Department of Mechanical, Environmental, and Civil Engineering

The department of Mechanical, Environmental, and Civil Engineering (MECE) offers bachelor's degrees in Civil Engineering, Environmental Engineering, Mechanical Engineering, and a master's degree in Mechanical Engineering. MECE majors engage in hands-on applications of discipline-related concepts and tools, taught in an engaging, student-centered, academic success-focused environment. Our department houses state-of-the-art instructional and research equipment including industry-standard software, 3D printing, automation and robotics, hydraulic flume, 145 mph wind tunnel, and a 100 kN universal testing machine. Students gain practical experience with these tools throughout the curriculum and also have the opportunity to conduct undergraduate research with our faculty. A degree from the MECE department opens doors to challenging and rewarding, high-salaried, high-tech engineering careers.

Math Readiness

The Civil, Environmental, and Mechanical Engineering programs do not have separate admission standards from that of the university, however, math preparedness is a critical component to success in either program. Thus it is very important for potential majors to strive to prepare in mathematics prior to entering college.

Civil, Environmental, and Mechanical Engineering degrees start at ***Calculus 1***, and the Math department requires *math placement* for incoming freshmen to register for Calculus 1. The math placement can be satisfied in any of the following ways:

- Prior college credit (dual credit) for either Plane Trigonometry (MATH 1316) or Precalculus (MATH 2412), since either is a prerequisite for Calculus 1
- Passing the NextGen Advanced Academic Functions (AAF) Accupplacer test with a score of **276** or higher
  - This placement test can be taken at any time at a variety of testing centers, e.g. most community colleges offer it. You can also take it at our testing center when you visit our Tarleton or Ft. Worth campuses; more info is available on the Stephenville Testing Center (https://www.tarleton.edu/drt/testing/stephenville-testing.html) webpage, where you can also sign up online for testing prior to your visit. You can also contact the testing center at 254-968-9423 or DRT@tarleton.edu to sign up for testing or with any questions.
- If your score on the NextGenAAF Accupplacer test is **263** or higher, you are eligible to register for Plane Trigonometry (MATH 1316), and, upon passing it, you will be able to take Calculus 1 in your second semester.

If you have neither dual credit nor the Accuplacer test (but you have the TSI math requirement satisfied), you can enroll in Precalculus (MATH 2412), and, upon passing it, you will be able to take Calculus 1 in your second semester.

It is possible to get credit directly for Calculus 1 without taking the class, in the following ways:

- Advanced Placement (AP) scores of
  - 4 or 5 in the Calculus AB exam, or
  - at least score of 3 in the Calculus BC exam – with an AB sub-score of at least 4
- College-Level Examination Program (CLEP) score of at least 50 in the CLP Calculus exam.

If you plan to start at a community college and then transfer to one of our programs:

- Coursework in engineering degrees is very sequential – each course has one or more prerequisites – so it is important to start taking courses *in your major* as early as possible if you wish to graduate in a four-year timeframe.
- Choosing to take only general education courses before transferring to one of our degrees is not recommended. Please contact the department for guidance on including appropriate math, science, and introductory engineering content – we'll be happy to help!

Departmental Course Prerequisite Policy

It is important for students to stay academically prepared as they progress through their curriculum. Prerequisite (taken previously) and corequisite (taken previously or concurrently) courses are in place to establish the foundational knowledge and skills needed to be successful in any given course. For all programs in the MECE department, students must earn a grade of "C" or better in all required Engineering, Computer Science, Mathematics and Science coursework to graduate, as well as to proceed to follow-up courses. The following summarizes the policy for allowing/disallowing forward progress when prerequisite (prereq) and/or corequisite (coreq) conditions are not fully met:

- If a student earns an F in a prereq course or has not taken that prereq, the student may NOT enroll in the follow-up course.
- If a student earns a D in a prereq for a course, the student IS allowed a prereq waiver to enroll in the follow-up course only if ALL THREE of the following conditions are met:
  - The student has an overall GPA of 2.2 or higher, AND
  - If by not enrolling in the follow-up course, the student's graduation date is adversely impacted (advisor must check the cascading effect of not enrolling in a course), AND
  - The student has not exceeded the max of FOUR prereq waivers.

If a student qualifies for a prereq waiver, the student must re-enroll in the prereq course concurrently; if the prereq course is not offered concurrently, the student must re-enroll on its immediate next offering. A student may utilize a maximum of FOUR prerequisite waivers over the duration of their pursuit of a degree within the MECE Department. Changing majors within the department does not reset the waiver count.

The department also allows a maximum of TWO engineering courses in a curriculum that can be taken as a transient (temporary) student at another university. Consult the department website, office or an advisor for additional information on these policies.

