

# DEPARTMENT OF ENGINEERING TECHNOLOGY

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The mission of the Department of Engineering Technology is to prepare students for technical/professional careers in industry and education. The mission is accomplished through a dedicated faculty offering programs in specialized areas with a formal, technical focus. Upon graduation, students are prepared to assume positions of professional responsibility in the areas of manufacturing, construction, concrete industry management, computer aided technologies, electronics, and education. Fourteen well-equipped technical laboratories serve to educate students in the techniques and processes used by contemporary world class industries.

## The Bachelor of Science major in Concrete Industry Management

The Bachelor of Science (B.S.) degree with a major in Concrete Industry Management (CIM) prepares students who are grounded in basic construction management, knowledgeable in concrete technology and techniques and able to manage people and systems to promote products and devices related to the concrete industry. CIM professionals find a wide array of opportunities in the concrete industry including positions in sales, operations, technical services and construction management.

## The Bachelor of Science major in Construction Science and Management

The Bachelor of Science (B.S.) degree with a major in Construction Science and Management (CSM) prepares students to enter professional careers in the construction industry. Graduates may become construction project managers, estimators, schedulers, field engineers, general and/or subcontractors, code inspectors, material suppliers and technical sales representatives. Students learn the technical aspects of how construction projects are built through classes in residential, commercial, engineering and industrial construction, and learn how to manage construction through the required business administration minor and courses in estimating, scheduling and project management. Career opportunities are many in this industry, which comprises 16% of the Gross National Product. Students entering this degree need to successfully complete the Pre-Construction Curriculum before they will be allowed to register for advanced Construction Science and Management courses. Also, a sophomore level internship is required, where students spend 10 weeks and 400 hours working in the construction industry. Students interested in pursuing the Construction Science and Management degree program can receive more information on the major contacting a CSM Faculty Advisor. This degree program is accredited by the American Council for Construction Education.

## The Bachelor of Science major in Technology Management

The Bachelor of Science (B.S.) degree with a major in Technology Management prepares students for professional management positions in industry, or to become public school teachers in the field of Technology Education. Industry bound graduates will be prepared for

work involving materials, processes, product design and development, quality management, safety management, supply chain issues, facility planning, and similar concepts in industrial management. Graduates of the Technology Education track will be prepared to teach a variety of industry and technology related subjects in Texas public schools. This degree has three specializations, Manufacturing Technology, Electronics Technology, and Technology Education. Students interested in pursuing the Bachelor of Science in Technology Management should see a faculty advisor in the Department of Engineering Technology for more details.

## The Bachelor of Science in Technology major in Engineering Technology

The Bachelor of Science in Technology (B.S.T.) degree with a major in Engineering Technology provides students with the technical background to work with engineers in planning production processes and automated systems, designing production facilities, developing tooling, establishing quality assurance procedures, developing safety programs, establishing work methods, and setting time standards. Students can specialize in Electrical Engineering Technology, Civil Engineering Technology, Environmental Engineering Technology, Manufacturing Engineering Technology, and Mechanical Engineering Technology. The Bachelor of Science in Technology major in Industrial Technology prepares students for work in industry in materials, processes, industrial safety, and concepts of industrial management. This degree has program majors in Manufacturing, and General Technology. The General Technology major, under Industrial Technology, can be customized to meet specific student needs offering opportunities in electronics, industrial safety, education, etc. Students interested in exploring such opportunities should see an Engineering Technology Department advisor for more details.

## Teacher Certification

A student seeking certification to teach at the secondary level must take:

Code	Title	Hours
CI 3325	Adolescent Growth and Development	3
CI 4332	Secondary Teaching: Curriculum and Technology	3
CI 4343	Instructional Strategies for the Secondary Teacher	3
CI 4370	Classroom Management, Ethics, and Legal Issues in Secondary Teaching	3
RDG 3323	Teaching Reading in the Content Areas	3
EDST 4681	Student Teaching 7-12	6

The student who has further questions should see the undergraduate advisor in Engineering Technology.

