

COURSE DESCRIPTIONS

Following are descriptions of many courses required of, or elected by, civil engineering undergraduates. Excluded from this list are the University Studies courses. Credit hours are enclosed in parenthesis following the course title. The terms during which the courses normally are offered are given for courses offered by the Department of Civil Engineering.

ACC 201 Principles of Accounting (3)

An introduction to accounting concepts and principles involved in the preparation of financial reports for internal and external use. Prereq: Sophomore standing.

BIO 208 – Principles of Microbiology (3)

Fundamental concepts of microbiology. The nutrition, physiology, genetics, molecular biology of microorganisms, and their roles in nature and in infection and immunity will be studied. Prereq: BIO 150-153; organic chemistry recommended.

CHE 105 General College Chemistry I (3)

A study of the principles of chemistry and their application to the more important elements and their compounds. Prereq: Math ACTE of 23 or above (SAT 540 or above), or MA 109 (or Math placement test), or Chemistry placement test, or the Community College course CHE 102R or CHM 100. Only 6 total hours of the 12 hours of CHE 104, 105, 106, 107 are permitted for credit toward a degree.

CHE 107 General College Chemistry II (3)

A continuation of CHE 105. A study of the principles of chemistry and their application to the more important elements and their compounds. Prereq: CHE 105 or both CHE 104 and CHE 106. Only 6 total hours of the 12 credit hours of CHE 104, 105, 106, and 107 are permitted for credit toward a degree.

CHE 230 – Organic Chemistry I (3)

Fundamental principles and theories of organic chemistry. Prereq: CHE 107 and 115.

CHE 236 – Survey of Organic Chemistry (3)

A one-semester course in organic chemistry. Not open to students who have already completed both CHE 230 and 232. Prereq: CHE 115.

CE 106 Computer Graphics and Communication (3) F, Sp

Introduction to the use of scale, dimensioning, and orthographic projections. Graphical solution of spatial problems. Integrated application of computer graphics. Lecture, two hours; laboratory, 4 hours per week. Prereq: High school algebra and trigonometry or equivalent.

CE 120 Introduction to Civil Engineering (1) F, Sp

An introduction to the Civil Engineering Profession and the use of computer hardware and software in CE systems analysis and design. Presentations will be used to illustrate the conception, design, construction and operation processes. Sample problems in the various technical areas of civil engineering will make use of existing computer software packages and spreadsheets.

CE 199 Topics in Civil Engineering (Subtitle Required; 1-4) Occasionally

An experimental, topical, department, or interdisciplinary course devoted to a special topic of current interest to civil engineering and approved by the Department Chair and the Dean of Engineering. May be repeated to a maximum of eight credits, but not more than four credits may be earned under the same title. Prereq: Consent of instructor.

CE 211 Surveying (4) F, Sp

A comprehensive course in the art & science of surveying as applied to Civil Engineering, including the use and care of surveying instruments, measurement of horizontal & vertical distances, angles & directions, collection of ground and underground data for the design and layout of roads, buildings, various mineral workings and other structures; and some aspects of the precise determination of position and direction for survey control. Lecture 3 hours, laboratory 3 hours. Prereq: CE 106, CE 120, and MA 114.

CE 303 Introduction to Construction Engineering (4) F, Sp

The study of the planning, administration, management, and cost of construction projects and an introduction to the methodology utilized in executing specified designs. Emphasis is placed on the organization of construction firms, development of construction documents, theory of estimating and quantity take-off, contractual and management systems, scheduling project administration, and inspection of construction operations. Prereq: Registration in College of Engineering and CE 106

CE 331 Transportation Engineering (3) F, Sp

An introduction to transportation and traffic engineering. Development of transportation systems in the United States. Route geometric and design. Traffic flow characteristics and control. Planning financing and economic analysis of transport facilities. Prereq: Registration in College of Engineering.

CE 341 Fluid Mechanics (4) F, Sp

Fundamental principles of fluid flow. Includes fluids at rest (hydrostatics) and fluids in motion. Continuity, momentum and energy relations, ideal and viscous fluids. Emphasis on incompressible fluids (liquids). Prereq or concur: Registration in College of Engineering.

