Department of Civil Engineering and Construction Management

The departmental goals are designed to give students state-of-the-art knowledge for professional career and life-long development skills needed to enter the fields of civil engineering and construction management while meeting all the requirements to earn a Bachelor of Science degree. The department engages in the best practices of teaching, scholarship, and service to ensure that graduates serve as ethical and highly qualified leaders of civil engineering and construction management. Students will find open doors to a dedicated and diverse faculty who are well-educated yet grounded in the practical aspects of “real world” civil engineering design and construction. The CE program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The CET program is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org, however; the CET program no longer accepts entering students. The Construction Management program is accredited by the American Council on Construction Education (ACCE), http://acce-hq.org.

Civil Engineering and Construction Management Majors


CENG 2131 Civil Engineering Fluid Mechanics
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course covers basic concepts of fluid mechanics, and the fundamentals and applications of ideal and real fluid flow. Topics include fluid statics, conservation principles, the Bernoulli equation, fluid flow in pipes, fluid flow measurement devices, open channel flow, and basic hydraulic structures.
Prerequisite(s): A minimum grade of "C" in ENGR 2231.

CENG 2231 Surveying
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Principles of the level, theodolite, electronic distance measurement (EDM), total station and global positioning systems, taping, note keeping, coordinate geometry, control surveys, triangulation, trilateration, plane coordinate systems, azimuth and topographic mapping. Laboratory includes use of level, theodolite, EDM, total station, GPS, traverse closure, level net closure, topographic mapping, measuring distances and heights using coordinate geometry calculations.
Prerequisite(s): A minimum grade of "C" in MATH 1112 or MATH 1113 or MATH 1441 and ENGR 1133 or TCM 1232.

CENG 3011 Leveling Topics in Surveying
0.1 Credit Hours. 0.1 Lecture Hours. 0.1 Lab Hours.
This is a leveling course to bridge the gap between the Surveying course required for the Civil Engineering Technology and the Civil Engineering program. It includes methods for analysis and presentation of surveying and positioning data, as well as, a comprehensive field surveying project which involves the use of level, total station, and GPS.

CENG 3131 Introduction to Environmental Engineering
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
The course is an introduction to environmental engineering. Topics include a review of the role of the United States Environmental Protection Agency (EPA) in environmental protection, mass balance, rainfall and runoff analysis, basic surface water and groundwater hydrology, water quality management, municipal solid waste and hazardous waste management, and air pollution control.
Prerequisite(s): A minimum grade of "C" in CHEM 1147.

CENG 3132 Introduction to Water and Wastewater Treatment
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
The course is an introduction to water and wastewater treatment. Topics include sources and characteristics of water and wastewater, treatment standards, selection of different water and wastewater treatment processes, design principles for treatment units in water and wastewater treatment plants, and standard laboratory tests used to control the operation of water and wastewater treatment plants.
Prerequisite(s): A minimum grade of "C" in CENG 2131, CENG 3131.
Cross Listing(s): CENG 3132H.

CENG 3132H Intro to W&WW Treatment Honors
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
The course is an introduction to water and wastewater treatment. Topics include sources and characteristics of water and wastewater, treatment standards, selection of different water and wastewater treatment processes, design principles for treatment units in water and wastewater treatment plants, and standard laboratory tests used to control the operation of water and wastewater treatment plants.
Prerequisite(s): A minimum grade of "C" in CENG 2131, CENG 3131.
Cross Listing(s): CENG 3132.

CENG 3133 Transportation Systems
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Overview of transportation engineering with respect to traffic operation and transportation planning, including mainly highway. Emphasis on design and traffic control devices with considerations of economy, safety, and environment. Laboratory involves data measurement and analysis techniques associated with transportation engineering using probability.
Prerequisite(s): A minimum grade of "C" in CENG 2231 and MATH 3337.

CENG 3135 Project Cost Analysis, Planning and Management
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course addresses various aspects of planning and management of civil engineering projects including economics, cost estimation, construction contracts, delivery methods, and scheduling. The course also covers various engineering economic topics such as time value of money and cost/benefit analysis. The probability and statistics topics relevant to civil and environmental engineering are additionally discussed along with ethical guidelines for professional conduct and code of ethics.
Prerequisite(s): A minimum grade of "C" in CENG 3233.

