855. The Industrial Revolution in Europe
Winter of even-numbered years. 3 credits. 318, 324. Interdepartmental with the History Department.
The preconditions that led to the momentous changes in agriculture and industry in Europe from 1700-1914.

857. Wage Theory
Fall. 3 credits. 309, 324, or approval of department. Interdepartmental with the School of Labor and Industrial Relations.
Advanced analysis of theories of wage determination; labor market research; economic effects of collective bargaining upon the national wage structure; output, employment, distribution of national income, the price level; nature and effects of government wage policies.

858. Industrial Relations
Fall. 3 credits. 309, 324, or approval of department. Interdepartmental with the School of Labor and Industrial Relations.
Advanced analysis of theories of wage determination; labor market research; economic effects of collective bargaining upon the national wage structure; output, employment, distribution of national income, the price level; nature and effects of government wage policies.

859. Labor Legislation and Public Policy
Spring. 3 credits. 305 or approval of department.
Criteria for public policy concerning unions and collective bargaining; current problems in labor legislation; role of federal and state governments in industrial relations; decision-making process in labor legislation.

860. Economics of the Firm
Fall. Winter. Summer. 4 credits.
Graduate students in Business Administration. Not open to Economics majors.
Analysis of the firm. Problems facing management; problem of using data, relative economic and non-economic considerations. Optimal output for market; optimal combination of products, prices, competitive forces in markets affecting the firm.

861. American Economy
Fall. Winter. Spring. Summer. 4 credits. Thirty credits in MBA core program. Not open to Economics and Agricultural Economics majors.

862. Business and Public Policy
Winter. Spring. 4 credits. 860 or approval of department. Not open to majors.
Problem of government regulation of business: Economic models which relate to regulation. Regulatory legislation, regulatory bodies and alternatives available.

876. Statistical Inference in Economics I
Fall. 3(3-0) 812A or 801; 877 443 or 883; or approval of department. Interdepartmental with the Agricultural Economics, and Statistics and Probability Departments.

877. Statistical Inference in Economics II
Winter. 3(3-0) 876 or approval of department. Interdepartmental with the Agricultural Economics, and Statistics and Probability Departments.

878. Statistical Inference in Economics III
Spring. 3(3-0) 877 or approval of department. Interdepartmental with the Agricultural Economics, and Statistics and Probability Departments.
Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and applied econometric research.

880. Organization and Control in the Political Economy: Institutions and Theory
Winter. 4(4-0) Interdepartmental with the Department of Management.
Organization and technique in choice and implementation of economic (especially planning, programming) functions of political authority.

881. Organization and Control in the Political Economy: Selected Problems
Spring. 3(3-0) Approval of instructor. Interdepartmental with and administered by the Department of Management.
Analysis of role and tasks, appropriate techniques and organizational structures of political agencies in planning and management of complex programs.

895. Graduate Reading in Economics
Fall, Winter, Spring, Summer. Variable credit.

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

911. Theory of the Firm and the Consumer
Fall, Summer. 3(3-0) 812 or approval of department.
Imperfect markets, rational behavior and other advanced topics.

912. Activity Analysis in Economic Theory
Winter. 3(3-0) Approval of department.
Linear programming; with an introduction to the theory of games. Production with fixed technical preparations.

913. General Equilibrium Economics
Winter. 2(2-0) 813 or approval of department.
General equilibrium economics; statics and dynamics. General equilibrium economics involving time and risk. Integration of micro-theories of production, consumption and markets with the macroeconomic variables. Dynamics as development through time.

914. Welfare Economics
Spring. 3 credits. 812 or approval of department.
Individual values, Pareto optimality and social welfare.

915. Economic Dynamics
Spring. 3(3-0) 811 and 813 or approval of department.
Models of economic behavior over time with emphasis on stability conditions, the trade cycle, and economic growth.

972. Methodological Approaches to Research
Fall of even-numbered years, Summer of odd-numbered years. 3(3-0) Two terms of graduate study in social science or approval of department. Interdepartmental with and administered by the Agricultural Economics Department.
Selection, planning and conduct of research. Alternative research approaches. Role of theory, beliefs and values. Critical appraisal of research studies.

990A. Monetary Theory and Policy Workshop
Winter, Spring. 3 to 16 credits. 812, 814, or approval of department.
Critical evaluation of research reports by staff and other students. Students writing doctoral dissertation in the appropriate areas are encouraged to participate in workshop and may do so while registered for 999.

990B. Industrial Organization and Public Policy Workshop
Fall, Winter, Spring. 3 to 16 credits. 812, 821A, or approval of department.
Critical evaluation of research reports by staff and other students. Students writing doctoral dissertation in the appropriate areas are encouraged to participate in workshop and may do so while registered for 999.

990C. Mathematical Economics and Econometrics Workshop
Fall, Winter, Spring. 3 to 16 credits. 812A, 822, or approval of department.
Critical evaluation of research reports by staff and other students. Students writing doctoral dissertation in the appropriate areas are encouraged to participate in workshop and may do so while registered for 999.

990D. Economic Development Workshop
Fall, Winter, Spring. 3 to 16 credits. 850, 851, 852 or approval of department.
Critical evaluation of research reports by staff and students. Students writing doctoral dissertation in Development are encouraged to participate in workshop and may do so while registered for 999.