Civil Engineering

The Civil Engineering (CVEN) program at Tarleton State University was launched in Fall 2014. The program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (https://nam11.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.abet.org%2F&data=04%7C01%7CAGAPIE%40tarleton.edu%7C8440dc5d24a14b88d3fc08d8df135a6c%7C2c5ee638a96349c0ac26828dd9b78d5e%7C0%7C0%7C637504621495074894%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=miktx%2FeS9ehBn5vwhOh4z7yZLggSW0HQKkznVvAYFDg%3D&reserved=0). The mission of the CVEN program is to prepare the students to work competently as a professional engineer in Civil Engineering related industries and consulting firms, for engineering licensure and for graduate studies through a rigorous curriculum utilizing modern analytical tools, hands-on laboratory experiences and field applications. The program includes the following broad fields of specialization: structural engineering, transportation engineering, construction engineering, hydrology and water resources engineering, geotechnical engineering, materials, and mechanics. Throughout the program, students develop their ability to communicate effectively in a team-oriented and project-driven environment. Additional studies in ethics and sustainability design develop students' ability to understand the responsibilities to public safety and to protect the environment as a civil engineer.

The mission of the CVEN program aligns with the mission of the College of Science and Technology (http://catalog.tarleton.edu/undergrad/collegeofsciencetechnology/), as well as the mission of Tarleton State University (http://catalog.tarleton.edu/undergrad/tarletonstateuniversityanoverview/).

Students must earn a grade of "C" or better in all required Engineering, Mathematics and Science coursework to graduate. Students must also take, or be registered to take, the Fundamentals of Engineering (FE) licensure exam to graduate.

Bachelor of Science in Civil Engineering

Required Courses		
Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)		43
ENGR 1100 [shared]	Transitioning to University Studies in Engineering	
ENGR 1211	Engineering Fundamentals I	2
ENVE 2251	Fundamentals of GIS for Engineers	2
ENGR 2321	Engineering Mechanics: Statics	3
ENGR 2324	Engineering Mechanics: Dynamics	3
ENGR 3311	Engineering Mathematical Methods	3
ENGR 4259	Engineering Capstone I	2
ENGR 4360 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Capstone II	3
CVEN 2200	Surveying	2
CVEN 2312	Intro to Civil Engineering	3
CVEN 2235	Civil Engineering Graphics	2
CVEN 3301	Structural Analysis	3
CVEN 3320	Construction Planning and Management	3
CVEN 3423	Strength of Materials	4
CVEN 3430	Civil Engineering Materials	4
CVEN 4305	Reinforced Concrete Design	3
CVEN 4306	Steel Design	3
CVEN 4325	Foundation Engineering	3
CVEN 4450 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Transportation Engineering	4
CVEN 4360	Highway Planning and Design	3
ENVE 2311	Soil Mechanics	3
ENVE 3300	Fluid Mechanics	3
ENVE 3310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Hydrology	3
ENVE 4310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Water Resources Engineering	3
Basic Science Elective:		4
GEOL 1403	Physical Geology	
or BIOL 1406	Biology for Science Majors	
CHEM 1409	College Chemistry for Engineers	4
PHYS 2425 [shared]	University Physics I	
PHYS 2426 [shared]	University Physics II	
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3433	Calculus III	4
MATH 3306	Differential Equations	3
Total Hours		**129**

Environmental Engineering

The Environmental Engineering program at Tarleton State University is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The mission of the Environmental Engineering program is to prepare graduates for employment as an engineer in Environmental Engineering related industries and consulting firms, for engineering licensure, and for graduate studies in Environmental Engineering, Civil Engineering or related disciplines. This is accomplished through a curriculum supported by hands-on laboratory and field experiences in which students develop their ability to synthesize concepts into solutions, use modern analytical tools and techniques, communicate professionally and work in a team environment. The program includes a breadth of topics including water and wastewater treatment, environmental risk assessment, solid and hazardous waste management, remediation engineering, and project management. Additional studies in ethics and policy assure that the graduate understands the special responsibilities of an engineer related to public safety and environmental issues. This results in engineering graduates who strive to advance the engineering profession through technical competence, innovative problems solving and design, professional conduct, and lifelong learning. Additional details can be found on the department website: https://www.tarleton.edu/mece/.

Students must earn a grade of “C” or better in all Engineering, Mathematics, and Science coursework in order to graduate. Students must also take, or be registered to take, the Fundamentals of Engineering (FE) licensure exam in order to graduate.