CE 351 Introduction to Environmental Engineering (3) F, Sp, Sum

Overview of environmental chemistry and microbiology, water quality, water and wastewater treatment, risk assessment, hazardous waste management, and air pollution control. Emphasis on the basic science and engineering principles required to understand both natural and engineered systems, as well as the engineering approach to understanding the natural environment and specific treatment and mitigation methods. Prereq: CHE 107, MA 214, PHY 231, and Registration in the College of Engineering or consent of instructor. (Same as AEN/CME/MNG 351)

CE 381 Civil Engineering Materials (3) F, Sp

A study of the microscopic and macroscopic structures and properties of materials used in civil engineering construction with emphasis on the relationships of their basic physical and mechanical properties to engineering design and application. Written reports and oral presentation of results will be required. Lecture, two hours; laboratory, three hours. Prereq or concur: EM 302 and Registration in College of Engineering.

CE 382 Structural Analysis (3) F, Sp, Sum

Analysis of statically determinate planar structures including trusses, beams and frames. Influence lines for truss and beam structures. Displacement calculations using virtual work principles. Introduction to statically indeterminate structures including approximate analysis and one "exact" classical analysis method. Introduction to plastic analysis of beam structures. Prereq: EM 302 and Engineering Standing.

CE 395 Independent Work in Civil Engineering (1-6) F, Sp, Sum

Individual work on some selected problem in the field of civil engineering. May be repeated for a maximum of six credits. Prereq: Engineering standing or consent of department chair and the instructor.

CE 401 Seminar (1) F, Sp

A discussion of the ethical and professional aspects of civil engineering practice. Concepts of loss prevention and conflict resolution. Structured small group discussion, oral presentations, and role playing. Lecture, two hours per week. Prereq: Engineering standing and senior classification.

CE 403 Construction Methodology (3) Sp

A study of the methodology used in heavy construction and building construction with an emphasis on equipment selection, productivity, concrete formwork design and building systems. The importance of cost, safety, and quality is stressed. Exercises on plan reading are also included. Prereq: CE 303, CE 381, and engineering standing.

CE 429 Civil Engineering Systems Design (4) F, Sp

Course is intended to be a very unique and, hopefully, rewarding, experience for seniors. The class is specifically designed to synthesize much of what you have been exposed to in individual civil engineering courses into a civil engineering design-build project. The course will introduce students to the process of project development including planning, design, and construction. Students will work in teams to complete the course requirements. Prereq: Final semester of senior year.

CE 451 Water and Wastewater Treatment (3) Sp

Fundamentals of the design and operation of water and wastewater treatment facilities. Prereq: CE 341, CE 351 and engineering standing or consent of instructor.

CE 460 Fundamentals of Groundwater Hydrology (3) F

The first course in the physics of saturated flow in porous media. Topics include groundwater occurrence, Darcian flow, well hydraulics, flow nets and layered systems flow. The basic concepts of pollutant movement and unsaturated flow are introduced and case studies are analyzed. Prereq: ME 330 or CE 341 or consent of instructor. (Same as BAE 438G)

CE 461G Hydrology (3) F, Sp

A study of the laws governing the occurrence, distribution, and movement of water and contaminant substances in watershed systems. Meteorological considerations, precipitation, evaporation, transpiration, infiltration, streamflow, hydrograph analysis, flood routine, groundwater flow, and frequency analysis. Principles and mathematical models describing the propagation of contaminants in rivers, lakes, soils, and groundwater. Prereq: CE 341 and engineering standing or consent of instructor.

CE 471G Soil Mechanics (4) F, Sp

A study of the strength, deformation and hydraulic properties of soils and their relationship to settlement, stress distribution, earth pressure, bearing capacity and slope stability. Written and oral presentations of student projects will be required. Lecture, two hours; laboratory, three hours. Prereq: EM 302; Prereq or concur: GLY 220; and engineering standing or consent of instructor.