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

ED
College of Education

101. Introduction to Teaching
A. Elementary Education.
Fall. Winter, Spring. 3(3-4) Approval of department.
Teaching profession. American educational heritage, teaching of children and youth, preparation and opportunities.
124. Introduction to Careers in Vocational and Practical Arts Education

Opportunities in teaching agriculture, business, home economics, or industrial education 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 machinist, finishing. Designed to exemplify, in both organization and equipment, desirable practices in today's secondary schools.

200. Individual and the School
Fall, Winter, Spring, Summer. 5(3-2)
Sophomores. Must be admitted to a teacher education program. 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) 141B or 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(0-6) 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 enameling, lapidary, ceramics, 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.

312. Human Growth and Development
Fall, Winter, Spring, Summer. 4(2-4) 200. 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
Basic scope, scale, 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(0-7) 200. September experience, 3.0 scholastic average must be taken concurrently with or prior to courses in 325 series.

B. ELEMENTARY MATHEMATICS AND SCIENCE
Fall, Winter, Spring, Summer. 3(0-6) Concurrently with 321A, 321B; MTH 201; B S 202, PHS 203.

C. ELEMENTARY LANGUAGE ARTS AND SOCIAL STUDIES
Fall, Winter, Spring, Summer. 3(0-6) Concurrently with 321A, 321B.

325A. Methods of Teaching Reading in the Elementary School
Fall, Winter, Spring, Summer. 3(0-6) 200. Juniors. Methods and materials of instruction of reading at elementary level. Analysis of learning and teaching problems, and study of concrete materials and classroom approach. 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(0-6) 200. Juniors. Course to acquaint prospective grade 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(0-6) 200. 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(0-6) 200. Juniors; SS 233.

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) 200. Juniors; MTH 201. Presents methods and materials 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) 200. Juniors, N S 193; B S 202; PHS 203. 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(3-2) Instrumental music major.
Instructional instruction program at elementary level.

327. Methods of Teaching—Secondary Common Elements
Fall, Winter, Spring, Summer. 2(2-0) 260; a subject area methods course 327A to 327G concurrently.

Instructional issues common to all subject areas. Selection of instructional techniques based on teacher values and belief systems, learner needs and characteristics, and sound education principles and policies.

327A-V. Methods of Teaching—Secondary Subject Areas
Specific of classroom instruction in the various subject matter fields. Selection of instructional techniques based on sound and current methods and philosophy, needs and characteristics of learners, and sound education principles and policies.

A. AGRICULTURE.
Fall, Winter. 3 credits. 200; 327 or concurrently.

B. ART.
Fall, Winter, Spring. 3 credits. 200; STA 303, 320, 327 or concurrently.

C. BUSINESS AND DISTRIBUTIVE EDUCATION.
Fall, Winter. 3 credits. 200; 327 or concurrently.

D. ENGLISH.
Fall, Winter, Spring, Summer. 3 credits. 200; 327 or concurrently.

E. FOREIGN LANGUAGES.
Fall, Winter, Spring, Summer. 3 credits. 200; 327 or concurrently.

F. HEALTH.
Spring. 3 credits. 200; 337 or concurrently.

G. PHYSICAL EDUCATION.
Fall, Winter, Spring. 3 credits. 200; 327 or concurrently.

H. HISTORY.
Fall, Winter. 3 credits. 200; 327 or concurrently.

I. HOME ECONOMICS.
Fall, Winter, Spring. 3 credits. 200; 327 or concurrently.
341A. Advanced Metalwork  
Winter and Fall of even-numbered years. Spring of odd-numbered years. 3(0-6)  
Work in bench metal, sheet metal, forging, welding, plating, casting, machining of metals. Designed to provide the industrial arts teacher with sufficient background and skill to enable him to establish such a program in a secondary school.

341B. Industrial Arts Mechanics  
Winter and Fall of even-numbered years. Spring of odd-numbered years. 3(0-6)  
Approval of department.  
Work with small motors and internal combustion engines, drive and transmission devices. Designed to exemplify desirable practice in course organization and facilities for the modern secondary school.

34IC. General Electricity  
Winter and Fall of even-numbered years. Spring of odd-numbered years. 3(0-6)  
Approval of department.  
Low voltage wiring, household devices and appliances, motor and general maintenance, home wiring, elementary radio, and elementary television. Designed to exemplify a desirable approach to this area in the industrial education program of the modern secondary school.

400H. Honors Work for Elementary Education Majors  
Fall, Winter, Spring. 18 credits, 200; approval of elementary education honors advisor.

401. Sociology of Education  
Winter, Summer. 3(0-4) SOC 411.  
Interdepartmental with and administered by the Sociology Department.  
School as a social institution, school-community relations, social aspects of education, and structure of school society.

402. Supervising High School Publications  
Spring, Summer. 3(0-0) Juniors: non-majors. Interdepartmental with and administered by the School of Journalism.  
Staff organization, makeup, illustrations, copy preparation, advertising, and editorial policies of school newspapers and yearbooks.

410. Instructional Design and Technology  
Fall, Winter, Summer. 3 to 4 credits.  
Students design plans for implementing instruction via systems approach and application of learning principles.

411. School Learning I  
Fall, Winter, Spring. 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. 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)  
Apres de l'An. Students prepare for leadership roles and responsibilities by encouraging the development of skills and techniques consistent with the principles of our democratic society.