## Admissions Requirements Construction Science and Management

1. Construction Science and Management majors must complete 30 semester credit hours of Pre-Construction coursework, which will consist of:

Code	Title	Hours
MATH 2328	Elementary Statistics	3
MATH 2417	Pre-Calculus Mathematics	4
PHYS 1315 & PHYS 1115	General Physics I and General Physics I Laboratory	4
CHEM 1335 & CHEM 1141	Engineering Chemistry and General Chemistry Laboratory I	4

PHYS 1325 & PHYS 1125	General Physics II and General Physics II Laboratory	4
CSM 1260	Introduction to the Construction and Concrete Industry	2
CSM 2313	Architecture Design I - Construction Documents	3
CSM 2342	Construction Materials and Processes	3
TECH 2351	Statics and Strength of Materials	3
Total Hours		30

2. When a student completes their Pre-Construction coursework, with the required GPA, or is currently enrolled in their final Pre-Construction course(s), the student can apply to become a "Full Major" in the Construction Science and Management program.

3. After completing the Pre-Construction coursework, students will be allowed to enter the Bachelor of Science major in Construction Science and Management, and will be allowed to enroll in the following Construction classes:

Code	Title	Hours
CSM 2160	Introduction to Construction Surveying and Site Layout	1
CSM 2360	Residential Construction I: Home Production	3
CSM 3360	Structural Analysis	3
CSM 3361	Commercial Building Construction Systems	3
CSM 3363	Heavy, Civil and Highway Construction Systems	3
CSM 3366	Soils and Foundations	3
CSM 3367	Mechanical, Electrical and Plumbing Systems	3
CSM 4360	Senior Construction Management Capstone	3
CSM 4361	Construction Estimating	3
CSM 4364	Construction Project Management and Scheduling	3
CSM 4368	Environmentally Conscious Design and Construction	3
CSM 4369	Construction Contracts, Liability and Ethics	3
Total Hours		34

## Bachelor of Science (B.S.)

- Major in Concrete Industry Management (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/concrete-industry-management-minor-business-administration-bs>)
- Major in Construction Science and Management (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/construction-science-management-minor-business-administration-bs>)
- Major in Construction Science and Management (Residential Construction Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/construction-science-management-residential-construction-bs>)
- Major in Technology Management (Electronics Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/technology-management-concentration-electronics-bs>)
- Major in Technology Management (Manufacturing Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/technology-management-concentration-manufacturing-bs>)

- Major in Technology Management (Teacher Certification in Technology Education, Grades 6-12) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/technology-management-teacher-certification-education-grades-6-12-bs>)

## Bachelor of Science in Technology (B.S.T.)

- Major in Engineering Technology (Civil Engineering Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/engineering-technology-civil-specialization-bst>)
- Major in Engineering Technology (Electrical Engineering Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/electrical-specialization-bst>)
- Major in Engineering Technology (Environmental Engineering Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/engineering-technology-environmental-specialization-bst>)
- Major in Engineering Technology (Manufacturing Engineering Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/engineering-technology-manufacturing-specialization-bst>)
- Major in Engineering Technology (Mechanical Engineering Technology Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/engineering-technology-mechanical-specialization-bst>)

## Minor

- Technology (<http://mycatalog.txstate.edu/undergraduate/science-engineering/technology/technology-minor>)

**Subjects in this department include: CIM (p. 2), CSM (p. 3), TECH (p. 5).**

## Courses in Concrete Industry Management (CIM)

### CIM 3330. Concrete Construction Methods.

This course covers forming, shoring, placing and reinforcing operations. Transporting, placing, consolidating, finishing, jointing and curing concrete for cast-in-place foundations, pavements, slabs on ground, structural frames, and other structural members are studied. Other topics include waterproofing concrete foundations and erecting precast concrete members. Corequisite: CIM 3420 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