CE 482 Elementary Structural Design (3) F, Sp, Sum

Application of principles of solid mechanics to the design of steel, timber, and reinforced concrete members and structures. Emphasis is on basic ideas and their application to practical design of relatively simple structures according to the building codes. Credit may not be used to satisfy degree requirements if credit is earned in CE 486G or CE 487G. Prereq: CE 382 and engineering standing.

Note: CE 482 contains elements of Concrete and Steel design. It therefore duplicates parts of CE 486G and CE 487G. For that reason students cannot fulfill BSCE degree requirements with CE 482 if they receive credit for one or more of the listed courses and vice-versa.

CE 486G Reinforced Concrete (3) F

Theory and design of beams, slabs, girders, columns and footings as related to building frames and bridges. Introduction to prestressed concrete, elastic design and ultimate strength design. Prereq: CE 382; Coreq: CE 487G; and engineering standing or consent of instructor.

CE 487G Steel Structures (3) F

Design criteria and methods. Behavior and design of structural steel beams, columns, beam-columns, and bolted and welded connections. Analysis and design of composite steel/concrete beams. Torsion of open and closed sections. Considerations of instability of beams, columns, and plates in design. Plastic analysis and design of continuous structures. Introduction to computerized structural analysis and design. Prereq: CE 382; Coreq: CE 486G; and engineering standing or consent of instructor.

CE 499 Topics in Civil Engineering (Subtitle required; 1-4) Occasionally

Devoted to a special topic of current interest in civil engineering. May be repeated to a maximum of eight credits, but only four credits may be earned under the same title. A particular topic may be offered at most twice under the CE 499 number. May be counted as technical or design elective with consent of department chair. Prereq: Variable, given when topic is identified, plus engineering standing.

CE 503 Construction Estimating (3) F

This course investigates the principles of predicting and controlling the cost of construction projects. Items studied include feasibility studies, preliminary and detailed estimating, budgeting, monitoring and variance analysis. Computer applications for construction estimating will be stressed. Prereq: CE 403 and engineering standing or consent of instructor.

CE 505 Construction Project Planning and Management (3) F

A study of the planning process and fundamental management procedures for construction projects. Special attention given to: planning of methods and resources; use of schedules; monitoring time; managing cash flow and costs; and overall project administration and record keeping. Prereq: CE 403 and engineering standing or consent of instructor.

CE 517 Boundary Location Principles (3) Occasionally

Procedures for locating or relocating the boundaries of real property; records searching, technical aspects of field work, preparation of descriptions and survey reports, land data systems, legal aspects, special problems. Prereq: CE 211 and engineering standing or consent of instructor.

CE 518 Advanced Surveying (3) Occasionally

Principles of precise survey procedures in triangulation, trilateration, traverse and leveling; adjustment computations; theory and practice of electronic distance measurement; basic geodesy and state plane coordinate systems; applications to the horizontal and vertical control of engineering projects; review of modern land surveying problems and procedures. Lecture, two hours; laboratory, three hours. Prereq: MA 214, CE 211 and engineering standing.

CE 525 Civil Engineering Applications of Geographic Information Systems (3) Occasionally

CE 525 focuses on GIS as a tool in Civil Engineering. The terms and concepts related to Geographic Information Systems are introduced. The management of spatial databases, particularly those related to Civil Engineering, is covered. Student will collect data using a Global Positioning System (GPS). Students will be required to use the GIS Arcinfo to solve a specific individual spatial problem that they propose based on several Civil Engineering databases available to them. Lecture, two hours; laboratory, three hours per week. Prereq: Engineering Standing and one of the following: CE 331, CE 341, or CE 471G.

CE 531 Roadway Geometric Design and Operations (3) F

Course focuses on the design aspects of rural and urban highways and the procedures used to translate these aspects into route design. First, a review of geometric design concepts and controls is presented. Second, specific components of roadway design affecting horizontal and vertical alignment are reviewed and students are exposed to design principles affecting these components. Third, software packages for designing roadway components and evaluating traffic operations on rural and urban (free-flow) roadway systems are presented and used. A group design project will be completed consisting of the preliminary design of a rural roadway.