CENG 3231 Highway Design I
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
The course covers different approaches to highway design, mainly based on considerations of geometric controls, structural requirements, drainage needs and costs.
Prerequisite(s): A minimum grade of "C" in CENG 2231.
Cross Listing(s): CENG 3231H.
CENG 3211H Highway Design I - Honors
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course covers different approaches to highway design, mainly based on considerations of geometric controls, structural requirements, drainage needs and costs.
Prerequisite(s): A minimum grade of "C" in CENG 2231.
Cross Listing(s): CENG 3231.

CENG 3232 Soil Mechanics
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course is an introduction to soil mechanics, including an investigation of the mechanical and physical properties of soils and the relation to soil action in problems of engineering such as soil composition, index properties, classification, exploration, compaction, permeability, stress distribution, consolidation, settlement, shear strength, bearing capacity, and lateral earth pressure.
Prerequisite(s): A minimum grade of "C" in ENGR 3233.

CENG 3233 Civil Engineering Materials
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Introduction to materials science and basic engineering properties of common civil engineering materials including metals, soils, aggregates, Portland cement concrete, asphalt binder and asphalt concrete, wood, and masonry. Written and oral communication skills are an important part of this course.
Prerequisite(s): A minimum grade of "C" in ENGR 3233.

CENG 3242 Structural Analysis
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Introduction to types of structures and loads. Analysis of statically determinate and indeterminate structures by classical and other methods. The types of structures covered include beams, plane trusses, and plane frames. Topics include external and internal reactions, deflections, moving loads and influence lines, approximate methods (including portal method and cantilever method), classical slope-deflection and moment distribution methods, and an introduction to matrix method. Computational laboratory activities in support of instruction, including use of industry-standard structural analysis software.
Prerequisite(s): A minimum grade of "C" in ENGR 1731, ENGR 3233, ENGR 1133, MATH 2243, MATH 2331.
Corequisite(s): MATH 3230.

CENG 3311 Fluid Mechanics Lab
1 Credit Hour. 0 Lecture Hours. 2 Lab Hours.
The laboratory includes measurement of water properties including specific weight and dynamic viscosity, use of the Bernoulli equation, pressure measurement, flow rate measurement on a pipe, open channel flow, calibration of flow-measuring, head loss in piping systems, and characteristics of centrifugal pumps.
Corequisite(s): ENGR 3235.

CENG 3331 Structural Analysis
3 Credit Hours. 3 Lecture Hours. 1 Lab Hour.
This course investigates the behavior of common structural systems under various loading conditions. The course focuses on the accurate analysis of statically determinate trusses, beams and frames and uses approximate methods to analyze indeterminate frames. The calculation of deflections and the effects of moving loads are also considered.
Prerequisite(s): MATH 3230 and a minimum grade of "C" in ENGR 3233.

CENG 3333 Reinforced Concrete Design
0.3 Credit Hours. 0.3 Lecture Hours. 0.1 Lab Hours.
Course covers characteristics of concrete materials; introduction to ACI Building Code requirements for reinforced concrete; entrength design of slabs, beams, columns and footings.
Prerequisite(s): A minimum grade of "C" in CENG 3331.
CENG 4890 Special Problems in Civil Engineering
1-4 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
This course provides for specialized study in the area of Civil Engineering not otherwise covered by the CE program.
Prerequisite(s): As determined by instructor.
Cross Listing(s): CENG 4890S.

CENG 4890S Special Problems in CE
1-4 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
This course provides for specialized study in the area of Civil Engineering not otherwise covered by the CE program.
Cross Listing(s): CENG 4890.

CENG 5133 Water Supply and Wastewater Collection Systems
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course covers water supply and wastewater collection systems. Topics include basic hydraulics, major and minor head losses, pipes in series and parallel, water distribution network analysis, design of water supply distribution systems, sanitary sewer collection systems, and storm sewer collection systems. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3132 or permission of instructor.
Cross Listing(s): CENG 5133G.