Bachelor of Science in Environmental Engineering

Required Courses		
Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)		43
ENGR 1100 [shared]	Transitioning to University Studies in Engineering	
ENGR 1211	Engineering Fundamentals I	2
ENGR 2322	Engineering Thermodynamics	3
ENGR 3311	Engineering Mathematical Methods	3
ENGR 4259	Engineering Capstone I	2
ENGR 4360 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Capstone II	3

CVEN 2235	Civil Engineering Graphics	2
ENVE 2251	Fundamentals of GIS for Engineers	2
ENVE 2310	Introduction to Environmental Engineering	3
ENVE 2311	Soil Mechanics	3
ENVE 3300	Fluid Mechanics	3
ENVE 3301	Environmental Systems Modeling	3
ENVE 3310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Hydrology	3
ENVE 3333	Groundwater Contamination and Remediation	3
ENVE 3340	Environmental Risk Assessment	3
ENVE 3350	Environmental Biotechnology	3
ENVE 4302	Atmospheric Systems and Air Pollution Control	3
ENVE 4310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Water Resources Engineering	3
ENVE 4320	Chemical and Biological Processes in Water and Wastewater Treatment	3
ENVE 4319	Physical Operations in Water and Wastewater Treatment	3
ENVE 4350	Solid and Hazardous Waste Management	3
ENVE 4325	Environmental Monitoring and Measurements	3
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3433	Calculus III	4
MATH 3306	Differential Equations	3
CHEM 1409	College Chemistry for Engineers	4
CHEM 2323	Organic Chemistry I	3
CHEM 2123	Organic Chemistry I Laboratory	1
GEOL 1403	Physical Geology	4
BIOL 4441	Freshwater Biology	4
PHYS 2425 [shared]	University Physics I	
PHYS 2426 [shared]	University Physics II	
Total Hours		**129**

Mechanical Engineering

The Mechanical Engineering program at Tarleton State University was approved in January 2017 and is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (https://nam11.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.abet.org%2F&data=04%7C01%7CAGAPIE%40tarleton.edu%7C289384552c6a4c6752b508d8ddd75623%7C2c5ee638a96349c0ac26828dd9b78d5e%7C0%7C0%7C637503264299483035%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=KFAsFpXWRilFQN9DLSy4cS8yE628z1ipn739UWlXVTs%3D&reserved=0). The mission of the Mechanical Engineering program is to prepare graduates for employment as an engineer in a breadth of Mechanical Engineering related industries, for engineering licensure, and for graduate studies in Mechanical Engineering or related discipline. This is accomplished through a curriculum supported by hands-on laboratory and prototyping experiences in which students develop their ability to synthesize concepts into solutions, use modern analytical tools and techniques, communicate professionally and work in a team environment. The program includes topics such as thermal-fluid system design, mechanical system design, mechatronics, and alternative energy systems. Additional studies in ethics develop students' ability to understand the engineer's responsibilities to society. This results in engineering graduates who strive to advance the engineering profession through technical competence, innovative problems solving and design, professional conduct, and lifelong learning. Additional details can be found on the department website: https://www.tarleton.edu/mece/.

Students must earn a grade of "C" or better in all Engineering, Mathematics, and Science coursework in order to graduate. Students must also take, or be registered to take, the Fundamentals of Engineering (FE) licensure exam in order to graduate.

The Bachelor of Science Degree in Mechanical Engineering

Required Courses		
General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)		43
Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
ENGR 1100 [shared]	Transitioning to University Studies in Engineering	
ENGR 1211	Engineering Fundamentals I	2
ENGR 2321	Engineering Mechanics: Statics	3
MEEN 2115	Engineering Computer Aided Manufacturing	1
MEEN 2212	Programming for Engineers	2
ENGR 2322	Engineering Thermodynamics	3
ENGR 2324	Engineering Mechanics: Dynamics	3
ENGR 3311	Engineering Mathematical Methods	3
ENGR 4259	Engineering Capstone I	2
ENGR 4360 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Capstone II	3
ELEN 2425	Electrical Circuit Theory	4
ELEN 3320	Engineering Analysis Techniques	3
CVEN 3423	Strength of Materials	4
MEEN 3305	Fluid Mechanics	3
MEEN 2210	Engineering Computer Aided Design	2
MEEN 3325	Advanced Thermodynamics	3
MEEN 3335	Mechanical Vibration	3
MEEN 3345	Heat Transfer	3

MEEN 4300 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Renewable Energy Systems and Applications	3
MEEN 4205	Mechanical Engineering Experimental Lab	2
MEEN 4310	Mechanical Engineering Design I	3
MEEN 4320	Mechanical Engineering Design II	3
MEEN 4420	Thermal-Fluid System Design	4
MEEN 4425	Mechatronics	4
MEEN 4443	Linear Control Systems	4
CHEM 1409	College Chemistry for Engineers	4
PHYS 2425 [shared]	University Physics I	
PHYS 2426 [shared]	University Physics II	
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3433	Calculus III	4
MATH 3306	Differential Equations	3
Total Hours		**128**

Academic Advising Guides

Academic Advising Guides area available at the following website:

https://web.tarleton.edu/majorinfo/

Civil & Environmental Engineering Courses

Civil Engineering Courses

CVEN 2200. Surveying. 2 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
Introduction to the principles of measurements of distances, angles, and elevations; use of modern surveying equipment, area calculations, effects of observation errors; topographic mapping, traverse and area computations, and triangulation. Lab fee: $2.

CVEN 2235. Civil Engineering Graphics. 2 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
Introduction to technical drawing applied to civil engineering; design and drawing of various reinforced concrete structure members and connections; use of computer graphic tools, such as AUTOCAD for drawing geometric construction, isometric projection, sectional view, dimensioning, multi-view projections and plans. Lab fee: $2.