CE 533 Railroad Facilities Design and Analysis (3) Sp

Principles of railroad location, construction, rehabilitation, maintenance, and operation with emphasis on track structure design and analysis, bridges and bridge loading, drainage considerations, track geometry effects, and operating systems analysis. Prereq: CE 331, CE 381, CE 382; Prereq or concur: CE 471G; and engineering standing.

CE 534 Pavement Design, Construction and Management (3) F

Design, analysis, construction and management of flexible and rigid pavements, stresses and strains, pavement materials, subgrade soil stabilization; bases and subbases, quality control, drainage, pavement type selection and pavement management. Prereq: CE 381; Prereq or concur: CE 471G; and engineering standing.

CE 539 Transportation Systems Design (3) Sp

Introduction to processes and procedures for transportation systems design. Policy design, functional design and sizing, operation and schedule design, location and geometric design, supporting structures design as they individually and collectively affect the efficacy of transportation systems. Written and oral presentation of student projects will be required. Lecture: three hours; laboratory: three hours per week. Prereq: CE 331 and engineering standing. Prereq: CE 531

CE 541 Intermediate Fluid Mechanics (3) F

Application of basic fluid mechanics to problems of importance to civil engineering practice. This includes pipe flow (pipe networks), open channel flow, culvert flow, flow through meters, pumps and turbines. Prereq: CE 341, CS 221 and engineering standing.

CE 542 Introduction to Stream Restoration (3) Sp

Introduction to principles of fluvial geomorphology for application in restoring impaired streams. Topics, include channel formation processes (hydrology/hydraulics), stream assessment, sediment transport, in-stream structures, erosion control, habitat, and monitoring. Prereq: CE 341 or equivalent and engineering standing or consent of instructor. (Same as BAE 532)

CE 546 Fluvial Hydraulics (3) F

Rainfall physics, principles of erosion on upland areas and construction sites, stable channel design in alluvial material, mechanics of sediment transport, river mechanics, reservoir sedimentation. Prereq: CE 461G, ME 330 or CE 341 and engineering standing. (Same as BAE 536)

CE 549 Engineering Hydraulics (3) Sp

Analysis of flow in closed conduits and natural and artificial open channels. Design of hydraulic structures. Prereq: CE 541 and engineering standing. (Same as BAE 545)

CE 555 Microbial Aspects of Environmental Engineering (3) F

This course provides the fundamental basis and underlying principles for understanding, designing, and the operation of microbially based processes. The fundamentals of bioenergetics and biogeochemical cycling of environmentally important elements and compounds. The application of these bioenergetic fundamentals for bio-production and bio-reduction of products and pollutants. Prereq: CHE 107 and Engineering Standing

CE 579 Geotechnical Engineering (3) Sp

Application of the principles of soil mechanics and structural mechanics to the design of retaining walls, bracing for excavations, footings, mat and pile foundations and to the analysis of the stability of earth slopes. Prereq: CE 471G and engineering standing.

CE 581 Civil Engineering Materials II (3) Sp

Design, evaluation and construction of Portland cement concrete and hot mix asphalt (HMA). Advanced topics related to high performance concrete and asphalt materials are covered in this course. Prereq: CE 381 and engineering standing.

CE 582 Intermediate Structural Analysis (3) Sp

Analysis of indeterminate, truss, frame and arch structures using energy principles associated with the flexibility and stiffness methods; influence line functions for indeterminate structures; and use of available computer programs for structural analysis and matrix operations. Prereq: CE 382 and engineering standing.

CE 584 Design of Timber and Masonry Structures (3) F

Current and historic design methods of buildings and their components using wood, wood products, bricks, and concrete blocks. Prereq: Courses in steel and reinforced concrete design at the senior level, or Consent of Instructor. (Same as ARC 584.)