CENG 5137 Open Channels and Pumps
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
The course covers the application of principles of fluid mechanics to flow in open channels and pumps. Topics include uniform flow, flow resistance, gradually varied flow, flow transitions for open channels, pump classification, system hydraulics, pump curves and duty points, and water and wastewater pumping stations. The course additionally addresses open channel design, and pump station design. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 2131 or permission of instructor.
Cross Listing(s): CENG 5137G.

CENG 5139 Advanced Water and Wastewater Treatment
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
The course covers advanced water and wastewater treatment processes necessary for designing and managing modern drinking water and wastewater treatment plants. Topics include ion exchange, ozonation, adsorption, membrane, Biological Nutrients Removal (BNR), Membrane Biological Reactor (MBR), disinfection, sludge treatment and disposal, wastewater reclamation and reuse, and effluent disposal. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3132 or permission of instructor.
Cross Listing(s): CENG 5139G.

CENG 5231 Pavement Analysis and Design
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course provides an introduction to different approaches to pavement analysis and design, including flexible and rigid pavement design, preservation, rehabilitation, and management. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3232, CENG 3233 or permission of instructor.
Cross Listing(s): CENG 5231G.

CENG 5232 Foundation Design
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course provides an introduction to foundation design methods, including shallow foundations, slope stability analysis, pile foundations, and retaining walls. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3232 or permission of instructor.
Cross Listing(s): CENG 5232G.

CENG 5234 Asphalt Mix Design
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.
This course is an introduction to contemporary materials and engineering properties of asphalt binders, modified binders, and asphalt mixtures including: modern binder and mixture specifications, mix design systems and test methods. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3232 or permission of instructor.
Cross Listing(s): CENG 5234G.

CENG 5331 Advanced Structural Analysis
3 Credit Hours. 3 Lecture Hours. 1 Lab Hour.
This course covers the analysis of statically indeterminate structures. Classical methods, such as the slope-deflection and moment distribution techniques are presented. The course additionally covers the matrix-based stiffness method of analysis for indeterminate trusses, beams, and frames. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3331, MATH 2331, ENGR 1731 or permission of instructor.
Cross Listing(s): CENG 5331G.

CENG 5332 Prestressed Concrete Design
3 Credit Hours. 3 Lecture Hours. 1 Lab Hour.
This course introduces students to the design of common prestressed concrete elements. It presents historical developments, the properties of constituent materials, prestress losses, and the design of prestressed structural members to support flexural and shear loadings. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 3333 or permission of instructor.
Cross Listing(s): CENG 5332G.
CENG 5336 Introduction to Finite Elements
3 Credit Hours. 3 Lecture Hours. 1 Lab Hour.
This course provides an introduction to the Finite Element Method, focusing on common elements and problems encountered in civil engineering practice. The course illustrates useful concepts and procedures associated with linearly behaving static structures, modeled by using truss, beam, name, plane, and plate elements. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.
Prerequisite(s): A minimum grade of "C" in CENG 5331 or permission of instructor.
Cross Listing(s): CENG 5336G.

TCET 2241 Surveying
0.4 Credit Hours. 0.2 Lecture Hours. 0.4 Lab Hours.
Principles of the level, theodolite, EDM, total station and global positioning system, taping, note keeping, coordinate geometry, control surveys, triangulation, trilateration, plane coordinate systems, azimuth and topographic mapping. Laboratory includes use of level, theodolite, EDM, total station, GPS, traverse closure, topographic mapping, measuring distances and heights using coordinate geometry calculations.
Prerequisite(s): MATH 1113, MATH 1441, MATH 2242.

TCET 3141 Environmental Pollution
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Prerequisite(s): CHEM 1145 or CHEM 1147.