CVEN 2312. Intro to Civil Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to the disciplines of civil engineering practice through understanding of various sub-specializations within civil engineering discipline such as geotechnical, structural, transportation, water resources and environmental engineering; sustainable design approaches to civil engineering projects through critical thinking and environmental stewardship; and professional and ethical obligations of civil engineering profession. Prerequisite: ENGR 1211.

CVEN 3123. Strength of Materials lab. 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).
Application of theory of strength of materials by conducting laboratory experiments. Students will conduct series of experiments to measure the properties of materials such as young's modulus and poison's ratio, tensile strength, compressive strength, torsional shear stress, as well as compute stress concentration factors, principal stresses and strains, and deformation using deflection equations. Prerequisite: ENGR 2321; CVEN 3323 or concurrent registration Lab fee: $2.

CVEN 3301. Structural Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduction to the basic principles of structural analysis; various methods of analyses for beams, trusses, rigid frames, as well as statically indeterminate beams and trusses; laboratory component includes the modeling of structural deflections, reactions, internal forces of frame and truss structures using software such as RISA-3D, SAP2000 and/or MATLAB. Prerequisite: ENGR 2321 Lab fee: $2.

CVEN 3320. Construction Planning and Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Importance of construction planning and management from awarding contract to completion; construction equipment and management techniques; scheduling, and control techniques in civil engineering; scheduling, progress monitoring, and recovery schedules, and use of tools for schedule optimization. Prerequisite: CVEN 2312.

CVEN 3323. Strength of Materials. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Basic concepts of the theory of strength of materials to engineering design and analysis. Topics include stresses and strains in members subjected to tension, compression, torsion, and shear; flexural and shearing stresses in beams, principal stresses and deflection of beams, column analysis. Prerequisite: ENGR 2321.

CVEN 3325. Contracts and Construction Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Legal aspect of construction industry, ownership, and contractor; contracts and contracting procedure; drawing and specifications used in contract, cost estimation and bidding; contract surety bonds, construction insurance; construction project management and administration; effective project time management; project cost management; prevailing labor market, labor laws, and labor relations; ethics and project safety aspect of construction engineering. Prerequisites: ENGL 1302; CVEN 2310; CVEN 2325.

CVEN 3423. Strength of Materials. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Application of the theory of strength of materials to engineering design and analysis. Topics include stresses and strains in members subjected to tension, compression, torsion, and shear; flexural and shearing stresses in beams, principal stresses and deflection of beams, column analysis. Prerequisite:ENGR 2321 Lab fee: $2.

CVEN 3430. Civil Engineering Materials. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Introductions to materials engineering; general properties and behavior of construction materials used in civil engineering particularly their mechanical and non-mechanical properties of cement, aggregate, concrete, metals, steel, aluminum, plastics, wood, and composites; environmental influences and construction material behavior; laboratory evaluation of civil engineering material properties through experiments; standard specifications for material properties, techniques for testing. Prerequisite: CVEN 2312 or concurrent enrollment Lab fee: $2.

CVEN 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 1-4 Hours).
Directed study of selected topics in Civil Engineering. May be repeated with approval of department head.

CVEN 4305. Reinforced Concrete Design. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Flexural analysis and design of reinforced concrete beams including singly and doubly reinforced rectangular beams and T-beams, shear and diagonal tension, serviceability, bond, anchorage and development length, short and slender columns, slabs, footings, and retaining walls, including computer software and a design project. Prerequisite: CVEN 3423.

CVEN 4306. Steel Design. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Fundamentals of analysis and design of steel structures; structural elements; simple and eccentric connections; includes a design project. Prerequisite: CVEN 3423.

CVEN 4325. Foundation Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 1 Hour).
Focuses on geotechnical design of shallow foundations, including spread footings, mats, driven piles, and drilled piers; coverage of bearing capacity, settlement, group effects, lateral load capacity of various foundation types; subsurface exploration, construction of deep foundations and analysis of pile behavior using wave equation and dynamic monitoring methods. Prerequisites: CVEN 2312 and ENVE 2311 Lab fee: $2.

CVEN 4360. Highway Planning and Design. 3 Credit Hours (Lecture: 3 Hours, Lab: 1 Hour).
This course aims to help students understand the basic principles and techniques in highway planning and design. It includes highway planning process, design of the alignment of intersections, evaluation of earthwork requirements, and safety consideration. Upon completion students should be able to perform basic highway design. The course also covers the topics in highway design in the FE exam. Prerequisite: ENGR 3311 Lab fee: $2.

CVEN 4450. Transportation Engineering. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Introduction to highway engineering and traffic analysis; geometric design of highways, traffic flow and queuing theory, highway capacity and level of service analysis, traffic control and analysis at intersections, travel demand and traffic forecasting. Prerequisite: CVEN 2312 or concurrent enrollment Lab fee: $2.