CE 585 Civil Engineering Failures (3) F

Fundamentals of failure investigation and forensic engineering; Types of failures and patterns; Failure modes and mechanisms; Failures of constructed facilities and environmental failures; Causes of failure; Case studies and discussions on various constructed facilities; Criteria for better design to prevent failures. Prereq: CE 382 or Consent of Instructor

CE 586 Prestressed Concrete (3) Sp

Fundamental basis and underlying principles for the analysis and design of prestressed concrete. Working stress and ultimate strength design methods, full and partial prestressing. Design for shear and torsion, deflection, crack control, and long-term effects, and prestress losses. Composite beams, continuous beams, slabs, short and slender columns, precast structures and their connections. Prereq: CE 486G and engineering standing.

CE 589 Design of Structural Systems (3) Sp

Design loads and structural systems. Systems concepts in planning, analysis, design, and construction of structures. Buildings, bridges, special structures and foundations. Computer aided design and drafting (CADD) utilizing microcomputers. Written and oral presentations of student projects will be required. Lecture: three hours; laboratory: three hours per week. Prereq: CE 486G, CE 487G and engineering standing; Prereq or concur: CE 579; or consent of instructor.

CE 595 Independent Work in CE (1 – 4)

Individual work on some selected problem in the field of civil engineering. May repeated for a maximum of six credits. Prereq: Consent of department chairperson, instructor and engineering standing.

CE 599 Topics in Civil Engineering (Subtitle Required; 1-4) Occasionally

A detailed investigation of a topic of current significance in civil engineering such as: design of small earth dams, man and the environment, drilling and blasting, scheduling construction operations, construction equipment and methods, traffic safety, optimum structural design, environmental impact analysis, systems analysis in civil engineering, motor vehicle noise and its control. May be repeated to a maximum of eight credits, but only four credits can be earned under the same title. A particular topic may be offered at most twice under the CE 599 number. Prereq: Variable, given when topic is identified; engineering standing.

CME 515 Air Pollution Control (3)

Kinetics and equilibria of photochemical and “dark” atmospheric reactions. Atmospheric statics and dynamics including lapse rates, inversions, and vertical and horizontal air motion. Single and area source diffusion. Stack meteorology. Prereq: CME 320 or ME 220.

COM 252 Introduction to Interpersonal Communication (3)

This course examines basic verbal and nonverbal concepts affecting the communication process between individuals in various interpersonal contexts. Course also requires participation in written and oral activities designed to develop and improve interpersonal skills. Topics may include: perspective-taking, relationship and conversation management, effective listening, conflict management, communication climate, communication anxiety, and cultural/gender differences in interpersonal communication.

COM 281 Communication in Small Groups (3)

A study of communication processes in small group situations. Topics include conflict, leadership, and decision-making. Students will participate in group discussion and develop skills in analyzing group performance.

CS 221 First Course in Computer Science for Engineers (2)

Characteristics of a procedure-oriented language; description of a computer as to internal structure and the representation of information; introduction to algorithms. Emphasis will be placed on the solution of characteristic problems arising in engineering. Prereq: MA 113.

ECO 201 Principles of Economics I (3)

The study of the allocation of scarce resources from the viewpoint of individual economic units. Topics include household and firm behavior, competitive pricing of goods and resources, and monopoly power.

EE 305 Electrical Circuits and Electronics (3)

A service course covering electrical engineering principles for engineering or science students with majors outside of electrical engineering. Topics include: circuits analysis, power, electronics, digital logic and instrumentation. Prereq: PHY 232, MA 114.

EM 221 Statics (3)

Study of forces on bodies at rest. Vector algebra; study of force systems; equivalent force systems; distributed forces; internal forces; principles of equilibrium; application to trusses, frames and beams, friction. Prereq or concur: MA 213.

EM 302 Mechanics of Deformable Solids (3)

A study of stress and strain in deformable solids with application primarily to linear elastic materials; stress and strain transformation; simple tension and compression of axial members; torsion of shafts; bending of beams; combined loading of members; buckling of columns. Prereq: Registration in College of Engineering or consent of department chair and EM 221; Prereq or concur: MA 214.

