental with the College of Education.
- 930. Sociology of Work**
Spring. 4(4-0) 430, 484 or approval of instructor.
Theory and research problems in occupational structure, work settings, functions and meanings of work, occupational mobility and career patterns.
- 940. Topics in Mathematical Sociology**
Fall, Winter, Spring. 5(5-0) Approval of department.
Seminar in the mathematical analysis of selected topics in sociology, such as, kinship systems, stratification systems, formal organization, social mobility, population and migration, social influence, mass behavior.
- 941. Human Ecology**
Fall. 4(4-0) Approval of department.
The analysis of population aggregates in terms of their place in a total ecosystem, defined as the structure of interdependencies involving population, environment, technology, and patterns of organization.
- 942. Urban Theory**
Winter. 4(4-0) 941; 812 and 967 recommended.
Examination and critique of competing theories of urban structure and process: theories of evolution of human settlement, classic location theories, human ecology, communication and system theories.
- 952. Techniques of Population Analysis**
Spring. 4(3-1) 420; STT 422; or approval of department.
Techniques for the analysis of population size and composition, mortality, fertility, migration, population estimates and forecasts, population and labor force distribution, and selected techniques of ecological analysis.
- 953. Experimental Methods**
Winter. 4(3-2) 860.
The design and analysis of social experiments, with special emphasis on laboratory investigation of social processes.
- 954. Social Survey Methods**
Spring. 4(4-0) 860.
The design and analysis of theoretically oriented survey research. Sampling, questionnaire construction, interviewing, and data processing.
- 955. Field Research Methods**
Spring. 4 credits. 312; approval of department.
An overview of the design and execution of social research.
- 964. Seminar in Small Group Research**
Fall. 3 to 5 credits. Thirty graduate credits including 811, or approval of department.
The experimental and theoretical investigation of organizational processes in small groups.
- 966. Social Structure and Personality**
Winter. 3 credits. 811 or approval of department.
Theoretical and research problems in analysis of influence of social positions on personality, and influence of personality and social factors in allocating persons to different social positions. Stress will be placed upon quantitative research and contemporary theories of social structure and personality.
- 967. Introduction to Formal Theory in Sociology**
Spring. Variable credit. 966.
Analysis of the structure of formal theory in sociology and of the problems of interpretation and verification of deterministic and probabilistic theories. Examination of specific practices of theory construction.
- 968. Symbolic Interactionism: Theory and Research**
Spring. 1 to 4 credits. 811; social psychology concentration.
Theoretical and research problems within the framework of symbolic interaction. The socialization process and the development, maintenance, and enhancement of the self. Critique of the literature and proposals for new research directions.
- 970. Theories of Conflict and Change**
Fall. 3(3-0) Approval of department.
Major theoretical European and American contributions to the study of conflict and change.
- 971. Race, Politics, and Social Structure**
Winter. 3(3-0) Approval of department.
Racism, including the social mechanisms by which it is created, maintained, and lessened, and the variant forms of political action related to racism and social structure.
- 972. War and International Conflict**
Spring. 3(3-0) Approval of department.
Causes, structure and patterns of wars between societies, revolutions within societies and the relation of war and revolution to cross-cultural conflict and change.
- 973. Values, Crises and Utopias in a Post-Modern Society**
Fall. 3(3-0) Approval of department.
Macro-sociological approach to study of social problems and stresses; planned change; and conscious improvement of modern societies.
- 976. Contemporary Social Systems**
Winter. 4 credits. 311 or approval of department.
Comparison and analyses of concepts, conceptual schemes and theories of outstanding social theorists in relation to modern research.
- 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.

**Descriptions — Sociology
of
Courses**

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. 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. 981.
Sampling problems, data collection strategies, problems of translation and concept equivalence. Management, analysis and interpretation of cross-cultural data.

991. Research Seminar in Work and Organization
Winter. 2(2-0) May re-enroll for a maximum of 6 credits. Thirty graduate credits and approval of instructor.
An advanced seminar devoted to analysis of designs used in current research in work and organization.

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

SOIL SCIENCE SLS

**College of Agriculture and
Natural Resources**

202. Soils and Man's Environment
Winter. 3(3-0) Interdepartmental with Fisheries and Wildlife and Resource Development Departments and Natural Resources.
Use of soil-water resources in a technological society as it relates to environmental quality. Nature of pollution problems and their possible solutions. Food production and world population.

210. Fundamentals of Soil Science
Fall, Winter. 5 credits.
Principles of the origin and development of soils. Relationship of properties to utilization and soil fertility to plant composition and animal health. Emphasis is placed on changing soils to serve man.

331. Soil Management
Winter. 4(4-0) 210.
Management of soils, drainage and irrigation, organic matter, tillage, rotation, conservation practices, soil reaction, lime, fertilizers, and micronutrients. Soil management vs. soil conservation. Special study in general crops, horticultural crops, greenhouse crops, turf and organic soils.

390. Soil Conservation and Land Use
Spring. 3(3-0) 210.
Soil resources of the United States and methods and plans for soil conservation including control of erosion. Interpretation of soil survey maps and land evaluation for farm crops, fruits, forestry, engineering and wildlife. Soil judging.

410. Special Soil Problems
Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll for a maximum of 6 credits. Approval of department.
Independent study topics include: Special soil problems, fertility, geography, classification, conservation, soil management, organic soils and turfgrass soils.

420. Seminar
Winter. 1(1-0) May re-enroll for a maximum of 4 credits. Interdepartmental and administered jointly with Crop Science.

424. Forest Soils
Spring. 4(3-3) 210; FOR 220. Interdepartmental with and administered by the Forestry Department.
Interrelationships of forest site and the growth of forests. Classification and productivity of forest soils. Effects of silvicultural and forest management practices on the soil. Two-day field trip required.

430. Soil Fertility and Fertilizers
Spring. 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
Spring. 4(3-2) MPH 200; 301 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
Spring. 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.

IDC. The Impact of Animal Resource Management Upon the World's Developing Nations
For course description, see Interdisciplinary Courses.

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 instructor.
Areas of work to include: advanced studies in soil science, chemistry, classification, conservation, fertility, geography, management, microbiology and biochemistry, micronutrients, micropedology, mineralogy, organic soils and physics.

820. Seminar
Winter, Spring. 1(1-0) May re-enroll for a maximum of 3 credits. Interdepartmental and administered jointly with Crop Science.
Studies and presentation of research in crop and soil sciences.

825. Clay Mineralogy
(945.) Winter. 4(3-4) 840, 850 or approval of department. Interdepartmental with and administered by the Geology Department.
Structures and properties of clays; their origins, occurrence, and utilization. Methods of studying clays including x-ray diffraction, differential thermal analysis, infrared absorption and other chemical and physical techniques.

830. Soil Fertility and Plant Nutrition
(930.) Spring of odd-numbered years. 3(3-0) 430 or approval of department.
Fundamental concepts in soil fertility and mineral nutrition of plants; fate of nutrients applied to soils, nutrient uptake, translocation and utilization by plants; principles of laboratory, greenhouse and field research methods.

835. Organic Soils
Spring. 2(2-0) Approval of department.
Information pertinent to organic soils formation, classification, water control, conservation, plant nutrients, soil testing, commercial utilization, special crops, road construction, and real estate development will be presented. Field trip included.

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. Fertility and Management of Tropical and Subtropical Soils
Winter. 3(3-0) Approval of department.
Fertility and management of tropical and subtropical soils, the use of soil testing techniques with field studies to evaluate the fertility status and develop cropping systems for optimum production.