Engineering Courses

ENGR 1100. Transitioning to University Studies in Engineering. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).
Practical study designed to prepare the student for university life, aid in the development of skills for academic success, promote personal growth and responsibility, and encourage active involvement in the learning process from an individual college perspective. These skill sets are presented in the context of engineering and computer science disciplines.

ENGR 1211. Engineering Fundamentals I. 2 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).
Introduction to engineering fundamentals, including problem solving methods and concepts, algorithm development, and analysis tools, including spreadsheets. Introduction to engineering as a profession, including ethics, team-based design, technical communication, and career paths. Prerequisite: Corequisite: MATH 1316 or 2412 or 2413. Lab fee: $2.

ENGR 1212. Engineering Fundamentals II. 2 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).
Development of skills in problem solving, design, analysis, estimation, communication and teamwork; introduction to accounting and conservation principles in engineering sciences emphasis on computer applications and programming. Prerequisites: ENGR 1211; MATH 2413 or concurrent registration, PHYS 2425 or concurrent registration. Lab fee: $20.

ENGR 2251. Fundamentals of GIS for Engineers. 2 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
This course offers an introduction to methods of managing and processing geographic information. Basic principles of geographic information systems and their use in spatial analysis and information management are introduced. Students gain experience with cutting-edge geospatial technologies and an understanding of their capabilities. Application in engineering is emphasized. Prerequisite: MATH 2413 or concurrent registration Lab fee: $2.

ENGR 2303. Engineering Economy. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Principles of economics equivalence; time value of money, analysis of single and multiple investments; comparison of alternatives; capital recovery and tax implications; certainty; uncertainty; risk analysis; public sector analysis; and break-even concepts. Prerequisites: MATH 2413 or concurrent registration.

ENGR 2321. Engineering Mechanics: Statics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Theory and analysis of bodies in equilibrium, including vector algebra, Newtonian mechanics, forces due to friction; forces acting on members of trusses and frame structures, and determinations of centroids and moments of inertia. Prerequisites: Either ENGR 1211, and concurrent enrollment in PHYS 2425 and MATH 2414; or PHYS 2425, and concurrent enrollment in ENGR 1211 and MATH 2414.

ENGR 2322. Engineering Thermodynamics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Theory and application of energy methods in engineering; conservation principles to investigate traditional thermodynamics (e.g., temperature, thermodynamic equilibrium, and heat). Prerequisite: ENGR 1211; MATH 2414 or concurrent registration.

ENGR 2324. Engineering Mechanics: Dynamics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Application of theory and principles of mechanics to dynamic particles and rigid body systems in rectilinear and curvilinear systems, including forces, acceleration, conservation of energy, and impulse and momentum. Prerequisite: ENGR 2321.

ENGR 3311. Engineering Mathematical Methods. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course presents mathematical techniques frequently encountered in advanced engineering analyses. The topics include the following areas: linear algebra, including matrix and eigenvalue applications; probability and statistics, including descriptive and inferential statistics, probability densities, statistical simulations and quality control. Prerequisites: MATH 2413 and ENGR 1211.

ENGR 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 1-4 Hours).
Directed study of selected topics in Engineering. May be repeated with approval of department head.

ENGR 4259. Engineering Capstone I. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).
This course is the first part of the capstone design experience synthesizing knowledge, skills and values necessary in engineering practice. Includes FE review sessions, engineering ethics, design process including multiple realistic constraints such as social, economic, safety, and sustainability, and the impact of engineering solutions in a global, economic, environmental, and societal context. During this course students develop a proposal for their capstone project. Prerequisites: Within one year of graduation and subject to instructor approval as per departmental capstone policy.

ENGR 4360. Engineering Capstone II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
This course is part 2 of the culminating design experience in the last year of the curriculum used to integrate the student's education. Includes reference to business concepts, mathematics, science, engineering and humanities. Emphasizes team work, a holistic approach to problem solving, and incorporates appropriate engineering standards and multiple realistic constraints. Prerequisite: ENGR 4259.

Environmental Engineering Courses

ENVE 2251. Fundamentals of GIS for Engineers. 2 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
This course offers an introduction to methods of managing and processing geographic information. Basic principles of geographic information systems and their use in spatial analysis and information management are introduced. Students gain experience with cutting-edge geospatial technologies and an understanding of their capabilities. Application in engineering is emphasized. Lab fee: $2.

ENVE 2310. Introduction to Environmental Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to environmental and occupational health, atmospheric systems and air pollution control, hazardous waste management, solid waste management, waste water management, and water supply treatment. Prerequisites: CHEM 1409 or CHEM 1312 and 1112.

ENVE 2311. Soil Mechanics. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduction to the principles of soil and their influence on the hydrological cycle, Darcy's law and fluid flow through porous medium, stress distribution and consolidation of soil, subsurface exploration. Prerequisite: MATH 2413; PHYS 2425 or concurrent enrollment Lab fee: $2.