418. Selection of School Library Materials  
Winter. 321C, 424; ASC 454.  

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.

426B. Teaching of Geography in Elementary and Junior High Schools  
Summer. 3(0-0) One course in geography or approved of the Geography Department. Objectives, problems, available materials, instructional 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-occupational implications of disability for special education and rehabilitation. Emphasis on medical lectures by physicians.

429G. Laboratory Programs in Driver and Traffic Education  
Winter, Spring, Summer. 5(3-4) 429F.  
Examination of the aims, objectives and role of laboratory programs in driver and traffic education. Directed laboratory experiences with new drivers will be provided.

429H. Organization and Administration of Driver and Traffic Education  
Fall, Spring, Summer. 3(3-0) 429G.  
Organizational and administrative aspects of driver and traffic education as they relate to the total school and other specialized programs. Historical and philosophical aspects, evaluation, related professional organizations, and occupational opportunities.

429J. Personality Factors in Driver and Traffic Education  
Winter, Spring, Summer. 3(3-0) 429C, PSY 225.  
Study of behavior with emphasis on attitudes, motivation, and adjustment and their relationship to unsafe driving. Investigation of principles, and methods appropriate in identifying, understanding, and modifying unsatisfactory behavior.

429K. Fundamentals of Traffic Law  
Fall, Summer. 3(3-0) Interdepartmental with the School of Criminal Justice.  
Nature, function and application of traffic law as it applies to the safe and efficient movement of people and goods in a broadly conceived traffic accident prevention program.

430A. Education of Visually Handicapped, Blind-Deaf Children and Youth  
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 15 credits. 321C, 144 ARC 454.

430B. Education of Deaf Children and Youth
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 424 or approval of department.

430C. Education of Physically Handicapped Children and Youth
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 321C, 434 or approval of department.

430D. Education of Mentally Retarded Children and Youth
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 425A, 424 or approval of department.

430E. Education of Emotionally Disturbed Children and Youth
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. 325A, 435 or approval of department.

431. Educational Media in Instruction
Fall, Winter, Spring. 3(3-1) Juniors.

436. Student Teaching
Fall, Winter, Spring, Summer. Variable credit. 327 for secondary majors; approval of department.

441A. General Industrial Arts
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 438 or approval of department.

441B. Advanced Industrial Arts Mechanics
Winter and Fall of even-numbered years, Spring of odd-numbered years. 3(0-6) 341B, approval of department.

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

441D. Advanced Printing and Graphics
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 244D or approval of department.

441E. Advanced Industrial Arts Crafts
Winter and Fall of odd-numbered years, Spring of even-numbered years. 3(0-6) 244C or approval of department.

446. Teaching Internship
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 17 credits. 321A.

447. Advanced Reading
Fall, Winter, Spring, Summer. 3(3-0) Juniors.

450. School and Society
Fall, Winter, Spring, Summer. 3(3-0)

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

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

471A. Instructional Systems in Business and Office Education
Fall, Spring. 3(3-2) 300, 327C concurrently or approval of department.

471B. Instructional Systems in Distributive Education
Fall, Spring. 3(3-2) 300, 327C concurrently or approval of department.

471C. Educational Foundations
Fall, Spring. 3(3-0) Approval of department.

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

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

480. Interdisciplinary Courses
Fall, Winter, Spring, Summer. 3(0-3) Approval of department.

500. Comparative and Cultural Foundations of Education
A. PHILOSOPHY OF EDUCATION
Fall, Winter, Spring, Summer. 3(3-0) Approval of department.

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

502. Research in the Facilities, Materials, and Organization of Special Needs Schools
Fall, Winter, Spring, Summer. 3(0-6) Approval of department.
State and its foreign antecedents. 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 on foreign countries.

C. Educational History: Plato to Locke. Winter, 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 Plato’s Republic, Aristotle’s Nicomachean Ethics, Comenius’ Orbis Sensum, and Rousseau’s Emile. 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 Plato’s Republic, Aristotle’s Nicomachean Ethics, Comenius’ Orbis Sensum, and Rousseau’s Emile. Works by Aristotle, Comenius, Locke, and others examined.

E. Education in the Western World. Fall, Summer. 3(3-0) Approval of department.

Comparative study of educational systems and philosophies in 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.

Emphasis upon current trends in comparative and international education. Analyzed and evaluated the relevance of research with special attention to techniques of selection and organization of programs. Special emphasis on the functions and role of educational planning and institution building, including the use of international methods in their application to educational problems.

III. Higher Education

111. School Learning II. Winter, Spring, Summer. 3(3-0) 410 or 411.

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

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

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

113. Social and Emotional Behavior in the Classroom. Summer. 3(3-0) 813.

Survey of research on school class as a social group; the development of attitudes and values.

115B. Principles of Guidance and Personnel Services. Fall, Winter, Spring, Summer. 3(3-0) 315B.

Survey of personnel 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.

115C. Student Personnel Work in Higher Education. Fall, Summer. 3(3-0) 315C.

Overview of student personnel services in colleges and universities. Philosophy, organization, and administration of the personnel programs at this level and of specific services provided. Opportunity to visit and study college personnel programs.

815D. Introduction to Rehabilitation Counseling. Fall. 3(2-4) Open to rehabilitation counseling majors only. Overview of techniques and orientation to the Michigan Division of Vocational Rehabilitation. Rehabilitation counseling pre-practicum experience with Michigan Department of Vocational Rehabilitation.


