990C. Mathematical Economics and Econometrics Workshop Fall, Winter, Spring. 3 to 16 credits.
812, 832; or approval of department. Interdepartmental with the Agricultural Economics Department.
Critical evaluation of research reports by staff and other students. Students writing doctoral dissertations in the appropriate areas are encouraged to participate in workshop and may do so while registered for 899.
999. Research Fall, Winter, Spring, Summer. Variable credit. Approval of department.

EDUCA TION
College of Education

101. Introduction to Teaching
A. ELEMENTARY EDUCATION.
Fall, Winter, Spring. 1(1-0)
Teaching profession, American educational heritage, teaching of children and youth, preparation and opportunities.
B. SPECIAL EDUCATION.
Fall, Winter, Spring. 1(1-0) Freshmen and Sophomores only.
Opportunities in education of children and youth impaired in vision, hearing, mental ability, emotional adjustment, speech and physical handicaps.

124. Introduction to Careers in Vocational and Practical Arts Education
Opportunities in teaching agriculture, business, home economics or industrial education and in closely related fields; analysis of student's potentialities for these fields.
A. AGRICULTURE.
Fall. 2(1-2)

B. BUSINESS AND DISTRIBUTIVE EDUCATION.
Fall, Winter. 2(2-0)

C. HOME ECONOMICS.
Spring. 2(2-0)

D. INDUSTRIAL ARTS.
Winter and Fall of even-numbered years, Spring of odd-numbered years. 2(2-0)

141A. General Industrial Arts
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) Approval of department.
Introductory experiences in all major areas of industrial arts. Organized under a comprehensive general shop organization similar to that utilized in the modern secondary school.

141B. General Woodwork
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) Approval of department.
Handwork, patternwork, carpentry, introductory machinework, finishing. Designed to emphasize in both organization and equipment, desirable practices in today's secondary school.

200. Indiscrete and the School
Fall, Winter, Spring, Summer. 5(3-2)
Sophomores.
Major psychological factors in the school learning-teaching situation; concepts in human development related to problems in the school situation; teacher's role in motivation, conceptual learning, problem solving, and the development of emotional behavior, attitudes and values; learning of skills; retention and transfer; and measurement of student abilities and achievement.

200A. Educational Psychology
Fall, Winter. 3(3-0) Approval of department.
Same goals as Education 200, but assumes a background in general psychology.

241A. Advanced Woodwork
Winter and Fall of even-numbered years, Spring of odd-numbered years. 3(0-6) Approval of department.
Safe operation of woodworking machines in home and school shop. Care and maintenance of shop tools and equipment.

241B. General Metalwork
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-8) Approval of department.
Bench metal, sheet metal, forging, welding, plating, casting, and machining. Designed to exemplify desirable facilities and course organization for the modern secondary school.

241C. Industrial Arts Crafts
Winter and Fall of even-numbered years, Spring of odd-numbered years. 3(0-6) Approval of department.
Typical crafts in outstanding public school programs of industrial arts. Work in plastics, leather, silver, aluminum, copper, metal enameled, lapidary, ceramic, and model making.

241D. Printing and Graphics
Winter and Fall of even-numbered years, Spring of odd-numbered years. 3(0-6) Approval of department.
Hand composition, press work, printing, bookbinding, block printing, plate making, silk screen work, and photography. Designed to exemplify a desirable approach to the work of this area in the modern secondary school.

310. Human Growth and Development
Fall, Winter, Spring. 4(2-4)

320. Growth of children from birth to adolescence and techniques for measurement. Problems of adjustment and physiological and psychological factors associated with them. Young children observed and studied in laboratory and natural situations.

321. Curriculum, Methods, and Materials
Basics, scope, and sequence of curriculum in reading, language arts and social studies; adaptation of principles to methods and materials of teaching in the elementary and middle school.

A. ELEMENTARY EDUCATION.
Fall, Winter, Spring, Summer. 3(2-1)
Must be taken immediately prior to student teaching, concurrently with 321B, 321C. Must have completed September teaching experience and have 20 satisfactory average.

B. ELEMENTARY MATHEMATICS AND SCIENCE.
Fall, Winter, Spring. 5(4-2)
Concurrently with 381A; 321C; MTH 201; B S 202; HPS 203.

C. ELEMENTARY LANGUAGE ARTS AND SOCIAL STUDIES.
Fall, Winter, Spring, Summer. 7(6-3)
Concurrently with 321A, 321B.

325A. Methods of Teaching Reading in the Elementary School
Fall, Winter, Spring, Summer. 3(3-0)

200. Methods and materials of instruction of reading at elementary level. Analysis of learning and teaching problems, and study of concrete materials and classroom attack. Consideration of practical bearings of research and progressive theory on current practice.

325B. Teaching of Language Arts in Elementary Grades
Fall, Winter, Spring, Summer. 3(3-0)

200. Course to acquaint prospective elementary teachers with content material and methods in language arts for grades below the seventh. Students also given opportunity to acquire skills in manuscript and blackboard writing.