### CIM 3340. Understanding the Concrete Construction System.

A detailed look at how the concrete construction industry works. The course includes a review of model building codes, building officials and their function, concrete industry codes and standards, concrete construction processes, quality assurance systems, contract documents, estimating, construction scheduling and concrete construction markets. Prerequisite: CIM 3420 and MATH 2328 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CIM 3366. Applications of Concrete in Construction.**

This course is a detailed study of the many uses of concrete in the construction of buildings, pavements and other facilities. Emphasis will be placed on the advantages, disadvantages, and unique problems faced by materials suppliers, contractors and design professionals when concrete is chosen for specific applications. Prerequisite: CIM 3330 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**CIM 3420. Fundamentals of Concrete: Properties and Testing.**

This course examines effects of concrete-making materials (aggregates, cements, admixtures, etc.) on the properties of fresh and hardened concrete. Concrete mixture proportioning calculations and statistical analysis of strength tests are also studied. Prerequisite: CHEM 1335 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter

**CIM 4310. Senior Concrete Lab.**

This course provides students with an opportunity to further develop their technical and laboratory knowledge and pursue a project of individual interest. A formal report/presentation will be required at the conclusion of the course. Prerequisites: CIM 3366 and CIM 3420 both with grades of "C" or better.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**CIM 4330. Management of Concrete Products – Ordering and Scheduling.**

This course is designed to provide the student with a basic understanding of managing the ordering and delivery process common to all concrete products. Emphasis will be in planning, organizing and controlling at both the first-line supervisory and managerial levels. Prerequisites: CIM 3340 and MGT 3303 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**CIM 4340. Concrete Problems: Diagnosis, Prevention and Dispute Resolution.**

Course involves diagnosing/preventing problems related to concrete production, testing, construction and performance. Students learn to identify causes of fresh and hardened concrete problems, i.e. fast and slow setting, air content variations, low strength, cracking and scaling. Pre-job conferences and dispute resolution methods are examined. Prerequisite: CIM 3366 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**CIM 4398. Capstone.**

This course covers the business aspects of the concrete industry with appropriate application to the student's career interests and builds upon the technical and practical industry components learned in previous courses. The final project will be presented to an industry committee. (WI) Prerequisites: ACC 2362 with a grade of "D" or better and CIM 4330 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Course Attribute(s):** Writing Intensive  
**Grade Mode:** Standard Letter

**CIM 4499. Capstone II.**

A continuation of CIM 4398, students continue developing a business plan with emphasis on the technical aspects of the concrete industry, building upon previous coursework. The final presentation will be made to an industry panel. A portion of the course is a seminar with guest speakers from the concrete industry. Prerequisite: CIM 4398 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**  
**Course Attribute(s):** Writing Intensive  
**Grade Mode:** Standard Letter

## Courses in Construction Science and Management (CSM)

**CSM 1260. Introduction to the Construction and Concrete Industry.**

This is an introductory course for Construction and Concrete Industry Management (CIM) majors. Residential, commercial, heavy, civil and highway construction is explored including the concrete industry. The role of the contractor, architect/engineer and owner are covered including contracts, careers, sustainability and economic importance of the construction industry.

**2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.**  
**Grade Mode:** Standard Letter

**CSM 2160. Introduction to Construction Surveying and Site Layout.**

Common construction surveying and site layout techniques are studied using both optical levels and total stations. Benchmarks, building lines, property lines, differential and profiling are discussed in lecture with applied exercises performed in the laboratory.

**1 Credit Hour. 1 Lecture Contact Hour. 1 Lab Contact Hour.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter

**CSM 2313. Architecture Design I - Construction Documents.**

Students are introduced to the language and process of producing architectural construction documents in residential projects utilizing computers and CAD software. Site plans, floor plans, sections, elevations, and details are drawn individually and as a team as orthographic projection theory and its importance in resolving complex building geometry are covered.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter

**CSM 2342. Construction Materials and Processes.**

This course will introduce students to various types of construction materials including ceramics, ferrous, non-ferrous, and organic materials used in construction. Their properties, working characteristics and processes used to manufacture and assemble these materials are studied. Laboratory activities are used to reinforce lecture material. Prerequisites: [PHYS 1115 and PHYS 1315] or PHYS 1410 or PHYS 1430 any with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**  
**Course Attribute(s):** Lab Required  
**Grade Mode:** Standard Letter