EM 313 Dynamics (3)

Study of the motion of bodies. Kinematics: cartesian and polar coordinate systems; normal and tangential components; translating and rotating reference frames. Kinetics of particles and rigid bodies: laws of motion; work and energy; impulse and momentum. Prereq: Registration in College of Engineering or consent of department chair and EM 221 and MA 214.

EGR 199 Topics in Engineering (Subtitle required; 1-3)

An experimental interdisciplinary course devoted to a topic of interest to students in several departments of the college. May be repeated to a maximum of six credits, but only three credits may be earned under the same title. A particular topic may be offered at most twice under the EGR 199 number. Prereq: Variable, given when topic is identified.

EGR 599 Topics in Engineering (Subtitle required; 1-3)

An experimental interdisciplinary course devoted to a topic of interest to students in several departments of the college. May be repeated to a maximum of six credits, but only three credits may be earned under the same title. A particular topic may be offered at most twice under the EGR 599 number. Prereq: Variable, given when topic is identified.

ENG 101 Writing I (3)

A course in writing designed to teach students to generate and develop ideas, through significant revision, in clear, effective written English. Course includes a review of grammar, usage, punctuation, and mechanics. **Note:** Credit not available by special examination. **Advanced placement accepted.**

ENG 102 Writing II (3)

Study and practice in writing in response to written texts. Writing assignments include summary, synthesis, critique, and argumentation. Instruction in library research methods and in the conventions of academic writing. **Note:** Credit not available by special examination. **Advanced placement accepted.** Prereq: ENG 101 or equivalent.

ENG 104 Writing: An Accelerated Foundational Course (4)

An intensive course in writing emphasizing critical inquiry and research, formulation of academic writing projects, and orientation to university study. Instruction and practice in reading critically, thinking logically, responding to texts, developing research skills, writing substantial essay through systematic revision, addressing specific consequences, developing a fluent, precise, and versatile prose style, and expressing ideas in standard and correct English. Focus on topics pertinent to university disciplines, activities, and environs. Notes: (a) credit or exemption not available by CLEP or by special departmental examination; (b) exemption possible by ACT, SAT, or AP English Language exam score.

GEO 285 Introduction to Planning (3)

An introduction to the history, purpose, and objectives of planning with an emphasis on urban and regional planning, planning processes, techniques, and legislation.

GEO 305 Elements of Cartography (3)

Fundamental training in map drafting, compilation, symbolization, scales, projections, and map reduction, including emphasis on the conceptual planning and designing of maps and graphs as a medium for communication.

GEO 409G Geographic Information Systems and Science: Fundamentals (3)

Investigation of geographic information systems (GIS) and science (GIScience). Including theory and applications areas. A major portion of the course will be based on use of a current widely-used GIS computer software system. Considered will be aspects of geographic data entry and editing, spatial analysis, and map development and display. Relationship of GIS to the Global Positioning System (GPS) and satellite generated data will be addressed. Prereq: Other GIS course, instructor permission, or graduate standing.

GEO 506 Introduction to Computer Cartography (3)

A basic introduction to computer-assisted cartography. Emphasis on basic computer graphics literacy and automated techniques for spatial data acquisition, storage, processing, and output. Introduction to current workstation and desktop mapping programs. Prereq. GEO 305 or consent of instructor.

GLY 220 Principles of Physical Geology (4)

How the Earth Works: an integrated course in physical geology, covering the physical, chemical and biological processes that combine to produce geological processes. Attention is focused on plate tectonics, earth surface processes, and properties and formation of earth materials. Lab exercises emphasize identification and interpretation of geologic materials and maps. Lecture: 3 hours; laboratory: 3 hours; one field trip required.

GLY 430 Environmental Geohydrology (3)

A course dealing with the occurrence and movement of water on and beneath the land surface, and its place in the hydrosphere, emphasizing the geologic perspective. Prereq: GLY 220.