325C. Children's Literature
Fall, Winter, Spring, Summer. 3(3-0)
Juniors.
Designed to acquaint elementary school teachers with wide variety of reading materials suitable for various grade levels below junior high school.

325D. Teaching of Social Studies in Elementary Grades
Fall, Winter, Spring, Summer. 3(3-0)

200. To help students develop understanding of philosophy and aims of social studies movement in elementary schools, and ability to further such aims through familiarity with a variety of materials, knowledge of social studies subject matter, and competence in using a variety of methods.

325E. Teaching of Mathematics in Elementary Grades
Fall, Winter, Spring, Summer. 3(3-0)
Juniors, 200.
Prepares students for teaching mathematics in the elementary school. Methods and techniques of presenting mathematics content meaningfully to elementary pupils will be illustrated.

325F. Teaching Science in the Elementary School
Fall, Winter, Spring, Summer. 3(3-0)
Juniors, N 5 193.
Extends the science background of prospective elementary teachers. Emphasis is placed upon methods and materials for science in elementary classrooms.

325G. School Music Instrumental Methods
Fall. 3(3-0) Instrumental music major.
Instrumental instruction program at elementary level.

325H. School Music Vocal Methods
Fall. 4(3-2) Approval of the Music Department.
Basic instructional program in primary and intermediate grades.

327. Methods of Teaching—Secondary
Specifics of classroom instruction in the various subject-matter fields. Selection of presentation and evaluation techniques based on recognized course objectives.

A. AGRICULTURE.
Fall. 5 credits. 200.

B. ART.
Fall, Winter, Spring. 5 credits. 200.

C. BUSINESS AND DISTRIBUTIVE EDUCATION.
Fall, Winter, Spring. 5 credits. 200.

D. ENGLISH.
Fall, Winter, Spring, Summer. 5 credits. 200.

E. ROMANCE LANGUAGES.
Fall, Winter, Spring. 5 credits. 200.

F. HEALTH.
Spring. 5 credits. 200.

G. PHYSICAL EDUCATION.
Fall, Winter, Spring. 5 credits. 200.
411. School Learning I
Fall, Winter, Spring, Summer. 3(3-0)
Verbal learning, concept formation, problem solving and transfer with implications for teaching in schools.

413. Mental Health of School Children
Fall, Winter, Spring, Summer. 3(3-0)
Social and emotional adjustments of children. Emphasis on balancing factors favoring prevention and resolution of behavior difficulties and evaluation of school programs on basis of their contribution to mental health.

415. Student Leadership Training
Fall, Winter, Spring. 2(0-3) Approval of the Dean of Students.
Prepares students for leadership roles and responsibilities by encouraging the development of skills and techniques consistent with the principles of our democratic society.

416. Personnel Work in Student Housing
Fall, Spring. 3(0-6) Fifteen credits of Education or approval of department. Fall: primarily for students selected to assist in administration of residence halls. Spring: for graduate students preparing for student personnel work. Organization, policies, practices, procedures of residence halls at Michigan State University and other educational institutions.

424. Education of Exceptional Children
Fall, Winter, Spring, Summer. 3(3-0) Dealing with atypical children in regular and special classrooms. Methods of facilitating growth and development of children who are crippled, hard of hearing, defective in vision, defective in speech, etc. Opportunity to observe and participate in instruction of such pupils in Lansing area.

425B. Teaching of Geography in Elementary and Junior High Schools
Summer. 3(0-3) One course in geography or approval of the Geography Department. Observations, study of materials, instructions, techniques, and evaluation aspects of teaching geography in the elementary and junior high schools.

429. Disabling Conditions: Special Education and Rehabilitation
Fall. 3(3-0) 424.
Etiology, medical, educational-vocational implications of disability for special education and rehabilitation. Emphasis on medical lectures by physicians.

429F. Driver Education and Traffic Safety I
Fall, Winter, Spring, Summer. 3(2-2) 21-year-old Juniors with a valid driver's license. Fundamentals, principles, practices and content of high school driver education and traffic safety. Laboratory experience in teaching beginners to drive in dual-control cars is provided.

429G. Driver Education and Traffic Safety II
Fall, Spring, Summer. 3(2-2) 429F, 21-year-old Seniors with a valid driver's license. Advanced professional preparation to meet the traffic safety needs of schools and communities. Laboratory work will be in the multiple car area and the Aetna Drivetrainer.

430A. Education of Visually Handicapped Children and Youth
Fall, Summer. Variable credit. May re-enroll for a maximum of 15 credits.

430B. Education of Deaf Children and Youth
Fall, Spring. Variable credit. May re-enroll for a maximum of 15 credits. 321C, 424; ASC 454.
Educational provisions for the deaf; methods, materials, curriculum. Speech and language development in an oral philosophy.