**CSM 2360. Residential Construction I: Home Production.**

This course deals with the process of constructing a home on an improved lot, including residential plan and specification interpretation, cost centers, profit and overhead, construction phases, subcontractor sequencing, materials, estimating, scheduling, building codes, permits and Mechanical, Electrical and Plumbing home requirements.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 3360. Structural Analysis.**

This is a structural engineering fundamentals class to include design loads, reactions, force systems, functions of a structure, and both the analysis and design of determinate structures by classical and modern techniques.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 3361. Commercial Building Construction Systems.**

This is a commercial building construction systems class that deals with soils, site work, heavy foundations, steel, reinforced concrete and pre-cast structures along with common assemblies. Commercial MEP's are studied along with CSI master format, as-built and shop drawings, schedule of values, AIA documents and appropriate building codes.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 3363. Heavy, Civil and Highway Construction Systems.**

Selection, acquisition and capabilities of heavy construction equipment are presented. Applications of economics to performance characteristics and production of equipment is discussed. Sector-specific construction management methods are covered, including unit price estimating, equipment fleet design, repetitive scheduling and major components of highways, bridges and engineered facilities.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 3366. Soils and Foundations.**

Properties of subsurface materials and the principles of subsurface construction are studied. Topics include soil classification and testing, soil mechanics and foundation systems, including site layout, excavation, caissons, piles, slurry wall, slab and spread footings.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 3367. Mechanical, Electrical and Plumbing Systems.**

This course covers typical Mechanical, Electrical and Plumbing (MEPs) systems found in residential and commercial construction along with design and installation methods used to conserve both energy and water in new and remodeled structures.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 3368. Construction Finance.**

This course provides an introduction to financial analysis and financing of construction-related companies and projects. Topics include analysis of financial statements, contractor payment methods, construction loans, and project cost controls. Prerequisite: MATH 2328 and [ACC 2301 or ACC 2362] and [CIM 3340 or CSM 4364] all with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 3369. Residential Construction II: Business Practices.**

This course will prepare students in the business practices used by residential land developers and home-builders. Technical skills are applied to the work process inside conventional home-building departments and how those collaborating departments and co-workers operate to become an efficient and sustainable new home-building company. Prerequisite: CSM 2360 with a grade of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 4313. Architectural Design II - Technology in Construction.**

Students create individual and group commercial projects which include plans, elevations, sections, details, and 3D drawings utilizing 3D building information modeling (BIM) and other current technologies used in the industry. Structural, mechanical, electrical, plumbing, accessibility, and sustainable building issues are discussed. Prerequisite: CSM 2313 with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 4360. Senior Construction Management Capstone.**

Students work in groups, preparing a bid proposal based on a real life construction project involving contract negotiations, construction documents interpretation, estimating, bidding, scheduling, safety and quality control plans. Emphasis is on developing leadership, team building, written and oral communication skills. AIC Level 1 Examination required for course completion. Prerequisites: CSM 4313 and CSM 4361 and CSM 4364 and CSM 4369 and TECH 2190 all with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 4361. Construction Estimating.**

The fundamentals of construction estimating are covered including feasibility, conceptual, square feet, cubic feet, unit in place, preliminary, engineering, range and contractor's detail bid estimates. Plans and specifications are used along with contemporary estimating software to develop estimates commonly used in the construction industry. Prerequisite: CSM 3361 with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 4364. Construction Project Management and Scheduling.**

Concepts of construction management are studied beginning with contract documents through the effective management of manpower, machines, material and money necessary to complete construction projects on time and within budget. Gantt Charts and PERT/CPM schedules are developed, using contemporary software. Corequisite: CSM 4361 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**CSM 4368. Environmentally Conscious Design and Construction.**