TCET 3142 Structural Analysis
0.4 Credit Hours. 0.3 Lecture Hours. 0.3 Lab Hours.
Introduction to types of structures and loads. Analysis of statically determinate and indeterminate structures by classical and other methods. The types of structures covered include beams, plane trusses and plane frames. Topics include external and internal reactions, deflections, moving loads and influence lines, approximate methods (including portal method and cantilever method), classical slope-deflection and moment distribution methods, and an introduction to matrix method. Computational laboratory activities in support of instruction, including use of industry-standard structural analysis software.
Prerequisite(s): TENS 2138, ENGR 1731, TENS 2143, MATH 2242.

TCET 3233 Transportation Systems
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Overview of transportation engineering with respect to operational and traffic characteristics of land, air and water transportation systems. Emphasis on design and traffic control devices. Laboratory involves data measurement and analysis techniques associated with transportation engineering.

TCET 3234 Construction Materials
0.3 Credit Hours. 0.2 Lecture Hours. 0.3 Lab Hours.
Introduction to engineering properties of common civil engineering materials including metals, soils, aggregates, Portland cement concrete, asphalt concrete, wood, and masonry. Laboratory involves performance of standard tests on aggregates, concretes, wood; emphasizing data analysis and application of test results to design specifications.
Prerequisite(s): TENS 2143.

TCET 3236 Project Cost Analysis, Planning and Management
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course focuses on the cost estimating process related to the site work and highway construction industry, and examines construction drawings and specifications documents as they relate to cost estimation process. The course also covers key aspects of project planning, scheduling, and management. Topics include: bid documents, estimating process, cost of labor and equipment, handling and transporting materials, earthwork and excavation, computerized estimating, techniques for economy studies of multiple alternatives, project scheduling, project management, and safety.
Corequisite(s): TCET 3234.

TCET 4141 Water Supply Systems
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Parameters, equations and procedures for the design of wastewater and storm water collection systems, parameters, equations and procedures for the design of water distribution systems, pumps, pump curves, pumping stations, sizing storage tanks and wetwells. Design of wastewater and stormwater collection systems. Rainfall-runoff computations. Hardy-Cross method for pipe networks. Design of culverts, drop structures, sheet flow, computer programs for unlined channel design.
Prerequisite(s): TENS 2144.
Cross Listing(s): TCET 4141H.

TCET 4141H Water Supply Systems-Honors
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Parameters, equations and procedures for the design of wastewater and storm water collection systems, parameters, equations and procedures for the design of water distribution systems, pumps, pump curves, pumping stations, sizing storage tanks and wetwells. Design of wastewater and stormwater collection systems. Rainfall-runoff computations. Hardy-Cross method for pipe networks. Design of culverts, drop structures, sheet flow, computer programs for unlined channel design.
Prerequisite(s): TENS 2144.
Cross Listing(s): TCET 4141.

TCET 4142 Reinforced Concrete Design
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Characteristics of concrete materials, introduction to ACI building code requirements for reinforced concrete, strength design of slabs, beams, columns and footings. Design/computational laboratory activities in support of instruction.
Prerequisite(s): TCET 3142.

TCET 4146 Structural Steel Design
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Characteristics of structural steels, introduction to AISC Load and Resistance Factor Design (LRFD) specifications. Design of tension members, columns, beams, beam-columns and connections. Design/computational laboratory activities in support of instruction.
Prerequisite(s): TCET 3142.

TCET 4243 Highway Design
0.4 Credit Hours. 0.3 Lecture Hours. 0.3 Lab Hours.
A synthetic approach to highway design based on considerations of geometric controls, structural requirements, drainage needs, and economy. Laboratory includes design projects, field stake out of horizontal curves, cross-sectioning, and slope staking.
Prerequisite(s): TCET 2241, TCET 3234, TCET 3233.

TCET 4244 Soil Mechanics and Foundations
0.4 Credit Hours. 0.3 Lecture Hours. 0.3 Lab Hours.
Introduction to soil mechanics and foundations, including: soil composition, index properties, classification, exploration, compaction, permeability and seepage, stress distribution, consolidation, settlement, shear strength, bearing capacity, lateral earth pressure; application of soil mechanics to design of footings and analysis of retaining walls and pile foundations. Laboratory includes evaluation of soil properties, using the test results in design and analysis.
Prerequisite(s): TENS 2143, TENS 2138.
TCET 4245 Water-Wastewater Treatment
0.4 Credit Hours. 0.3 Lecture Hours. 0.3 Lab Hours.
Sources and characteristics of water and wastewater. Principles of design for units and processes in water and wastewater treatment plants. Treatment standards. Standard laboratory tests used to control the operation of water and wastewater treatment plants. Field trips to water and wastewater treatment plants. Computer program design of water treatment units.
Prerequisite(s): TCET 3141, TENS 2144.
Cross Listing(s): TCET 4245H.