430C. Education of Physically Handicapped Children and Youth
Fall, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 321C, 424, or approval of department.
Educational, social, and psychological provisions for education of crippled, hospitalized or home-bound children and youth. Emphasis upon cerebral palsy, multi-handicapped and learning disabilities.

430D. Education of Mentally Retarded Children and Youth
Fall, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 424 or approval of department.
Educational provisions, social control, and methods and curriculum for mentally retarded children.

430E. Education of Emotionally Disturbed Children and Youth
Fall, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 424 or approval of department.
Classroom observation and management techniques. Remedial practices for children with specific learning disabilities. Seminar on methods and materials.

431. Educational Media in Instruction
Fall, Winter, Spring. 3(3-1) Juniors.
Educational media for preservice teachers. Selection and utilization of flat pictures, slides, filmstrips, motion picture films, sound, models, radio, television and field trips. Equipment operation acquired through self-instruction laboratory.

436. Student Teaching
Fall, Winter, Spring, Summer. Variable credit. 397 for secondary majors; approval of department. 2.0 scholastic average; ASC 477 for Speech Correction majors.
Participation in activities of school and community. Teaching and related activities, observation, and seminar on the problems of teaching. Usually requires students to live in typical Michigan cities for an entire term.

441A. General Industrial Arts
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 438 or approval of department.
Research in the facilities, materials, and organization of general industrial arts in the modern secondary school.

441B. Advanced Industrial Arts
Winter and Fall of even-numbered years, Spring of odd-numbered years. 3(0-6) 341B, approval of department.
Typical applications of power and its control, internal combustion engines, external combustion...
tion engines, motors, drive, and transmission devices, hydraulic and pneumatic equipment, experimentation with organizational patterns and teaching devices when taken for graduate credit.

441C. Advanced General Electricity
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 341C or approval of department.

Development and construction of simple electric motors, radio, and electronic devices. Experimentation with the development of organizational patterns appropriate to secondary schools when taken for graduate credit.

441D. Advanced Printing and Graphics
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 341D or approval of department.

Printing, letter making, and photography. Attention to development of adult programs in the area of graphics. Development of resource materials when taken for graduate credit.

441E. Advanced Industrial Arts Crafts
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 241C or approval of department.

Designed to provide the industrial arts teacher with sufficient breadth and skill to enable him to establish such a program in a secondary school.

446. Teaching Internship
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 17 credits. 391A.

Internship teaching experience under the guidance and supervision of intern consultants and other MSU faculty. Involves a variety of activities, including full-time teaching experience in a selected school.

450. School and Society
(301.) Fall, Winter, Spring, Summer. 5(3-2) 436.

School as a social institution, teacher as a member of the community, society as basic orientation for both the teacher and the school. Purposes of the public school, major concepts of educational philosophy, and politico-legal-economic support of the schools.

464. Standardized Tests and Testing Programs
Fall, Winter, Spring, Summer. 3(3-0) 200.

History and status of educational measurement. The available standardized tests and sources of information about them. Interpretation of standard test scores. Norms and profiles. Local and widescale testing programs.

465. Testing and Grading
Fall, Winter, Spring, Summer. 3(3-0) 200.

Construction, use, and evaluation of teacher-made classroom tests, objective and essay, in elementary schools, secondary schools, and colleges. Statistical analysis of test scores and item responses. Grading problems.

471A. Instructional Systems in Business and Office Education
Fall, Spring. 4(3-2) 200; 327C concurrently or approval of department.

Application of learning principles to selection of materials, media, and methods. Measurement and evaluation of learning in relation to objectives.

471B. Instructional Systems in Distributive Education
Fall, Spring. 4(3-2) 200; 327C concurrently or approval of department.

Dimensions of the total distributive education programs: the organizational patterns, principles of curriculum formulation, selection and use of appropriate teaching strategies, and the effective use of youth clubs.

472. Organization and Administration of Cooperative Office and Distributive Occupations Programs
Fall, Spring. 3(3-0) 471A or 471B concurrently or approval of department.

Development of knowledge and understanding of (1) purpose of preparatory in-school curricula and its relationship to cooperative programs of office and distributive occupations; (2) organization and administration of a cooperative program; (3) preparation of students for further training; and (4) correlation of on-the-job and in-school learnings through related instruction class.

476. Canadian-American Studies
For course description, see Interdisciplinary Courses.

482. Seminars and Independent Study in Education
Fall, Winter, Spring, Summer. 1 to 8 credits. Approval of department.

Selected professional educational problems will be dealt with on an individual and group basis. Each student is expected to select one or more problems for study.

483. Readings and Independent Study in Education
Fall, Winter, Spring, Summer. 1 to 6 credits. Approval of department.

Study on an individual basis in the various fields of emphasis in education.

484. Field Experience in Education
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.

Supervised undergraduate practitioners in education.