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, orientations, and 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. Procedures 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 their own interaction and motives. Diadactic content related to experiences of the course, techniques, and materials.

D. Procedures in Counseling.

Fall, Winter, Spring, Summer. 3(3-0) 815B.

444, 816B.

Diagnosis and interpretation of case study materials. Role-playing the interviewing interviewee procedure. Consideration of basic issues in counseling. Practice in test interpretation.

820. Principles of Curriculum Improvement. Fall, Winter, Spring, Summer. 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. Fall, Winter, Spring, Summer. 3(3-0) 821A.

Approaches to curriculum construction; organization and function of personnel; initiating and evaluating curriculum change; curriculum research.

821B. The Core Curriculum. Winter. 3(3-0) 821B.

Critical study of existing core programs. Special attention to techniques used and organization of core materials and to cooperative planning of units of work. At least one resource unit developed by students.

821C. Work Experience in the Curriculum. Fall. 3(3-0) 821C.

Work experience in schools, colleges, agencies, and industries; 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.

Purpose, 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 at a laboratory for evaluating ways and means of procedures.

822E. 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.

822C. Curriculum Construction in Industrial Education. Winter, Summer. 3(3-0) Approval of department.

Planning and organization of school shops in terms of adequacy, adaptability, efficiency, economy, and safety.

822N. Principles and Programs of Vocational Education and Practical Arts. Fall, Summer. 3(3-0) 822N.

Principles of vocational and technical education, comprehensive school program characteristics, program planning. Special emphasis is given to programs in agriculture, distributive, home economics, industrial, and business education. For vocational and practical arts teachers and school directors.

822P. Coordination in Occupational Training Programs. Fall, Winter. 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 educational programs.

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 federal governmental and private agencies in manpower development. Designed for majors in fields other than vocational education.

822S. Developing Occupational Curricula in Two-Year Colleges. Fall, Winter. 3(3-0) 822S.

Examination of issues and problems in occupational education. Special emphasis on the emerging role of federal governmental and private agencies in manpower development. Designed for majors in fields other than vocational education.

822T. Developing Occupational Curricula in Two-Year Colleges. Fall, Winter. 3(0-3) 822T.

Examination of issues and problems in occupational education. Special emphasis on the emerging role of federal governmental and private agencies in manpower development. Designed for majors in fields other than vocational education.
828D. Teaching Adult and Young Farmer Classes in Agriculture
Fall, Winter, Spring, 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.
Designed 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.

828A. Education of the Gifted Student
Winter, Spring, Summer. 3(3-0) Approval of department.
Study of the dimensions of giftedness—identification, characteristics, development, and sociological role and status, categorization. Law, regulations, and policies concerning gifted and talented students. Characteristics and techniques for improving reading skills.

830A. Special Methods and Materials of Teaching
Fall, Winter, Spring, Summer. 3(3-0) May re-register in different subject-matter areas for a maximum of 15 credits. Graduate student in education; experience in teaching; undergraduate course in the area; approval of department.
Develops an understanding of the basic principles and techniques of effective instruction 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) Graduate student in education; undergraduate methods course in reading; 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 appraised. Outstanding investigations dealing with problems in this area are studied and evaluated.

830D. Methods in Reading at the Secondary Level
Fall, Winter, Spring, Summer. 3(3-0) Graduate students; teaching experience; approval of department.
An analysis of the reading problems of high school and college students. Material and procedures for identifying the reading attainments and needs of the individual. Basic principles and techniques for improving reading skills.

830E. Diagnosis of Reading Disability
Fall, Winter, Spring, Summer. 3(2-2) Graduate students in education; 830C or 830D; approval of department.
Causes and types of reading retardation are considered, and procedures for working with retarded readers are examined. Laboratory experiences in administering and interpreting standardized and informal tests are provided.

830F. Clinical Practice in Remedial Reading
Fall, Winter, Spring, Summer. 3(2-2) Graduate students in education; 830C or 830D; 830E recommended, approval of department.
Students work with individual cases, observe and practice group procedures in the University reading clinic.

830G. Methods of Teaching Agricultural Mechanics
Winter. 3(3-0) Approval of department.
Methods of instruction including program planning, scheduling, use of teaching aids, management of buildings, facilities and equipment; the selection, organization, and evaluation of activities in farm mechanics.

831A. Educational Media in Instruction
Fall, Winter, Spring, Summer. 3(3-1) Students may not receive credit in both 831A and 831A.
Improvement of teaching through educational media. Learning principles; nature and application of Hans, filmstrips, slides, transparencies, flat pictures, developmental boards, models, tape recordings, radio and television, and equipment operation.

831B. Graphics Design and Use in Instruction
Fall, Winter, Spring, Summer. 3(3-1) Approval of department.

831C. Photogrophics in Instruction
Fall, Winter, Spring, Summer. 3(2-2) 831B, or approval of department.
Design, production, and use of photographic materials for instruction. Production of photographs, slides, filmstrips, overhead transparencies, sound tapes, and motion pictures. 35mm still camera (preferably a single lens reflex) required.

831D. Instructional Materials in Vocational and Practical Arts Education
Winter of odd-numbered years, Summer. 3(3-0) Approval of department.
For teachers of agriculture, business, home economics, industrial arts and vocational-industrial education. Selection, preparation and use of distinctive materials that characterize shop and laboratory instruction.