ENVE 3300. Fluid Mechanics. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Principles of hydrostatics, dynamics of viscous and inviscid non-viscous fluids, resistance to flow in pipes and open channels, transport processes, energy equation, Bernoulli equation, conservation of mass, conservation of momentum, pump characteristics, similitude, dimensional analysis. Includes an introduction to computational analysis of fluid flow and pressure distributions and laboratory experiences. Prerequisites: PHYS 2425 and MATH 2414 Lab fee: $2.

ENVE 3301. Environmental Systems Modeling. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Apply conceptual and numerical techniques to model environmental systems. Use differential equations to describe processes. Prerequisites: MATH 3306 and ENVE 2310 Lab fee: $2.

ENVE 3310. Engineering Hydrology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Study of the hydrologic cycle, precipitation processes, soil moisture, infiltration, groundwater, rainfall-runoff processes, utilization of water resources, and frequency analysis; introduction to HEC-HMS programs for modeling hydrologic processes, elementary principles of field work. Prerequisite: ENVE 3300.

ENVE 3333. Groundwater Contamination and Remediation. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is an introduction to the fundamentals of subsurface flow with emphasis on the examination of the fate and transport of inorganic and organic contaminants therein and their management. Topics include groundwater flow and well hydraulics, modeling of contaminant transport processes, site investigations, natural attenuation, remediation and legal issues in groundwater protection. Prerequisite: ENVE 3310; MATH 3306 or concurrent registration.

ENVE 3340. Environmental Risk Assessment. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduction to the fundamentals of environmental and ecological risk assessment, including toxicity assessment, characterizing fate and transport processes in various environmental media, evaluating exposure pathways, dose-response assessment and modeling uncertainty. Prerequisites: ENVE 2310 and ENGR 3311 Lab fee: $2.

ENVE 3350. Environmental Biotechnology. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Application of fundamental principles of aquatic chemistry, molecular biology and biochemistry to understand and analyze complex chemical/biological processes in environmental engineering (natural and engineered systems). Prerequisites: CHEM 1409 or CHEM 1312 and 1112; MATH 2414; ENVE 2310 Lab fee: $2.

ENVE 3401. Environmental Systems Modeling. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Apply conceptual and numerical techniques to model environmental systems. Use differential equations to describe processes. Prerequisites: MATH 3306 and ENVE 2310. Lab fee $2.

ENVE 3420. Groundwater Hydrology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Topics include aquifer characteristics, infiltration, fluid dynamics of groundwater flow, potential flows, well analysis, water quality, groundwater pollution, legal issues in groundwater. Credit for both HYDR 320 and ENVE 320 will not be awarded. Prerequisites: ENVE 2411, GEOL 1403 or ENVE 2310, CHEM 1312 and 1112, MATH 2414. Lab fee: $2.

ENVE 3450. Environmental Biotechnology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Application of fundamental principles of aquatic chemistry, molecular biology and biochemistry to understand and analyze complex chemical/biological processes in environmental engineering (natural and engineered systems). Prerequisites: CHEM 1409 or CHEM 1312 and 1112, MATH 2414, ENVE 2310 Lab fee: $2.

ENVE 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 0 Hours).
Directed study of selected topics in Environmental Engineering. May be repeated with approval of department head.

ENVE 4302. Atmospheric Systems and Air Pollution Control. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Study of atmospheric impact on air pollution. Study of sources of air pollution and their control to include gases and particulate matter. Study of air pollution regulations and air pollution modeling. Design of systems to control and abate air pollution. Study and design of sampling systems to monitor air pollution. Prerequisite: CHEM 1409, ENGR 2322.

ENVE 4310. Water Resources Engineering. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Fundamentals of hydraulics applicable to open channel flow, natural streams and waterways; irrigation flow characteristics; hydrologic analysis; fluid measurement methods; introduction to hydraulic models including HEC-RAS; and economic aspects of water resources. Prerequisite: ENVE 3300.

ENVE 4319. Physical Operations in Water and Wastewater Treatment. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Physical operations in water and wastewater treatment are covered in this course. These include the design of lift stations and gravity sewers, screens, sedimentation tanks, clarifiers and holding basins. Prerequisite: ENVE 3300.

ENVE 4320. Chemical and Biological Processes in Water and Wastewater Treatment. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course covers processes associated with water and wastewater treatment that are mediated chemically or using biological means as well as the design of systems that use such mechanisms. Design of secondary treatment systems, removal of nutrients and design of tertiary treatment systems are covered. Prerequisites: CHEM 2323 (coreq); ENVE 3350 (coreq).

ENVE 4325. Environmental Monitoring and Measurements. 3 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
Studying and analyzing environmental engineering processes and systems through appropriate experimental methods. The course will include sampling, protocol development and design of experiments, relevant measurement techniques and experimental methods. Emphasis on quality control, calibration, documentation and interpretation of results facilitating the development of best practice approaches for experimental design and analysis. Prerequisite: ENVE 3350 (coreq); ENVE 4320 (coreq) Lab fee: $2.