500. Crucial Issues in Education
Fall, Winter, Spring, Summer. 3(3-0) Approval of department.

Problem analysis of timely issues in education analyzing their legal, historical, sociological, and philosophical dimensions. Attention centered on problems of continuing concern. Particular attention devoted to the role of the teaching profession in issues involving public policy.

501. Seminars in Social and Philosophical Foundations of Education
A. PHILOSOPHY OF EDUCATION.
Fall, Winter, Spring. Summer. 3(3-0) Approval of department.

Identification of underlying philosophical problems in education. Use of philosophical methodology in resolving these problems. Development of a consistent personal philosophy of education.

D. SOCIAL CRITICISM and EDUCATION.
Fall, Summer. 3(3-0) 801A, Approval of department.

Educational implications of critical analyses of contemporary society. Particular attention given to dissonance between ideology and practice. Building school programs designed to cope with cultural inadequacies.

E. COMPARATIVE EDUCATIONAL PHILOSOPHY.
Winter, Summer. 3(3-0) 801A.

Critical analysis and evaluation of the educational philosophies of Plato and Dewey and their implications for practice.

F. MODERN PHILOSOPHIES of EDUCATION.
Spring. 3(3-0) 801B, Approval of department.

Critical analysis and evaluation of leading modern philosophies of education and their implications for practice, such as: existentialism, idealism, perennialism, realism, reconstrucionism.

804. Historical and Comparative Foundations of Education
A. HISTORY of AMERICAN EDUCATION.
Fall, Winter, Spring, Summer. 3(3-0) Approval of department.

Development of educational thought and practice in the United States. Importance of cultural influences. A critical examination of progress toward educational goals. Applications of historical background for present problems.

B. HIGHER EDUCATION in THE UNITED STATES.
Fall, Winter, Summer. 3(3-0) Approval of department.

Development of higher education in the United States and its foreign counterparts. Survey of higher education today with attention to purposes, curriculum, organization, financing, and the major issues in these areas. Attention is also given to a world view of higher education with special focus upon the influences of United States higher education in foreign countries.

C. EDUCATIONAL HISTORY: PLATO TO LOCKE.
Winter, Summer. 3(3-0) Approval of department.

Deals historically with relation of school to developing social trends. An intensive study of the works of leading figures in educational thought. Emphasis upon Plato's Republic. Works by Aristotle, Comenius, Locke, and others examined.

D. DEVELOPMENT of EDUCATIONAL THOUGHT and PRACTICE in the MODERN WORLD.
Spring, Summer. 3(3-0) Approval of department.

Deals historically with the development of modern education in the last three centuries. An intensive study of the works of leading figures in educational thought. Emphasis upon Rousseau's Emile. Works by Pestalozzi, Herbart, Froebel, James, and others examined.

E. EDUCATION in the WESTERN WORLD.
Fall. 3(3-0) Approval of department.

Comparative study of educational systems and philosophies of Canada, England, France, Russia, and other Western countries. Visiting foreign educators. Field trip to Canada.

F. EDUCATION in the NON-WESTERN WORLD.
Winter. 3(3-0) Approval of department.

Comparative study of educational systems and philosophies of Asian and African countries to gain insight into the American educational system. Visiting foreign educators.

G. ADVANCED COMPARATIVE and INTERNATIONAL EDUCATION
Spring. 3(3-0) 804E; 804F.

Objectives, content, methodology, research problems of comparative and international education analyzed. Social and historical forces affecting educational planning and institutional building studied. Agencies involved in international education identified.

811. School Learning II
Winter, Spring, Summer. 3(3-0) 411.

Survey of research with special attention to applications to teaching and development of school programs.

812. Growth and Behavior
Fall, Summer. 3(3-0) 312.

Survey of research with special attention to applications to teaching and school programs.
### 813. Social and Emotional Behavior in the Classroom  
**Spring, Summer. 3(3-0) 813.**  
Survey of research on school class as a social group; the development of attitudes and values.

### 815B. Principles of Guidance and Personnel Services  
**Fall, Winter, Spring, Summer. 3(3-0) 815B.**  
Survey of guidance services and their application in educational settings—elementary and secondary. Introduction to the field of pupil personnel work in schools. Practical guidance problems are considered.

### 815C. Student Personnel Work in Higher Education  
**Fall, Summer. 3(3-0) 815C.**  
Overview of student personnel services in colleges and universities. Philosophy, organization, and administration of the personnel program at this level and of specific services provided. Opportunity to visit and study college personnel programs.

### 816. Techniques of Counseling and Guidance  
**A. OCCUPATIONAL, EDUCATIONAL, AND SOCIAL INFORMATION.**  
**Fall, Winter, Spring, Summer. 3(3-0) 815B or approval of department.**  
Methods for providing occupational, educational, and social information in the guidance program. Techniques of teaching units in occupations, orientation or other life-adjustment areas considered. Techniques of placement and follow-up; community, educational or occupational trends; and classification and description of jobs and industries.