831E. Planetarium Instruction and Management
Summer. 3(4-0) Approval of department.
Planning and instruction using modern planetarium facilities.

832. Advanced Methods and Materials in Special Education
A. VISUALLY HANDICAPPED CHILDREN AND YOUTH
Spring. 3(3-0) 424, 430A, 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 modifications, and guidance of visually handicapped pupils in a variety of organizational arrangements.

B. DEAF CHILDREN AND YOUTH
Winter, Summer. 3(2-0) 430B, student teaching or clinical experience with audistically handicapped 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 adjustment, educational and vocational programs will be investigated and discussed.

C. LEARNING DISABILITIES
Winter, Summer. 3(3-0) 430C, student teaching or clinical experience with physically handicapped children or approval of department.
Approaches to remediation of learning disabilities in the classroom. Identification, evaluation, methods, materials, aids, and programs, are considered within major theoretical structures.

D. MENTALLY HANDICAPPED CHILDREN AND YOUTH.
Winter. 3(3-0) 430D, 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.

E. EMOTIONALLY DISTURBED CHILDREN AND YOUTH.
Winter. 3(3-0) 430E, student teaching or clinical experience with emotionally disturbed children or approval of department.
An analysis of the organization, operation, and supervision of classrooms in open and closed treatment settings. Specific psychoeducational procedures, instructional material modifications, and classroom management techniques will be examined and appraised from the standpoint of theory and research.

837A. Supervision of Student Teaching
Summer. 3(3-0) Approval of department.
Designed to assist supervising teachers in guidance of student teachers, in addition to a general overview of the problems of student teaching, the following topics will be studied: trends in teacher education, orientation of student teachers to student teaching, responsibilities of the supervising teacher, relationships between supervising teachers and college personnel, conferences with student teachers, and evaluation of student teaching.

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

839. Program Development in Distributive Education
A. PRINCIPLES AND ORGANIZATION
Fall, Summer. 3(3-0) Goals, historical background, and trends; contributions to individual development and manpower needs; program credit; curriculum field, post-secondary, and adult levels; overview of curriculum and instructional strategies; program evaluation.

B. CURRICULUM DEVELOPMENT
Winter, Summer. 3(3-0) 839A or approval of department.
Adapting content of marketing and related disciplines to develop courses in marketing; selection of learning experiences; materials and media; development of performance goals related to course objectives; scope and sequence patterns.

C. INSTRUCTIONAL STRATEGIES
Spring, Summer. 3(3-0) 839A and 839B or approval of department.
Selecting appropriate teaching strategies; use of the project method, laboratory simulations, on-the-job training, youth organizations, and other methods; evaluation of student achievement.
840. Improving Instruction in Office Subjects

Improving instructional processes through research findings, readings, and experience; objectives, scope and sequence, diagnosis of learning difficulties, selecting learning activities, evaluating achievement, selecting materials, and equipment.

A. Typing and Office Procedures
   Summer, 3(3-0) Experience in teaching.

B. Shorthand and Transcription
   Summer, 3(3-0) Experience in teaching.

C. Data Processing
   Summer, 3(3-0) Experience in teaching.

841. Driver and Traffic Education

A. Innovations in Driver and Traffic Education
   Fall, Summer, 3(3-0).
   Explanation of the broad spectrum of innovations in driver and traffic education. Particular emphasis will be placed on your adoption and application for improving classroom and laboratory instruction.

B. The Highway Transportation System
   Fall, Summer, 3(3-0).
   Overview of the development, management and operation of the highway transportation system and its implications for the traffic safety educator.

C. Principles of Traffic Communications
   Winter, Summer, 3(3-0).
   Specialized problems involved in traffic safety communications in a transportation-oriented society. Design and manipulation of the communication process to better understand and influence traffic behavior. Planning public information and community support programs.

D. Motor Vehicle Administration
   Spring, Summer, 3(3-0).
   Functions of motor vehicle administration in highway traffic administration, Driver licensing, motor vehicle inspection, vehicle titling and registration, and financial responsibility as legal and administrative methods of driver and vehicle control.

842A. Curriculum and Program Planning

823B. Summer, 3(3-0).

Needs and goals in education and manpower training for business, general business and economic education, program structure, professional and youth organizations, related legislation and historical background.

842B. Contemporary Issues in Education for Business

Summer, 3(3-0).
Twenty-four graduate credits or approval of department.

Analysis and discussion of selected issues relating to: 1. education for business—business structure, manpower needs, legislation, curriculum, training by government and business; 2. curriculum and instruction; Emphasis upon problem-solving and extensive reading.

842C. Theory of Instruction in Business and Distributive Education

(Fall 940.) Summer, Spring, 3(3-0)
Graduate course in learning theory or approval of department.

Analysis of research and literature in learning theory and application to problems: self-instructional programming, selection of learning activities and materials, skill building, measurement and curriculum. Emphasis upon independent study in selected specializations.

842D. Seminar-Research in Business Education

Summer, 2 to 8 credits. Prior course in research or approval of department.

Emphasis on review of research and development projects and application to business education programs; study of design particularly to student's personal research interests.

843. Program Development in Office Education

A. Strategy and Structure
   Fall, Summer, 3(3-0)
   Twelve graduate credits in Business or Vocational Education or approval of department.