TCET 4245H Water-Wastewater Treatment
0.4 Credit Hours. 0.3 Lecture Hours. 0.3 Lab Hours.
Sources and characteristics of water and wastewater. Principles of design for units and processes in water and wastewater treatment plants. Treatment standards. Standard laboratory tests used to control the operation of water and wastewater treatment plants. Field trips to water and wastewater treatment plants. Computer program design of water treatment units.
Prerequisite(s): TCET 3141, TENS 2144.
Cross Listing(s): TCET 4245.

TCET 4536 Senior Project
3 Credit Hours. 0 Lecture Hours. 6 Lab Hours.
Designed to be culmination of the undergraduate civil engineering technology education, the course draws together divers elements of the CET curriculum to provide integrating experiences and to develop competence in focusing both technical and nontechnical skills in solving problems. The project involves design and analysis of a new or modified civil engineering project or system with demonstration feasibility.
Prerequisite(s): TCET 4142, TCET 4146.

TCET 4890 Special Problems in CET
1-4 Credit Hours. 0 Lecture Hours. 0-4 Lab Hours.
Individual and specialized study in areas of civil engineering technology (CET) not otherwise covered in the student's program.

TCM 1231 Introduction to Construction Management
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course presents an introduction to the construction management profession and the construction industry that it serves. It includes an overview of industry sectors, professional organizations, and the industry's impact on the economy. The basics of the construction process and delivery systems will be discussed. Students will be introduced to software that is part of the construction manager's day-to-day role. A thorough understanding of the construction management curriculum and the various courses will be provided.

TCM 1232 Construction Graphics
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course is a study of construction drawings and specifications. It exposes students to fundamental graphical communication knowledge and print-reading skills. Students will also learn necessary modeling techniques to create basic construction models and generate construction drawings using the most cutting-edge Building Information Modeling (BIM) tools. Topics include print reading, sketching and drafting techniques for the presentation of floor plans, elevations, sections and building components using BIM software.
Prerequisite(s): TCM 1231, MATH 1112, MATH 1113, MATH 1441.

TCM 2233 Construction Surveying
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Introduction to the equipment and techniques used for construction surveying, including measurement of distances, horizontal and vertical angles, and differences in elevation. Emphasis is placed on accuracy of measurements, precise operation of instruments, completeness in laboratory exercises, and accurate field notes.
Prerequisite(s): A minimum grade of "C" in TCM 1232, MATH 1112 or MATH 1113 or MATH 1441.

TCM 2234 Mechanical and Electrical Equipment and Systems
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course includes a study of mechanical and electrical equipment and systems as related to the construction industry. The course is composed of three basic parts. Part one addresses available energy sources, thermoflow and ventilation characteristics, air handling systems, and mechanical codes. Part two addresses domestic water and waste systems, fire sprinklers and stand pipe systems and plumbing codes. Part three addresses electrical power, lighting and communication systems and electrical codes.
Prerequisite(s): A minimum grade of "C" in TCM 1232, PHYS 1111, PHYS 1113 or permission of instructor.

TCM 2240 Introduction to Structures
0.4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
The theory of structures and its applications to building construction. Topics include analysis of coplanar force systems, analysis of trusses and frames, friction, centroids and moment of inertia, stresses and strains, properties of materials, bending, shear, deflections in beams, combined stresses and analysis of columns.
Prerequisite(s): A minimum grade of "C" in PHYS 1111, PHYS 2211, PHYS 1113.