**B. PROCEEDURES IN INDIVIDUAL ANALYSIS.**  
**Fall, Winter, Spring, Summer. 3(3-0) 815B or approval of department.**  
Place of the inventory service in the personnel and instructional programs. Practice in the use and analysis of techniques for understanding the individual including both testing and non-testing procedures.

**C. GROUP PROCEDURES IN GUIDANCE.**  
**Fall, Winter, Spring, Summer. 3(3-0) 815B or approval of department.**  
Principles and practices of group counseling. Students participate in a group to examine in depth their own interaction and motives. Didactic content related to experiences of the course. Enrollment limited.

**D. PROCEDURES IN COUNSELING.**  
**Fall, Winter, Spring, Summer. 3(3-0) 484, 815B.**  
Diagnosis and interpretation of case study materials. Role-playing observation of interviewing procedures. Consideration of basic issues in counseling. Practice in test interpretation.

### 820. Principles of Curriculum Improvement  
**Fall, Winter, Spring. 3(3-0) 820.**  
Experience in teaching; approval of department. Principles of curriculum improvement will be developed through the critical analysis of practices found in public schools.

### 821A. Curriculum Construction  
**Winter, Summer. 3(3-0) 820.**  
Approaches to curriculum construction; organization and function of personnel; initiating and evaluating curriculum change; curricular research.

### 821B. The Core Curriculum  
**Winter. 3(3-0) 821A.**  
Critical study of existing core programs. Special attention to techniques of selection and organization of course materials and to cooperative planning units of work. At least one resource unit developed by students.

### 821C. Work Experience in the Curriculum  
**Winter, Summer. 3(3-0) 821C.**  
Work environment in schools, colleges, agencies and business and industry; educational objectives and outcomes; administrative aspects of work experience programs, research in the field.

### 822A. Community College  
**Fall, Winter, Spring, Summer. 3(3-0) 822A.**  
Purposes, functions, and offerings of the community college.

### 822B. Adult Education: A General Survey  
**Fall, Summer. 3(3-0) Approval of department.**  
Philosophies, methods, and techniques, materials, agencies and facilities for developing and operating a program of adult education. Emphasis on participating in local adult education activities as a laboratory for evaluating ways and means of procedures.

### 822E. New Developments in Home Economics Education  
**Spring, Summer. 3(3-0) 822E.**  
Planned to assist homemaking teachers in keeping up with trends in curriculum development, methods and materials.

### 822F. Occupational Analysis and Course Construction in Vocational Education  
**Winter, Summer. 3(3-0) Approval of department.**  
Techniques of analyzing an occupation to determine the processes, instructional units and curricular arrangements.

### 822G. Curriculum Construction in Industrial Education  
**Winter, Summer. 3(3-0) Approval of department.**  
Selection of general and specialized areas of study in junior and senior high school and adult industrial education courses. Industrial problems, their relation to a particular community and its needs in relation to instruction.

### 822J. Organization and Management of School Shops  
**Spring, Summer. 3(3-0) Approval of department.**  
Planning and organization of school shops in terms of adequacy, adaptability, efficiency, economy, and safety.

### 822K. Curricula in Home Economics  
**Fall, Summer. 3(3-0) Approval of department.**  
Clarification and use of a rationale in curriculum development in home economics. Special problems in application.

### 822M. Programs in Home and Family Life Education  
**Summer. 3(3-0) Approval of department.**  
Develops depth in home and family living courses offered in secondary school programs.

### 822N. Principles and Programs of Vocational Education and Practical Arts  
**Fall, Summer. 3(3-0) 822N.**  
Principles of vocational and technical education, comprehensive school programs, characteristics, program planning. Special emphasis is given to programs in agriculture, distributive, health, home economics, industrial, and office education. For vocational and practical arts teachers and local coordinators and directors of programs.

### 822P. Coordination in Occupational Training Programs  
**Winter, Summer. 3(3-0) Approval of department.**  
Analysis of objectives and scope of distributive, office, trade and industrial cooperative education programs, apprenticeship, and general education work experience. Emphasizes organization and administration, instructional procedures, coordination techniques, club activities, and evaluation of cooperative occupational education.

### 822Q. Current Issues and Developments in Vocational Education  
**Fall, Winter, Spring, Summer. 3(3-0) 822Q.**  
Examination of issues and problems in occupational education. Special emphasis on the emerging role of various governmental and private agencies in manpower development. Designed for majors in fields other than vocational education.

### 822R. Foundations of Business and Distributive Education  
**Fall, Summer. 3(3-0) 822R.**  
Critical study of the effect of socio-economic forces on education for business and examination of the development, scope, and purposes of secondary and beyond-the-high-school curricula.