GLY 560 Geophysical Field Methods (4)

An introduction to the principles and applications of geophysics in the field. The course will present the geophysical methods used to assess the configuration and physical properties of the Earth's subsurface, as well as to explore for natural resources. Designed for geology students (upper-division or first-year graduate) and other science or engineering students without prior formal instruction in geophysics. To understand the discussions and exercises, the student should be familiar with first-year calculus and physics. Prereq: MA 113, 114; PHY 221, 213 or PHY 231, 232 or consent of instructor. MA 114, PHY 213 or PHY 232 may be taken concurrently.

HIS 106 Western Culture: Science and Technology I (3)

Presents the interactions of science and technology with the social and cultural development of Western civilization; the values in scientific inquiry as compared with other kinds of inquiry; the importance of science and technology in modifying social organization and human expectations. Emphasizes the period to the Industrial Revolution.

HIS 107 Western Culture: Science and Technology II (3)

Presents the interactions of science and technology with the social and cultural development of Western civilization; the values in scientific inquiry as compared with other kinds of inquiry; the importance of science and technology in modifying social organization and human expectations. Emphasizes the period since the Industrial Revolution.

HON 101 Freshman Colloquium (3)

From Greek and Roman antiquity to the early Christian centuries: an interdisciplinary course in intellectual history. Readings vary at the discretion of the faculty.

HON 102 Freshman Colloquium (3)

From the Middle Ages through the Reformation; an interdisciplinary course in intellectual history. Readings vary at the discretion of the faculty. Written assignments required.

HON 201 Sophomore Colloquium (3)

From the development of the modern scientific method through mid-nineteenth century industrialism: an interdisciplinary course in intellectual history. Readings vary at the discretion of the faculty.

HON 202 Sophomore Colloquium (3)

The contemporary world: an interdisciplinary course in intellectual history. Readings vary at the discretion of the faculty.

MA 109 College Algebra (3) THIS COURSE DOES NOT COUNT TOWARD THE BSCE DEGREE

Selected topics in algebra and analytic geometry. Develops manipulative algebraic skills required for successful calculus study. Includes brief review of basic algebra, quadratic formula, systems of linear equations, introduction to analytic geometry including conic sections and graphing. This course is not available for credit to persons who have received credit in any mathematics course of a higher number with the exceptions of MA 112, 123, 162, 199, 201, and 202. Credit not available on the basis of a Special Examination. Prereq: Two years of high school algebra or MA 108R.

Note: Students who earn a grade of "A" in MA 109 have a 70% probability of earning a "C" or better in MA 113. Those who earn a "B" have a 23% chance and those who earn a "C" have only a 15% chance.

MA 110 Analytic Geometry and Trigonometry (4) THIS COURSE DOES NOT COUNT TOWARD THE BSCE DEGREE

This is a course specifically designed for students intending to enroll in a calculus sequence. Topics will include trigonometric functions, exponentials and logarithms, graphs, polar coordinates, conic sections and systems of conics. Students may not receive credit for MA 110 and either MA 109 or MA 112. This course is not available to persons who have received for any mathematics course of a higher number with the exception of MA 113, 123, 201 or 202. Credit is not available by special examination. Lecture three hours; recitation, two hours per week. Prereq: Two years of high school algebra and a Math ACTE score of 23 or above, or consent of department.

MA 112 Trigonometry (2) THIS COURSE DOES NOT COUNT TOWARD THE BSCE DEGREE

A standard course. Includes trigonometric functions, identities, multiple analytic formulas, laws of sines and cosines and graphs of trigonometric functions. This course is not available for credit to persons who have received credit for any mathematics course of a higher number with the exceptions of MA 113, 115, 123, 131, 132, 162, 201, and 202. Credit not available by Special Examination. Prereq: Two years of high school algebra or MA 108R.

Note: Students who have not had the equivalent of at least 12 weeks of trigonometry in high school should enroll in MA 112 before attempting to take Calculus II (MA 114). MA 112 can be taken concurrently with either MA 109, MA 123, or MA 113.

MA 113 Calculus I (4)

A course in one-variable calculus, including topics from analytic geometry. Derivatives and integrals of elementary functions (including trigonometric functions) and applications. Lecture, three hours; recitation, two hours. Prereq: Math ACTE score of 26 or above, or MA 109 and MA 112, or consent of department.