TCM 2333 Building Information Modeling for Construction Management
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Introduction to Building Information Modeling (BIM). This course highlights the merits of BIM in promoting productivity and profitability in the construction industry. Topics include the history of information modeling technology and its impacts on construction industry; major BIM software applications and basic modeling techniques; application of BIM authoring and analysis skills for construction projects. The course emphasizes hands-on modeling skills and the utilization of BIM technology to solve construction project problems.
Prerequisite(s): A minimum grade of "C" in TCM 1232.

TCM 2430 Construction Safety
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course includes a study of safe construction practices. Topics include workers' compensation insurance, OSHA regulations, construction disasters, safe construction training and planning, and the hidden costs of accidents. Students are highly encouraged to obtain the OSHA 30-hour safety card as part of this course.

TCM 3231 Structures I
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course explores the means and methods used in the construction of structural systems with a primary focus on steel structures. The course presents topics on the fundamental material properties and strengths of structural steel elements and on the purposes of different structural elements (beams, columns, shear and moment connections, splices, braces, composite slabs, gusset plates, bolts, anchor rods, shear studs, welds, stiffeners, etc.) The course additionally presents a description of the design methods in steel structures and construction of various structural systems.
Prerequisite(s): A minimum grade of "C" in TCM 1232, TCM 2240.
TCM 3232 Structures II
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course discusses the means and methods used in the construction of structural systems with emphasis on concrete and masonry structures. The course presents topics on the fundamental properties and characteristics of concrete, concrete mix, strengths, design and construction of concrete formwork, concrete reinforcing, placement, testing, masonry materials and construction of various structural systems.
Prerequisite(s): A minimum grade of "C" in TCM 1232, TCM 2240.

TCM 3330 Quantity Estimating
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Construction estimating with emphasis on quantity take-off and specifications, including techniques of interpreting a visualizing construction drawings.
Prerequisite(s): A minimum grade of "C" in TCM 3231, TCM 3232, TCM 2232, TCM 1131.

TCM 3331 Construction Finance
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
A study of financial management for contractors with special emphasis on project level financial controls, cost accounting and variance analysis, the time value of money, cash flow management, overhead and break-even analysis, banking and bonding, financial statements and ratios.
Prerequisite(s): A minimum grade of "C" in ECON 2105, ACCT 2030, TCM 1231.

TCM 3332 Construction Equipment Management
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The various aspects of heavy equipment management and ownership. Topics include equipment acquisition and disposition options, production costs and productivity, cost analysis and control, management staffing and responsibilities, selected topics in maintenance, depreciation and economic life.
Prerequisite(s): A minimum grade of "C" in MATH 1112, MATH 1113, MATH 1441.
Cross Listing(s): TCM 3325.

TCM 3335 Const. Equip. Management
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The various aspects of heavy equipment management and ownership. Topics include equipment acquisition and disposition options, production costs and productivity, cost analysis and control, management staffing and responsibilities, selected topics in maintenance, depreciation and economic life.
Prerequisite(s): A minimum grade of "C" in MATH 1112, MATH 1113, MATH 1441.
Cross Listing(s): TCM 3332.

TCM 3333 Building Codes
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course includes a study of codes applicable to the construction industry with emphasis on the Standard Building Code. An introduction to construction related federal regulations with an emphasis on labor related issues; construction labor unions and the collective bargaining process.
Prerequisite(s): A minimum grade of "C" in TCM 1131.

TCM 3890 Special Problems in Construction
1-4 Credit Hours. 1-4 Lecture Hours. 0-4 Lab Hours.
Individualized study in the area of building construction and contracting not otherwise available in the student's program.
Prerequisite(s): Permission of instructor 6 weeks prior to term course will be taken.

TCM 4090 Selected Topics in Construction
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Scheduled on an infrequent basis to allow the exploration of undergraduate topics within building construction and contracting. Course shall carry a subtitle for topic identification.
Prerequisite(s): Permission of instructor.

TCM 4090H Sel. Topics in Construction
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Scheduled on an infrequent basis to allow the exploration of undergraduate topics within building construction and contracting. Course shall carry a subtitle for topic identification.
Prerequisite(s): Permission of instructor.