Criteria of vocational office education planning/organizing a curriculum pattern including block-time and senior intensive; content scope and sequence; program evaluation; special attention to legislation and curriculum research.

B. Classroom Systems
   Winter, Summer, 2(2-0)
   Approval of department.

The initiation of new classroom systems in office education, the scope and sequence of office education systems, their curriculum content and instructional objectives, Emphasis on follow up and evaluation design.

C. Seminar
   Spring, Summer, 2 or 3 credits.
   Advanced graduate standing or approval of department.

Focuses as needed on current issues and problems; curriculum development projects; contemporary research. Emphasis on individual investigations and writing.

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 basic information in such areas as educational organization, roles of administrative leadership in schools and communities, and teacher's role in administration.

851. Foundations of Administration

Emphasizes basic administrative theory and research, focuses on current practice and emerging trends in such problems and issues as personnel, plant, finance, community school programs, and instructional improvement. Intended primarily for those actively preparing for administrative positions in schools and other educational agencies.

A. Theory and Organization
   Fall, Winter, Summer, 3(3-0) Approval of department.

B. Practice and Problems
   Winter, Spring, Summer, 3(3-0) 851A or approval of department.

852. Administration of Educational Institutions

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.

B. Secondary School Administration
   Fall, Spring, Summer, 3(3-0) Twelve graduate credits in Education including 851A, 851B, or approval of department.

C. Instructional Supervision
   Fall, Summer, 3(3-0) Twelve graduate credits in Education including 851A, 851B, or approval of department.

D. Business Administration of Schools
   Winter, Summer, 3(3-0) Twelve graduate credits in Education including 851A, 851B, or approval of department.

853. 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 850 or approval of department.

B. Vocational Education Programs
   Summer, 3(3-0) Twelve graduate credits in Education including 850 or approval of department.

C. Personnel Programs
   Fall, Spring, Summer, 3-0) 815B.

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.

865. Principles of Educational Measurement

Winter, Spring, Summer, 3(3-0) 841 or 843; 863.

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.

866. Approval 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 and reliability, measurement of intelligence with the Stanford-Binet, Revised, and Wechsler scales, Observation, practice, supervision, 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; 813 or PSY 826.