Note: All curricula in engineering list Calculus I (MA 113) as the first course in mathematics for which credit is awarded toward an engineering degree. However, in many cases, this is not the appropriate first course for entering students to take. Please refer to the Handbook section entitled MATHEMATICS for guidance in selecting the first mathematics course that should be attempted. The importance of following the advice given by the Mathematics department cannot be overemphasized. Enrollment in a math course for which the student is unprepared is a very serious mistake, the consequences of which may never be overcome completely.

MA 114 Calculus II (4)

A continuation of MA 113, primarily stressing techniques of integration. Lecture, three hours; recitation, two hours. Prereq: High School trigonometry or MA 112; and a grade of C or better in MA 113 or MA 132.

MA 213 Calculus III (4)

A course in multivariate calculus. Topics include three-dimensional vector calculus, partial derivatives, double and triple integrals, sequences and infinite series. Prereq: MA 114 or equivalent.

MA 214 Calculus IV (3)

A course in ordinary differential equations. Emphasis is on first and second order equations and applications. The course includes series solutions of second order equations and Laplace transform methods. Prereq: MA 213 or equivalent.

MA 321 Introduction to Numerical Methods (3)

Floating point arithmetic. Numerical linear algebra; elimination with partial pivoting and scaling. Polynomial and piecewise polynomial interpolation. Least squares approximation. Numerical integration. Roots of nonlinear equations. Ordinary differential equations. Laboratory exercises using software packages available at computing center. Prereq: MA 213 and CS 221 or equivalent. Knowledge of a procedural computer language is required.

MA 322 Matrix Algebra and Its Applications (3)

Algebra of matrices, elementary theory of vector spaces and inner product spaces, the solution of simultaneous linear equations using Gaussian elimination and triangular factorization. Orthogonal projections, pseudo inverse and singular value decomposition, least squares approximation. Determinants, eigenvalues and eigenvectors, diagonalization. Prereq: MA 114.

MA 416G Principles of Operations Research (3)

The course is an introduction to modern operations research and includes discussion of modeling, linear programming, dynamic programming, integer programming, scheduling and inventory problems, and network algorithms. Prereq: MA 213 or equivalent.

MA 432G Methods of Applied Mathematics I (3)

Partial differentiation, Jacobians, implicit function theorem, uniform convergence of series, line and surface integrals. Green's and Stokes' theorems. Prereq: MA 214 or equivalent.

ME 220 Engineering Thermodynamics I (3)

Fundamental principles of thermodynamics. Prereq: PHY 231. Prereq or concur: MA 214.

MNG 303 Deformable Solids Laboratory (1)

Experimental studies of the mechanical properties of materials and structural elements. Laboratory, three hours. Prereq or concur: EM 302.

MNG 551 Rock Mechanics (4)

Determination of the physical properties of rocks, rock mass classification, stress around mine openings, strain and displacement of the rock mass, rock reinforcement and support, stress interaction and subsidence, strata control. Lecture, three hours; laboratory, three hours per week. Prereq: EM 302, MNG 303, GLY 230, and engineering standing.

PHY 231 General University Physics (4)

An advanced general course covering the mechanics of solids, liquids, and gases; heat; and sound. Lecture, three hours; recitation, one hour. Prereq or concur: MA 114.

PHY 232 General University Physics (4)

An advanced general course covering electricity, magnetism, and optics. Lecture, three hours; recitation, one hour. This course is prerequisite to a significant number of courses in this and related areas of study. Prereq: PHY 231, concur: MA 213.

PHY 241 General University Physics Laboratory (1)

An advanced general laboratory course involving experiments on the mechanics of solids, liquids, and gases; and on heat and sound. Prereq or concur: PHY 231.

PHY 242 General University Physics Laboratory (1)

An advanced general laboratory course involving experiments on electricity, magnetism, and light. This course is prerequisite to other courses in physics and related areas of study. Prereq: PHY 241; concur: PHY 232.