This course covers environmentally sustainable practices used in building design and construction. THE LEED system will be used to guide the course, which covers aspects of sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and the CAD design process. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**CSM 4369. Construction Contracts, Liability and Ethics.**

Legal aspects of design and construction contract documents are presented, including contract formation, interpretation, rights and duties and changes. Legal liabilities are explored in the context of professional ethics for design firms and constructors. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**CSM 4370. Residential Capstone.**

This is an advanced course in residential construction related to developing communities and building homes. Students work in groups to develop proposals to select and develop raw land into build-able lots, design and schedule site specific homes, and develop a marketing plan. AIC Level 1 Examination required. Prerequisite: CSM 3369 and CSM 4313 and CSM 4364 and CSM 4369 all with grades of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CSM 4380. Construction Safety.**

This course covers construction and concrete industry safety-related topics, including state and federal construction safety laws, the application of the Occupational Safety and Health Administration (OSHA) and Mining Occupational Safety Administration (MOSA) requirements, and writing safety plans.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

## Courses in Technology (TECH)

**TECH 1311. Engineering Design Graphics.**

This course provides an introduction to the fundamentals of technical drawing and the related graphical tools used to communicate engineering design concepts. The topics include two dimensional graphics, orthographic projections, geometric dimensioning and tolerancing, computer-aided graphics, parametric solid modeling, and introduction to three dimensional graphics.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 1363. Manufacturing Processes I.**

The course will provide an overview of the manufacturing processes. Major emphasis is placed on machining theory, setup and tooling. Metal forming and fabrication procedures are introduced. Joining and assembly includes welding, mechanical fastening, adhesive bonding and surface finishing concepts. Laboratory demonstrations and tutorials involve machining, joining and forming techniques.

**3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 1393. Manufacturing Processes II.**

The course involves the fundamentals of casting and molding processes. Emphasis is placed on casting terminology, molding sand, molding processes, pattern making, coremaking and quality control. Ferrous and non-ferrous alloy composition and casting geometry are explored. Plastic and composite forming concepts are included. Microelectronic manufacturing principles and processes are introduced. Prerequisite: TECH 1363 with a grade of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 2190. Industrial Internship.**

This course is a supervised experiential learning course in various technical disciplines as appropriate to a student's degree program. This work integrated learning course helps the student link theory with practice. Repeatable for credit. Prerequisites: 45 hours completed with at least 12 having been completed at Texas State and a minimum major GPA of 2.25.

**1 Credit Hour. 0 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing

**Grade Mode:** Credit/No Credit

**TECH 2310. Introduction to Computer-Aided Design (CAD).**

Principles of 3D modeling are introduced in the preparation of drawings for manufacturing processes. Emphasis includes the parametric solid modeling of machine elements and geometric dimensioning and tolerancing. The laboratory component involves production of engineering drawings and simulations connecting this course to computer-aided engineering. Prerequisite: ENGR 1313 or TECH 1311 either with a grade of "C" or better or instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 2340. Environmental Technology I.**

This course emphasizes the fundamental chemical, biological, ecological and hydrological principles, and mass and energy balances involved in solving environmental problems. Specific environmental areas covered include water, water quality and wastewater treatment. Environmental regulations and testing as pertinent to water will be covered. Prerequisite: CHEM 1342 and PHYS 1430 both with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 2344. Power Technology.**

This class deals with understanding the basic laws of thermo-dynamics. It probes efficiency and examines energy-converting devices from the inputs, processes, outputs model. Internal combustion engines, electric motors, hydraulic, pneumatic, and gearing systems, and fuel analysis are reviewed from a practical and theoretical perspective.