### 822S. Developing Occupational Curricula in Two-Year Colleges  
**Winter, Summer. 3(3-0) 822S.**  
Curricular and instructional programs involving community college faculty, students and employers. For prospective teachers and administrative personnel in two-year colleges.

### 828A. Methods of Teaching Adults in Homemaking  
**Spring. 3(3-0) Approval of department.**  
Developmental needs of adults and changes in society affecting families as a basis for development of adult programs in homemaking education. Experiences will be provided with programs in progress.

### 828B. Teaching Adult and Young Farmer Classes in Agriculture  
**Fall, Summer. 3(3-0) Approval of department.**  
Objectives of adult education in agriculture, organizing and promoting classes, course planning, instructional procedures, follow-up and evaluation.

### 828D. Instructional Methods in Business and Industry  
**Winter, Summer. 3(3-0) Approval of department.**  
Organized for personnel responsible for the training function. Various instructional methods examined with emphasis on the conference method of problem solving.

### 828E. Principles and Problems of Instruction in Higher Education  
**Spring, Summer. 3(3-0) Approval of department.**  
Instructional problems in the various areas of higher education with emphasis on common principles underlying each of them.
829A. Education of the Gifted Student  
Winter, Spring, Summer. 3(3-0)  
Approval of department.

Study of the dimensions of giftedness—identification, characteristics, development, and societal role. Emphasis will be placed upon the problems of curriculum, teaching, administration, and guidance. Literature in areas of creativity, critical thinking, and motivation will be reviewed as this applies to the development of gifted children.

830A. Special Methods and Materials of Teaching  
Fall, Winter, Spring, Summer. 3(3-0)  
May re-enroll in different subject-matter areas for a maximum of 15 credits. Experience in teaching; approval of department.

Develops an understanding of the basic principles and techniques of teaching in the various subject-matter areas in the school curriculum. Students will be expected to investigate research as it relates to the improvement of instruction in a special field of study.

830C. Problems in Elementary Reading Instruction  
Fall, Winter, Spring, Summer. 3(3-0)  
Undergraduate methods course in reading or approval of department.

For experienced teachers. Includes consideration of the basic aspects of ability to read, desirable reading attitudes, habits, and skills. Practices and materials used in reading programs are examined and approved. Outstanding investigations dealing with problems in this area are studied and evaluated.

832. Advanced Methods and Materials in Special Education  
A. VISUALLY HANDICAPPED CHILDREN AND YOUTH  
Spring. 3(3-0) 424, 426, student teaching or clinical experience with visually handicapped children or approval of department.

Relationship of research, theories in education and related disciplines to educational practice, curriculum development, instructional modification, and guidance of visually handicapped pupils in a variety of organizational arrangements.

B. DEAF CHILDREN AND YOUTH  
Winter. 3(3-0) 426, student teaching or clinical experience with deaf children or approval of department.

A review of recent research, and a study of its implications for the education of deaf children. History, legislation, service agencies, social adaption, educational and vocational programs will be investigated and discussed.

837B. Supervision in Home Economics  
Summer. 3(3-0)  
Approval of department.

Objectives, techniques, and organization of supervised teaching in teacher training and city programs.

838. Interdisciplinary Seminar on Africa  
For course description, see Interdisciplinary Courses.

840. Improving Instruction in Business and Distributive Education  
Summer. 3(3-0)  
May re-enroll for a maximum of 8 credits. Experience in teaching.

Problem areas in classroom instruction: developing objectives, course construction, selection of learning activities, evaluation of student achievement, classroom equipment and layout and selection of instructional materials.

850. Teacher and the Administrative Leadership  
Fall, Winter, Spring, Summer. 3(3-0)  
Twelve credits in Education and approval of department.

Not intended for school administration majors. Theory and practice underlying administration of schools in a democratic society. Intended for educational personnel seeking to obtain information in such areas as educational organization, roles of administrative leadership in schools and communities, and teacher's roles in administration.

851. Foundations of Administration  
Fall, Winter, Spring, Summer. 3(3-0)  
430C, student teaching or clinical experience with mentally handicapped children or approval of department.

An analysis of research, trends, and programs in the area of mental retardation. Emphasis upon the relationship these factors have to problems of curriculum, teaching methods, guidance of students, and general classroom management.

852. Administration of Educational Institutions  
Winter, Spring, Summer. 3(3-0) 851A or approval of department.

Exploration of the nature and scope of responsibilities of areas in educational administration. Designed to serve as an initial application of administrative theory for those aspiring to one of the several areas.

A. Elementary School Administration  
Winter, Summer. 3(3-0)  
Twelve graduate credits in Education including 851A, 851B, or approval of department.
852. Administration of Educational Programs

Designed to promote the study of application of theory and research to specialized program areas. Persons will normally select the section allied to their major program area.

A. Audio-Visual Programs
   Winter, Summer. 3(3-0) Twelve graduate credits in Education including 851A, 851B, or approval of department.