ENVE 4330. Texas Water Resource Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
The ecological relation of water in this biosphere with special reference to the human role; the role of behavioral sciences (social, legal, economic, political, and psychological) in the development, conservation, regulation, and utilization of water resources; current political structure and laws pertaining to the administration of water resources in the state of Texas. Prerequisites: ENVE 3310 and GOVT 2306.

ENVE 4350. Solid and Hazardous Waste Management. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is designed to provide students with the necessary background and knowledge pertaining to the engineering design of solid and hazardous waste management and disposal. Topics covered include landfill design, resource conservation recovery and reuse, hazardous waste management. Prerequisites: CHEM 1409 or CHEM 1312 and 1112, and ENVE 2310.

ENVE 4420. Water and Waste Water Treatment. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Treatment and distribution of residential and industrial water supplies, waste water treatment and disposal methods of municipal and industrial systems, environmental toxicology; aspects of groundwater monitoring and water quality maintenance. Laboratory analysis of water and waste water quality. Design of elementary treatment, distribution, and collection systems. Prerequisites: CHEM 2423 or both CHEM 2323 and CHEM 2123, ENVE 2310, and ENVE 3300 Lab fee: $2.

Mechanical Engineering Courses

MEEN 2115. Engineering Computer Aided Manufacturing. 1 Credit Hour (Lecture: 1 Hour, Lab: 2 Hours).
This is a fundamental course that demonstrates the integration of Computer-Aided-Design (CAD) and Computer-Aided-Manufacturing (CAM), and examines how to program and operate Computer Numerical Control (CNC) mills and lathes. It is a study of modern prototyping and machining methods, with emphasis on teaching the use of CAM software. This program converts 2D and 3D CAD drawing geometry directly into tool path information that is used to drive numerically-controlled turning and milling machines. Prerequisite: MEEN 2210 (prereq); MATH 2413 (coreq).

MEEN 2210. Engineering Computer Aided Design. 2 Credit Hours (Lecture: 2 Hours, Lab: 2 Hours).
Fundamentals of engineering design and solid modeling using computer aided drafting tools; application of solid modeling, analysis and simulation software and 3-D printing to problem solving and design. Prerequisite: ENGR 1211 (coreq); MATH 2412 (coreq) Lab fee: $2.

MEEN 2212. Programming for Engineers. 2 Credit Hours (Lecture: 1 Hour, Lab: 2 Hours).
Programming principles and techniques for matrix and array operations, equation solving, and numeric simulations applied to engineering problems and visualization of engineering information; platforms include spreadsheets, symbolic algebra packages, engineering analysis software, and laboratory control software. Prerequisite: MATH 2413 Lab fee: $2.

MEEN 2310. Engineering CAD/CAM. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).
Application of solid modeling, analysis and simulation software and 3-D printing to problem solving and design. Fundamentals of engineering design and solid modeling using computer-aided drafting tools. Standard terminologies, conventions, processes, operations, design and operational characteristics of key hardware components, programming techniques, applications, merits and demerits of Computer Numerical Controlled (CNC) machines. Prerequisite: ENGR 1212; MATH 2413 or concurrent registration Lab fee: $2.

MEEN 3305. Fluid Mechanics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is an introduction to fluid mechanics, and emphasizes fundamental concepts and problem-solving techniques. Topics to be covered include fluid properties, fluid statics, fluid kinematics, control volume analysis, dimensional analysis, internal flows (pipe flows), and external flows (lift and drag). Brief introductions to computational fluid dynamics (CFD), compressible flow, and fluid power systems such as turbomachinery (pumps and turbines) will also be provided. Prerequisite: PHYS 2425, MATH 2414, ENGR 2322.

MEEN 3310. Materials and Manufacturing Processes in Design. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course covers the relationship between product design and manufacturing, assembly, testing and service. Includes materials selection, traditional and nontraditional manufacturing process, inspection, reliability, quality engineering and the economic impact of modern process engineering. Also emphasizes mechanical properties of materials, material microstructures and use of design methodology. Prerequisites: MEEN 2210, CVEN 3423.

MEEN 3314. Signals and Systems. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Modeling and analysis of electrical and mechanical systems using Laplace transformation methods; transient and steady-state analysis; Fourier series; Fourier transform; elementary feedback. Prerequisite: ELEN 2425, MATH 3306 or concurrent registration.

MEEN 3325. Advanced Thermodynamics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Design of power and refrigeration systems, mixing or separation, multiphase, air conditioning and energy conversion processes; engine design and operating parameters dealing with thermo-chemistry of fuel air mixtures; properties of working fluids; power cycle analysis with thermodynamic properties and working fluids. Prerequisites: ENGR 2322, CHEM 1409, and MATH 3306 (coreq).