Study of general personality structure and methods in personality assessment related to education.
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Research Methods</td>
<td>Fall, Winter, Spring, Summer. 3(0-3) Approval of department. Rational for and methods of research in education. Focus is given to the identification of researchable problems and the interpretation of research studies in the student's major field.</td>
</tr>
<tr>
<td>Evaluation of Programs of Vocational and Practical Arts Education</td>
<td>Fall, Winter, Spring, Summer. 3(0-3) Approval of department. Evaluation principles and practices in the specialized areas of agricultural, business, and industrial education.</td>
</tr>
<tr>
<td>Quantitative Methods in Educational Research</td>
<td>Fall, Winter, Spring, Summer. 4(3-0) Approval of department. Application of descriptive statistical techniques to educational data. Introduction to estimation and tests of hypotheses. Interpretation of statistical reports.</td>
</tr>
<tr>
<td>The Secondary School: Role, Function and Structure</td>
<td>Fall, Winter, Spring, Summer. 3(0-3) Teaching experience in secondary school classrooms. Examines the role, function and structure of various secondary schools. Emphasis is given to the relationships that do and should exist with other segments of the educational enterprise as well as with external agencies, organizations and institutions.</td>
</tr>
<tr>
<td>The American Secondary School Student</td>
<td>Fall, Winter, Spring, Summer. 3(0-3) 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.</td>
</tr>
<tr>
<td>Workshops in Education</td>
<td>Fall, Winter, Spring, Summer. 2 to 10 credits. May re-enroll for a maximum of 10 credits. Approval of department. Laboratory approach which provides opportunities for educational personnel to concentrate their study on common administrative and supervisory problems.</td>
</tr>
<tr>
<td>Seminars in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Seminars in the various fields of emphasis.</td>
</tr>
<tr>
<td>Readings and Independent Study in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Study on an individual or group basis in the various fields of emphasis.</td>
</tr>
<tr>
<td>Laboratory and Field Experience in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Supervised graduate practicum, observation, internships, and externships in the various areas of emphasis.</td>
</tr>
<tr>
<td>Research</td>
<td>Fall, Winter, Spring Summer. 2 to 12 credits. Approval of department.</td>
</tr>
<tr>
<td>Educational Sociology Seminar</td>
<td>Fall, Winter, Spring. Variable credit. Approval of department. Interdepartmental and administered by the Sociology Department.</td>
</tr>
<tr>
<td>Educational Psychology Seminar</td>
<td>Fall, Winter, Spring. 3(3-0) May re-enroll for a maximum of 15 credits. Doctoral candidates in educational psychology. First enrollment must be in fall. Review of major areas and critical analysis of research problems and professional issues.</td>
</tr>
<tr>
<td>Counseling Proseminar I</td>
<td>Fall. 3(3-0) Admission to doctoral study in counseling or pupil personnel administration. Orientation to counseling and pupil personnel administration. Examination of historical and philosophical bases, selection and training practices, and evaluation of outcomes. Apprentice experiences in instruction and research.</td>
</tr>
<tr>
<td>Counseling Proseminar II</td>
<td>Winter. 3(3-0) 915A. Continuation of 915A.</td>
</tr>
<tr>
<td>Rehabilitation as a Profession</td>
<td>Fall, Winter, Spring. 2 credits. Doctoral candidate. Orientation to doctoral study in rehabilitation counseling.</td>
</tr>
<tr>
<td>Methods and Materials of Instruction in Continuing Education</td>
<td>Winter, Summer. 3(3-2) Twelve credits in Education, approval of department. Difference in methods used with children and adults. Psychology of adult learner and techniques for stimulating new interests and purposes. Various methods of instruction evaluated and teaching skills demonstrated. Materials of instruction including books and pamphlets, visual and auditory aids, recorder, etc. Use of field trip as adult learning device.</td>
</tr>
<tr>
<td>Theory and Practice of Administration</td>
<td>Fall, Winter, Spring, Summer. 3(3-0) Approval of department. Administrative process as exemplified in agencies such as schools, colleges, universities, government agencies, business enterprises, and voluntary organisations. Relation of administrative theory to the practice of administration and to scientific knowledge of human relations in a free society.</td>
</tr>
<tr>
<td>Counseling Theories</td>
<td>Winter, Summer. 3(3-0) Approval of instructor. Survey of counseling theories and research with emphasis on current issues which have implications for counseling practice or for counselor education.</td>
</tr>
<tr>
<td>Psychometric Theory</td>
<td>Spring. 3(3-0) 965. 969B. Advanced theoretical aspects and derivation of formulas involved in reliability, validity, item analysis, weighting and differential prediction, sampling and norm construction, and the relation of item characteristics to test statistics.</td>
</tr>
<tr>
<td>Problems of Educational Measurement</td>
<td>Fall, Winter, 3(3-0) 965. Approval of department. Advanced consideration of the logical and philosophical bases of educational measurement. Theory of test planning and development and evaluation. Problems of test administration and scoring. Issues in test use.</td>
</tr>
<tr>
<td>Evaluation of Higher Education</td>
<td>Fall, Winter, Spring. 3(3-0) 969B. Ways in which evaluation takes place in higher education: course examinations, grading, comprehensive examinations, teacher evaluation, institutional evaluation, state surveys, and regional and national studies of higher education problems.</td>
</tr>
<tr>
<td>Advanced Research Methods in Education</td>
<td>Spring, Summer. 4(3-2) 967 and 989, or 999B. The research process in survey, clinical, and historical studies. Sampling data collection techniques and data analysis. Emphasis on non-experimental research.</td>
</tr>
<tr>
<td>Research Analysis in Personnel Work</td>
<td>Winter, Summer. 3(3-0) Approval of department. Review of research and literature in counseling and personnel services.</td>
</tr>
<tr>
<td>Quantitative Methods in Educational Research</td>
<td>Fall, Winter, Spring, Summer. 3(3-2) 969B. 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.</td>
</tr>
<tr>
<td>Experimental Design in Education</td>
<td>Winter, Spring, Summer. 3(3-2) 968B. Theory and practice in the design, analysis, and interpretation of experimental and quasi-experimental research.</td>
</tr>
<tr>
<td>Seminars in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Seminars in the various fields of emphasis.</td>
</tr>
<tr>
<td>Readings and Independent Study in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Study on an individual or group basis in the various fields of emphasis.</td>
</tr>
<tr>
<td>Laboratory and Field Experience in Education</td>
<td>Fall, Winter, Spring, Summer. Variable credit. Approval of department. Supervised advanced graduate practicum, observation, internships, and externships in the various areas of emphasis.</td>
</tr>
<tr>
<td>Counseling Pre-Practicum</td>
<td>Winter, Spring. 3(3-1) Doctoral status in college counseling or related area and approval of department. Seminar emphasizing establishing good interpersonal relationships, self-understanding, an understanding of psychodynamics, and test interpretation as preparation for assuming counseling responsibilities. Approach is didactic and experiential with limited contacts with clients.</td>
</tr>
<tr>
<td>Counseling Practicum I</td>
<td>Fall, Winter, Spring. 3(0-3) 985 or approval of department. Supervised experience working with college students in a counseling relationship. Group discussions, group supervision and observation of counseling interviews, and individual supervision.</td>
</tr>
<tr>
<td>Counseling Practicum II</td>
<td>Fall, Winter, Summer. 3(0-3) 986A. Supervised experience working with college students in a counseling relationship. Group discussions, group supervision and observation of counseling interviews, and individual supervision.</td>
</tr>
</tbody>
</table>
**Descriptions — Education of Courses**

986C. Counseling Practicum III
Fall, Winter, Spring. 3(0-3) 986B. Supervised experience working with college students in a counseling relationship in the residence halls. Individual supervision, increased client contact hours, and participation in staff activities.