B. Vocational Education Programs
   Summer. 3(3-0) Twelve graduate credits in Education including 851A, 851B, or approval of department.

C. Pupil Personnel Programs
   Fall, Spring, Summer. 3(3-0) 813B.

D. Administration of Special Education Programs
   Winter, Summer. 3(3-0) Approval of department.

Organization and administrative aspects of special education programming. Federal, state, intermediate and local district level programs in special education are reviewed.

855. Principles of Educational Measurement
   Winter, Spring. 3(3-0) 464 or 465; 869.

Nature of measurement and types of scales. Units, scores, norms, sampling, item analysis, batteries and profiles. Principles of reliability and validity. Use of test scores in decision making.

856. Appraisal of Individual Intelligence and Personality

A. Individual Measurement I
   Winter, Summer. 3(3-0) 464 or 465 or PSY 415; approval of department.

Fundamentals of individual intelligence measurement. Measurement of intelligence with the Stanford-Binet, Terman, Binet, project, and interpretation in an educational setting.

B. Individual Measurement II
   Fall, Spring, Summer. 3(3-0) 464 or 465 or PSY 415; approval of department.

Measurement of intelligence with the Wechsler scales. Observation, practice, supervision, and interpretation.

C. Personality Assessment in Education
   Spring. 3(3-0) 464 or 465; 913 or PSY 826.

Study of general personality structure and methods in personality assessment related to education.

867. Educational Research Methods
   Fall, Winter, Spring, Summer. 3(3-0) Approval of department.

Rationale for and methods of research in education. Emphasis is given to the identification of researchable problems and the interpretation of research studies in the student's major field.

868. Evaluation of Programs of Vocational and Practical Arts Education
   Fall, Winter, Spring, Summer. 3(3-0)

Approval of department. Evaluation principles and practices in the specialized areas of agricultural, business, home economics, and industrial education.

869. Quantitative Methods in Educational Research
   4(3-2) Approval of department.

Application of descriptive statistical techniques to educational data. Introduction to estimation and tests of hypotheses. Interpretation of statistical reports.

871. The Secondary School: Role, Function and Structure
   Fall, Winter, Spring, Summer. 3(3-0) Teaching experience in secondary school classrooms.

Examines the role, function and structure of secondary schools. Emphasizes the relationships that do and should exist with other segments of the educational enterprise as well as with external agencies, organizations and institutions.

872. The American Secondary School Student
   Fall, Winter, Spring, Summer. 3(3-0) Teaching experience in secondary school classrooms.

Focuses upon the issues and problems confronting the secondary school student as an adolescent and/or young adult. Attention is given to the relevance of school curricula and staff competencies to meeting these needs of secondary students. Emphasis will be placed upon developing guidelines for needed change.

881. Workshops in Education
   Summer. 2 to 10 credits. May reenroll for a maximum of 10 credits. Approval of department.

Laboratory approach which provides opportunities for experienced educational personnel to concentrate their study on common administrative and supervisory problems.

882. Seminars in Education
   Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Seminars in the various fields of emphasis.

883. Readings and Independent Study in Education
   Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Study on an individual or group basis in the various fields of emphasis.

884. Laboratory and Field Experience in Education
   Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Supervised graduate practicum, observation, internships, and externships in the various areas of emphasis.

899. Research
   Fall, Winter, Spring. 2 to 12 credits. Approval of department.

901D. Educational Sociology: Seminar
   Fall, Winter, Spring, Variable credit. Approval of department. Interdepartmental with and administered by the Sociology Department.
969. Quantitative Methods in Educational Research
Fall, Winter, Spring, Summer. 4(3-2) 869.
Principles and techniques in the application of inferential statistics to educational data with emphasis on the analysis of variance. Overview of correlation methods, non-parametric procedures and multi-variate techniques.

C. Experimental Design in Education.
Winter, Spring. Summer. 4(3-2) 969B.
Theory and practice in the design, analysis, and interpretation of experimental and quasi-experimental research.

982. Seminars in Education
Fall, Winter, Spring. Summer. Variable credit. Approval of department.
Seminars in the various fields of emphasis.

983. Readings and Independent Study in Education
Fall, Winter, Spring. Summer. Variable credit. Approval of department.
Study on an individual or group basis in the various fields of emphasis.

984. Laboratory and Field Experience in Education
Fall, Winter, Spring. Summer. Variable credit. Approval of department.
Supervised advanced graduate practitioners, observation, internships, and externships in the various areas of emphasis.

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

**Electrical Engineering and Systems Science**

**College of Engineering**

**Electrical Engineering**

305. Introduction to Electromagnetic Theory
Fall, Winter. 4(4-0) MTH 215, PHY 288.
Vector analysis; electrostatic fields and sources; scalar potential; Poisson's and Laplace's equations; dielectric media; capacitance; energy storage; boundary value problems in electromagnetic fields.