TCM 4090S Sel. Topics in Construction
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Scheduled on an infrequent basis to allow the exploration of undergraduate topics within building construction and contracting. Course shall carry a subtitle for topic identification.
Prerequisite(s): Permission of instructor.

TCM 4432 Construction Administration
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
Terms, documents and operations inherent in building construction management. Topics include business ownership, company organization, project bidding/negotiating methods, construction contracts, bonds, insurance and accounting.
Prerequisite(s): A minimum grade of "C" in TCM 3331 and Junior status.

TCM 4434 Site Construction
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
The site development construction process with an emphasis on soils as a construction material. Topics include soils investigation, testing, classification, engineering properties and modification techniques, excavation equipment, construction dewatering, slope stability and support, layout and grade staking, sediment and erosion control, foundations, underground utilities and pavements.
Prerequisite(s): A minimum grade of "C" in TCM 2233, TCM 3332.

TCM 4530 Senior Project
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
This course includes an exercise in project management, including estimating and scheduling from construction documents of a project. The assigned project includes developing a fictitious organization, production of a project estimate and schedule and preparing a construction bid and other construction documentation.
Prerequisite(s): COMM 1110, STAT 2231.
Corequisite(s): TCM 5431, TCM 5433.
Cross Listing(s): TCM 4530S, TCM 4530H.

TCM 4530H Senior Project (Honors)
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
An exercise in estimating and scheduling from construction documents of an actual building project utilizing major elements of the CM program. Project includes developing a fictitious construction company organization, production of a project estimate and schedule and preparing a construction bid and construction documentation.
Prerequisite(s): COMM 1110, STAT 2231.

TCM 4530S Senior Project
0.3 Credit Hours. 0.2 Lecture Hours. 0.2 Lab Hours.
An exercise in estimating and scheduling from construction documents of an actual building project utilizing major elements of the CM program. Project includes developing a fictitious construction company organization, production of a project estimate and schedule and preparing a construction bid and construction documentation.
Prerequisite(s): COMM 1110, STAT 2231.

TCM 4740 Internship
4 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
Designed for students to receive practical work experience with an approved construction firm. A total of 560 contact hours with the construction firm is required.
Prerequisite(s): A minimum grade of "C" in TCM 4432.
TCM 5330 Green Building and Sustainable Construction  
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.  
This course is a study of advanced topics in green construction beginning with the philosophy behind sustainability related technology and its implementation. The course provides a thorough expansion on LEED (Leadership in Energy and Environmental Design) core concepts including construction and design for sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality and innovation and design. The course also examines sustainable construction methodologies and their associated environmental impacts. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.  
Prerequisite(s): A minimum grade of "C" in TCM 1131, TCM 2234 or permission of instructor.  
Cross Listing(s): TCM 5330G.

TCM 5431 Construction Cost Estimating  
3 Credit Hours. 3 Lecture Hours. 1 Lab Hour.  
This course includes methods and procedures for estimating costs of construction projects. Topics include types and purposes of estimates, direct and indirect costs, labor and equipment cost analysis, the CSI Masterformat, approximate estimates, and computerized estimating methods. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.  
Prerequisite(s): A minimum grade of "C" in TCM 3330, TCM 3331 or permission of instructor.  
Cross Listing(s): TCM 5431G.

TCM 5433 Proj Planning/Scheduling  
3 Credit Hours. 2 Lecture Hours. 2 Lab Hours.  
This course covers the fundamentals and techniques of planning and scheduling for construction projects. Topics include bar charts, Critical Path Method using both arrow and node networks, precedence networks, cost-time trade-offs, PERT, resource leveling, updating schedules during construction, project control, earned value method, lean construction principles and practices, and computerized scheduling techniques. Graduate students will be required to complete individual advanced level research in an area beyond the scope of the undergraduate requirements that demonstrates a higher level of mastery in the subject matter with additional required deliverables representative of graduate level work, as determined by the instructor.  
Prerequisite(s): A minimum grade of "C" in STAT 2231, TCM 1231 or permission of instructor.  
Cross Listing(s): TCM 5433G.