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

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**ELECTRICAL ENGINEERING AND SYSTEMS SCIENCE**

College of Engineering

**Electrical Engineering**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Department</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>305</td>
<td>Electromagnetic Fields and Waves I</td>
<td>EEE</td>
<td>3-0</td>
<td>Fall, Winter. 3(3-0) MTH 215, PHY 288. Vector analysis. Electromotive fields: EM sources, scalar potential, Poisson's and Laplace's equations, dielectric media, capacitance, and energy storage. Bounday value problems for electrostatic fields.</td>
</tr>
<tr>
<td>306</td>
<td>Electromagnetic Fields and Waves II</td>
<td>EEE</td>
<td>3-0</td>
<td>Spring, Summer. 3(3-0) 306; 308. Magnetostatic fields: EM sources, vector potential, magnetic media, inductance, and energy storage. Time-varying fields and Maxwell's equations: energy conservation, potential theory, and radiation concepts.</td>
</tr>
<tr>
<td>307</td>
<td>Electromagnetic Fields and Waves III</td>
<td>EEE</td>
<td>3-0</td>
<td>Spring, Summer. 3(3-0) 306; 308 concurrently. Application of Maxwell's equation: radiation, propagation, reflection, and power flow of plane EM waves; EM boundary value problems. Transmission line theory: transient and steady-state waves, standing and traveling waves, reflections and standing-wave-ratio.</td>
</tr>
<tr>
<td>308</td>
<td>Fields and Waves Laboratory</td>
<td>EEE</td>
<td>3-0</td>
<td>Spring, Summer. 1(0-3) 306; 307 concurrently. Experimental investigation of: charged particle motion in EM fields, dielectric and magnetic properties and materials, probing of currents and charges, and propagation of transient and steady-state waves. Digital computer solutions for EM field and wave problems.</td>
</tr>
<tr>
<td>311</td>
<td>Fundamentals of System Modeling</td>
<td>EEE</td>
<td>3-0</td>
<td>Fall, Winter. 3(3-0) MTH 334; PHY 288. System measurements, signal representations, mathematical models for systems of lumped physical components, topological equations for electrical networks; linear graph theory and its application to modeling electrical, mechanical, hydraulic, and other systems.</td>
</tr>
<tr>
<td>312</td>
<td>Analysis of Linear Systems</td>
<td>EEE</td>
<td>3-0</td>
<td>Winter, Spring. 3(3-0) 311. State Models for general systems; numerical and analytical solutions.</td>
</tr>
</tbody>
</table>

*Effective March 1, 1968.*

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313. Analysis of Large Scale Systems
Spring, Summer. 3(3-0) 312. Stability, pulse and frequency response characteristics, analysis by Laplace and Z transforms, subassemblies of multi-terminal components.

321. Analog and Digital Computation Laboratory
Fall, Winter. 1(0-3) MTH 334, PHY 288; 311 concurrently. Numerical solution of electrical systems problems, component modeling by digital computer, analog computer simulation.

345. Instrumentation and Computation Laboratory
Fall, Winter. Spring. 4(3-3) PHY 288. Signal measuring and generating devices: accuracy and error considerations in laboratory measurements; terminal characteristics of components from measurements; use of analog computers.

374. Electronics I

375. Electronics II
Winter, Spring. 4(4-0) PHY 288. Voltage, current and power amplification, stability and transient effects. Oscillators, operational amplifiers.

376. Electronics III
Spring, Summer. 3(3-0) 375. Boolean algebra and logic circuits. Design, analysis, and evaluation of monostable, astable and bistable multi-vibrator circuits, logic circuits and systems. Aspects of reliability.

384. Electronics Laboratory I
Fall, Winter. 1(0-3) 374 concurrently. Experimental and measurement procedures, as appropriate to topics covered in 374.

386. Electronics Laboratory II
Spring, Summer. 1(0-3) 376 concurrently. Experimental investigation of topics covered in 375 and 376. Computer-aided analysis and design of electronic circuits.

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. 455, MTH 354. 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. 3(3-0) 415. Realization of linear controllers, consistent models for plant and computer sampling; algorithms for digital control, organization of digital controllers.

419. Introduction to Network Synthesis
Spring. 3(3-0) 313. Overview of specification, approximation, synthesis. Physical realizability of passive two element kind one-port and two-port functions. Foster and Cauer one-port syntheses. Lattice, ladder and cascade two-port syntheses. Selected active network synthesis.

435. Guided Transmission Systems
Fall. 3(3-0) 308. Electric circuit theory from EM field theory. Guided wave theory: normal modes, propagation characteristics, power transmission, wave impedances, traveling and standing waves, rectangular and circular waveguides. Electromagnetic resonators: frequency and Q.

436. Microwave Networks and Antennas

437. Microwave Electronics and Plasma
Winter. 3(3-0) 436; 439 concurrently. Microwave transmission and radiation laboratory. Measurement of frequency, wavelength, standing waves, impedance, and power. Experiments on transmission lines, waveguides, cavity resonators, microwave circuits, and circuit and radiation properties of antennas.

439. Microwave Electronics and Plasma Laboratory
Spring. 1(0-3) 435; 439 concurrently. Experimental investigations on topics from 437. Laboratory experiments on klystron characteristics, traveling wave amplifier, microwave semi-conductor oscillator, plasma measurements, and plasma-field interactions.

455. Deterministic Communication Systems
Fall. 3(3-0) 374 or approval of department. Communication systems. Representation of signals in time and frequency domain. Processing of signals by linear, simple nonlinear and time-variant systems. Linear and nonlinear analog and digital modulation and demodulation; for example, AM, FM, PCM.

456. Applied Probability in Communication Theory
Winter. 3(3-0) 455 or approval of department. Probability theory as applied in the study of communication systems. Representation of random signals and noise as stochastic processes. Autocorrelation and spectral density.

457. Introduction to Statistical Communication Theory
Spring. 3(3-0) 456; 467 concurrently. Representation, processing and filtering of random signals. Performance of analog linear and nonlinear modulation systems with noise. Optimal digital communication systems.