Prerequisites: [MATH 1315 or MATH 1317 or MATH 2417 or MATH 2471] and [(PHYS 1115 and PHYS 1315) or PHYS 1430] all with grades of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 2351. Statics and Strength of Materials.**

Course covers principles of statics and strength of materials to include forces, equilibrium, friction, centroids, and stress/strain relationships, axial stress and deformation, thermal stress and deformation, stress concentrations, factor of safety, torsional stress, beam stresses and combined stress. Prerequisite: [CSM 2342 or ENGR 2300] and [(PHYS 1115 and PHYS 1315) or PHYS 1430] all with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 2370. Electricity/Electronics Fundamentals.**

This course covers fundamentals of safety, Ohm's Law, series, parallel, and series/parallel circuits, meters, relays, DC/AC circuit analysis and basic semiconductors.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TCCN:** ENGR 2305

**TECH 3322. Development of Technology.**

The role of technology in the development of Western World culture is studied from a technical perspective. Social repercussions resulting from the introduction of foundational technical developments are reviewed. Examples of technical areas examined are agriculture, transportation, manufacturing, engineering, defense, and communications. Readings focus discussions and papers on specific topics and encourage synthesis level understanding. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**TECH 3340. Environmental Technology II.**

This course covers air pollution, solid waste and hazardous waste management, sustainability and risk management. Environmental regulations and testing as pertinent to soils, sediments, residual and air will be covered. Prerequisite: TECH 2340 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 3344. Applied Thermofluids.**

Basic concepts, first and second laws of thermodynamics, thermodynamic properties, heat transfer by conduction, convection and radiation, fluid statics and fluid dynamics are studied. Prerequisite: PHYS 1430 and TECH 2344 both with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 3345. Principles of Lean Systems.**

The course provides an in-depth understanding of the lean principles as they apply to manufacturing and service organizations with emphasis on lean tools and concepts such as Value Stream Mapping, 5S, kaizen, waste, takt/cycle time, visual control, six-sigma, mistake proofing, single piece flow, cell design and pull systems. Prerequisite: TECH 3364 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 3357. Facilities Planning and Design.**

This project-based course provides students with a practical knowledge of designing efficient facility layout and material handling system. Systematic layout planning (SLP) based on a product and process information is studied in depth. Simulation tools are used for flow analysis. Prerequisites: TECH 2310 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 3364. Quality Assurance.**

This course covers the principles of quality management to include basic probability and statistics concepts, control charts for attributes and variables, sampling plans, quality audits and costs. The laboratory component of this class includes exercises that provide exposure to basic metrology and data collection.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 3370. Electronics.**

This course is a study of the characteristics of basic electronic circuits and their component parts. Course content includes the use of electronic test equipment, inductance, capacitance, reactance, impedance, rectification, switching, amplification, and electronic circuit fabrication. Prerequisite: EE 2400 or TECH 2370 either with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 3373. Communication Systems.**

This course deals with basic principles of communication systems. Specific topics include analysis of signals and systems, modulation techniques (digital and analog), analysis of transmitters and receivers, networking, and wireless communication systems. Prerequisite: EE 2400 or TECH 2370 either with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 4330. Foundry & Heat Treatment.**

The technical aspects of foundry and heat treatment of ferrous and non-ferrous metals are reviewed. Students gain proficiency with interpretation of binary phase diagrams, mathematical modeling of gate and runner systems, micro-structural analysis, process cost evaluation, sand casting, and investment casting. The course includes writing technical reports and conducting experiments. Prerequisites: ENGR 2300 and [ENGR 1313 or TECH 1311] and [MFG 2332 or TECH 1393] all with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**TECH 4340. Design for Environment.**

This course covers the basic principles of design for environment. Topics covered include: industrial ecology, resource depletion, product design, process design, material selection, energy efficiency, product delivery, use, end of life and life cycle analysis. Prerequisite: TECH 3340 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 4362. Manufacturing Process Engineering.**

This course will provide students with fundamentals of manufacturing processes planning and engineering. Major emphasis will be placed on make-buy analysis, tolerance analysis and dimensional control, tool and fixture design, process and material selection, design for manufacturing, design for assembly, and process planning. Prerequisites: TECH 1393 and TECH 2310 both with grades of "C" or better.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4365. Machine Elements: Dynamics and Design.**

Principles of the design of mechanical components; theories of failure; material selection; design of shafts, gears, cams, fasteners, springs and brakes; dynamics; balancing of machinery and vibration control are studied. Prerequisite: TECH 2310 and TECH 2351 both with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 4372. Electronic Devices and Circuits.**