306. Electromagnetic Fields and Waves
Winter. 4(4-0) 305.
Magnetostatic fields and sources; vector potential; magnetic media; inductance; energy storage; time-varying fields; Maxwell's equations; energy conservation; potential theory; radiation concepts; plane waves; skin-effect; surface impedances.

311. Fundamentals of System Modeling
Fall, Winter. 4(4-0) MTH 334; PHY 288.
System measurements; signal representations; mathematical models for systems of lumped physical components; Kirchhoff's laws; linearity; impulse response; phasors, sinusoidal steady-state analysis; impedance, transfer functions.
*Effective March 1, 1969.*

312. Analysis of Linear Systems
Winter. Spring. 4(4-0) 311.
Topological constraint equations; linear graph theory and its application to modeling electrical, mechanical, hydraulic, and other systems; state models for general systems; numerical and analytical solutions.

313. Analysis of Large Scale Systems
Spring, Summer. 4(4-0) 312.
Solution of state models by functions of a matrix, stability, pulse and frequency response characteristics, analysis by Laplace and Z transforms, subassemblies of multi-terminal components.

322. Properties of Semiconductors
Winter. Spring. 4(4-0) PHY 288.
Elementary principles of wave mechanics and statistical mechanics and their use in developing the basic properties of semiconductors. Study of dielectric and magnetic properties of materials.

323. Solid State Devices
Spring, Summer. 4(4-0) 322, 311 or approval of department.
Formation and properties of a p-n junction. Fabrication and characteristics of transistors; terminal and thermal properties; biasing circuits.

345. Instrumentation and Computation Laboratory
Fall, Winter, Spring. 4(2-2) PHY 288.
Signal measuring and generating devices; accuracy and error considerations in laboratory measurements; terminal characteristics of components from measurements; use of analog computers.

347. Electrical Properties Laboratory
Spring, Summer. 3(1-0) 323, 345.
Investigation of dielectric and magnetic properties, contact voltage, Hall effect, energy gap and drift mobility. Transistor fabrication, evaluation, and biasing.

403. Special Problems
Fall, Winter, Spring, Summer. 1 to 4 credits. Approval of department.
Investigation of a topic in electrical circuits or systems compatible with the student's prerequisites, interest, and ability.

415. Control Systems
Fall. 3(3-0) 313 or M E 325; MTH 334.
Formulation of automatic control problems; review of modeling method; specifications; controllability and stability; controller design via root locus and state-vector methods; survey of digital control.

416. Control System Design
Winter. Spring. 4(3-0) 415.
Realization of linear controllers; consistent models for plant and computer sampling; algorithms for digital control; organization of digital controllers; simulation of control systems.

417. Static Optimization
Spring. 3(3-0) MTH 214, 334.
Mathematical formulation of engineering steady-state optimization problems; linear and quadratic performance functions; gradient methods, direct search, simulation, and introduction to dynamic optimization.

418. Introduction to Network Synthesis
Spring. 3(3-0) 311.

425. Small-Signal Electronics
Fall. 3(3-0) 323.
Determination of small-signal parameters and their interaction. Small-signal amplifier voltage, current, and power amplification. Stability, noise, and transient effects.

426. Large-Signal Electronics
Winter. 4(3-3) 425.
Design and analysis of simple Class A, B, and C power amplifiers and of complementary and quasi-complementary amplifiers. Servo and operational amplifiers. Experiments on single and multistage signal and power amplifiers.

427. Computer Electronics
Spring. 4(3-3) 428.

435. Guided Transmission Systems
Fall. 3(3-0) 366.
Guided wave theory; classification of modes, mode impedance, propagation constant, wave velocities, traveling and standing waves; transmission lines; normal models in cylindrical waveguides; waveguide components; EM resonators.

436. Microwave Networks and Antennas
Winter. 4(3-3) 352.
Circuit theory for wave guiding systems; equivalent circuits and currents; impedance determinations; scattering matrix; excitation and coupling, radiating systems; linear antennas; arrays; impedance; radiation fields; microwave antennas.

437. Field-Charged-Particle Interactions
Spring. 4(3-3) 436.
Dynamics of charged particles in electric and magnetic fields; microwave generation; ionospheric waves; klystron; traveling wave tubes; gas discharges; plasmas; plasma parameters; sheet formation; EM waves in plasma; five laboratory exercises.

455. Communications Systems
Fall. 3(3-0) 313.
Study of systems for transmitting information at high frequencies over long distances. Relations between system parameters, such as bandwidth and signal-to-noise ratio, to performance of AM, FM, and digital communication systems.

456. Information Transmission
Winter. 4(3-3) 455.
Application of probability theory to the theoretical study of information transmission, Entropy and channel capacity as a basis for comparing modulation schemes.

457. Communication Theory
Spring. 4(3-3) 456.
Analysis of systems processing noise-like signals, including models for communication channels. Introduction to optimum detectors for pulse communication systems.