MEEN 3335. Mechanical Vibration. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Modeling, analysis and design for mechanical vibrations. Fundamentals of free vibration, harmonically excited vibration and vibration under general forcing conditions for one degree and multidegree of freedom systems; vibration design strategies including isolation and absorbers; analysis of mechanical systems for stability, resonance, damping, and modal coupling. Prerequisite: ENGR 2324, CVEN 3423, MATH 3306 Lab fee: $2.

MEEN 3345. Heat Transfer. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Heat transfer by conduction, convection, and radiation; steady-state and unsteady heat conduction; free and forced convection heat transfer; radiative heat transfer; heat exchanger analysis. Prerequisite: ENGR 2322, MEEN 3305, MATH 3306.

MEEN 3350. Measurement System Design. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).
Design of measurement systems including hardware and software specifications, design, prototyping and testing. Includes fundamentals of data acquisition, design of experiments, instrumentation and sensor calibration commonly used in industry and research (e.g., sensors, signal conversion and conditioning, and wireless data communications). Prerequisite: ELEN 3314, MEEN 2210, PHYS 2426 Lab fee: $2.

MEEN 3400. Fluid Mechanics. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Perform analyses involving hydrostatics, fluid dynamics, pipe flow, open-channel flow, pumps, and dimensional analysis. Design and conduct fluid mechanics experiments. Perform computer simulations of fluid processes. Prerequisites: PHYS 2425 and MATH 2414 Lab fee: $2.

MEEN 3440. Heat Transfer. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Steady and transient conduction in one- and two-dimensions; forced and natural convection; radiation; phase change; basic heat exchangers design; elements of thermal system design. Includes an introduction to computational analysis of heat transfer and temperature distributions and laboratory experiences. Prerequisite: ENGR 2322 Lab fee: $2.

MEEN 4086. Special Problems. 1-4 Credit Hours (Lecture: 1-4 Hours, Lab: 1-4 Hours).
Directed study of selected topics in Mechanical Engineering. May be repeated with approval of department head.

MEEN 4205. Mechanical Engineering Experimental Lab. 2 Credit Hours (Lecture: 1 Hour, Lab: 3 Hours).
Experimentation and measurements in fluid mechanics and heat transfer; efficiency analysis; design of experiment; data processing and analysis; report writing. Prerequisite: MEEN 3305, MEEN 3345 Lab fee: $2.

MEEN 4300. Renewable Energy Systems and Applications. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI **(**http://catalog.tarleton.edu/academicaffairs/**)]**
Study of renewable energy sources, future demands, energy management and conservation techniques with focus on sources such as solar energy, biomass (conversions), wind power, geothermal energy, ocean energy, fuel cells and hydro power; assessing the viability of renewable energy systems; and analysis of renewable energy systems, applications, backup energy needs and economic factors. Prerequisites: MEEN 3325, MEEN 3305, MEEN 3345.

MEEN 4310. Mechanical Engineering Design I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Application of principles of mechanics and physical properties of materials, stress fundamentals and failure theories to the design, selection and analysis of linear elastic solid materials in machine elements with consideration of economics, safety and design for manufacturing. Prerequisite: MEEN 2210, MEEN 2115, CVEN 3423, ENGR 2324.

MEEN 4320. Mechanical Engineering Design II. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Modeling, analysis and design of machine elements such as springs, bearings, gears, shafts, and mechanisms based on extensive application of physics, mathematics, core engineering principles and industrial practice; design for optimal manufacturability, quality and reliability in the mechanical engineering practice of design. Prerequisite: MEEN 4310, MEEN 3305 Lab fee: $2.

MEEN 4420. Thermal-Fluid System Design. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Application of thermodynamics, heat transfer and fluid mechanics concepts to the analysis and design of thermal-fluid systems. Emphasis on component and system modeling, energy balances, performance measurements and experimental design. Prerequisite: ENGR 2322, MEEN 3305, MEEN 3345 Lab fee: $2.

MEEN 4425. Mechatronics. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
The study and design of electromechanical devices including comprehensive principles from mechanics, electronics, instrumentation and software; includes sensors, control systems and actuators along with how to choose a proper controller for mechanical engineering design problems. Prerequisites: ELEN 2425, MEEN 4310; ELEN/MEEN 4443 Lab fee: $2.

MEEN 4443. Linear Control Systems. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Application of state variable and frequency domain techniques to modeling and analysis of single input, single output linear control systems; physical implementation of control systems by integrating sensors, actuators and other control system components; use of software design tools. Prerequisite: ELEN 2425, ELEN 3320 or COSC 3344, MATH 3306. Lab fee: $2.

School of Engineering Courses

SENG 1100. Transitioning to University Studies in Engineering, Engineering Tech, Construction and Computer Sci. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).
Practical study designed to prepare the student for university life, aid in the development of skills for academic success, promote personal growth and responsibility, and encourage active involvement in the learning process from an individual college perspective. These skill sets are presented in the context of engineering, engineering technology, construction, and computer science disciplines.