This course covers transistor configurations, field effect transistors and circuits, voltage regulation, amplifier feedback principles, operational amplifiers and circuitry, and unijunction transistors and applications. Prerequisites: EE 2400 or TECH 2370 either with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4373. Control Systems and Instrumentation.**

This course is an introduction to modern control systems and instrumentation. Topics covered include transducers, sensors, actuators, instrumentation, open and closed loop control systems, PID controllers, programmable logic controllers and ladder logic, and computer interface software and hardware. Prerequisites: EE 2400 or TECH 2370 either with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4374. Digital Systems.**

Solid state digital electronics from basic concepts to current industrial needs in terms of logic gates (all types), number systems counters (all types), registers (all types), sequential control circuits, and shift register generator. Prerequisite: PHYS 2425 or TECH 2370 either with a grade of "C" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4380. Industrial Safety.**

Introduction to the field of industrial safety with emphasis on compliance with Federal and State regulations. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

**TECH 4389A. Advanced Residential Construction.**

Advanced concepts in residential construction are covered including land acquisition, land development, infrastructure, deed restrictions, cash flow, financial forecasting, marketing, scheduling and sustainable building practices. Prerequisite: CSM 2360 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**TECH 4389B. Construction Industry Best Practices.**

This course will cover current issues facing the construction industry today including the best practices used to resolve these issues. Several industry leaders will lecture on these contemporary problems facing the industry. Restricted to Junior level Construction Science and Management Majors.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**TECH 4390. Internship.**

Supervised on-the-job professional learning experience in construction, manufacturing, electronics, and other technical areas. This course provides practical work experience in their particular field of interest. Repeatable for credit. (WI) Prerequisites: Instructor approval.

**3 Credit Hours. 0 Lecture Contact Hours. 40 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dual Enrollment Permitted|Time Conflicts Permitted|Writing Intensive

**Grade Mode:** Standard Letter

**TECH 4392. Micro and Nano Manufacturing.**

This course covers the basic principles of micro and nano manufacturing. Emphasis is placed on the process descriptions, terminology, equipment requirements, and processes for micro and nano systems. Basic physics and process chemistry is combined with control schemes to arrive at overall systems descriptions. Prerequisite: [CHEM 1335 or CHEM 1341] and [PHYS 1325 or PHYS 1420 or PHYS 2425] both with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**TECH 4395. Automated Manufacturing Systems I.**

This course primarily deals with automation in industrial systems. In particular, this course focuses on automation and control technologies in manufacturing systems at machine and device levels. Included in its structure are areas such as fundamentals of industrial automation, sensors and actuators, numerical control, robotics, and PLC.

Prerequisites: TECH 2310 with a grade of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4396. Automated Manufacturing Systems II.**

This course primarily deals with automation, simulation, and digitization in industrial systems. Course topics include discrete-event simulation of manufacturing systems, automated quality control and inspection, automated identification, industrial Internet of Things, automated material handling, automated data acquisition systems, and applied finite element analysis. Prerequisites: TECH 4395 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

**TECH 4397. Special Problems.**

The investigation of a special topic by developing the problem, researching the topic, and presenting the findings as they apply to industry/technology. This course will be applicable to all areas of technology, and must be done only with the approval of the cooperating faculty member and Department Chair. Repeatable for credit with different emphasis. Prerequisite: Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing

**Grade Mode:** Standard Letter

**TECH 4398. Senior Design.**

This course deals with application of technical and non-technical skills and knowledge using a multidisciplinary team-based approach for solving real-world problems related to product and process development. The topics include systematic product design, requirements analysis, project management, cost estimation, documentation and presentation, prototyping, fabrication and concurrent engineering. (WI) Prerequisites: EE 3400 or TECH 3340 or TECH 3373 or TECH 4372 or TECH 4395 any with a grade of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Lab Required|Writing Intensive

**Grade Mode:** Standard Letter