Approved Technical Elective Courses for CEAE Students

Courses listed below may be used to fulfill technical electives for AREN and CVEN majors. You may take up to 6 credits of technical electives outside AREN/CVEN – chosen from this list or approved by petition.

Any AREN/CVEN course 3000+ will count as a technical elective.

Any course <u>outside</u> AREN/CVEN must be specifically listed here, or it will not count as a technical elective. Other upper-division math, science, or engineering courses may be petitioned for approval – see your academic advisor for more information BEFORE enrolling in an unapproved course.

Note: Pre-requisites may apply; you may want to consider using your free elective to fulfill a pre-requisite requirement for a course in which you are very interested. **See the CU catalog: www.colorado.edu/catalog** for current course restrictions and pre-requisites.

Courses outside of CEAE may be restricted to students in that major, but exceptions may be made if space permits. For engineering courses, most departments have course request forms posted at https://www.colorado.edu/engineering-advising/departmental-course-request-forms for each semester. Otherwise, contact the department in charge of the course to request permission to enroll.

Do a course search to see which courses are being offered each semester.

College of Engineering and Applied Science:

AREN 3xxx or 4xxx – all upper-division AREN courses not counting elsewhere toward degree requirements

ASEN 3116 (3) Introduction to Biomedical Engineering
ASEN 4090 (3) Global Positioning Systems Applications
ASEN 4128 (3) Human Factors in Engineering and Design
ASEN/ATOC 4215 (3) Descriptive Physical Oceanography
ASEN 4216 (3) Neural Signals & Functional Brain Imaging
ASEN 4218 (3) Large Space Structures Design
ASEN 4238 (3) Computer-Aided Control Systems Design
ASEN 4248 (3) Computer-Aided Control System Design 2
ASEN 4426 (3) Neural Systems and Physiological Control

CHEN 3220 (3) Chemical Engineering Separations and Mass Transfer
CHEN 3660 (3) Energy Fundamentals
CHEN 4130 (3) Chemical Engineering Laboratory
CHEN-4330 (3) Chemical Engineering Reaction Kinetics
CHEN 4440 (3) Chemical Engineering Materials
CHEN-4450 (3) Polymer Chemistry
CHEN 4460 (3) Polymer Engineering
CHEN-4520 (3) Chemical Process Synthesis
CHEN 4521 (3) Physical Chemistry for Engineers
CHEN-4530 (2) Chemical Engineering Design Project
CHEN-4570 (4) Instrumentation and Process Control
CHEN 4630 (1) Intellectual Property Law and Engineering
CHEN 4650 (3) Particle Technology
CHEN-4801 (3) Pharmaceutical Biotechnology
CHEN 4803 (3) Metabolic Engineering
CHEN 4805 (3) Biomaterials
CHEN-4810 (3) Biological Engineering Laboratory
CHEN 4820 (3) Biochemical Separations
CHEN-4830 (3) Chemical Engineering Biokinetics

CHEN-4836 (3) Nanomaterials
CHEN 5360 (3) Catalysis and Kinetics

CSCI 3002 (4) Fundamentals of Human Computer Interaction
CSCI 3104 (4) Algorithms
CSCI 3155 (4) Principles of Programming Languages
CSCI 3202 (3) Introduction to Artificial Intelligence
CSCI 3287 (3) Design and Analysis of Data Systems
CSCI-3302 (3) Introduction to Robotics
CSCI 3308 (3) Software Development Methods and Tools
CSCI 3434 (3) Theory of Computation
CSCI 3656 (3) Numerical Computation 1
CSCI-3702 (3) Cognitive Science
CSCI 3753 (4) Design and Analysis of Operating Systems
CSCI 4113 (3) LINUX System Administration
CSCI 4229 (3) Computer Graphics
CSCI 4273 (3) Network Systems
CSCI-4239 (3) Advanced Computer Graphics
CSCI-4302 (3) Advanced Robotics
CSCI 4308 (4) Software Engineering Project 1
CSCI-4314 (3) Algorithms for Molecular Biology
CSCI 4318 (4) Software Engineering Project 2
CSCI 4348 (4) Startup Essentials: Entrepreneurial Projects in Computing
CSCI 4446 (3) Chaotic Dynamics
CSCI 4448 (3) Object Oriented Analysis and Design
CSCI-4502 (3) Data Mining
CSCI 4555 (3) Compiler Construction
CSCI 4576 (4) High Performance Scientific Computing 1
CSCI 4593 (3) Computer Organization
CSCI 4753 (3) Computer Performance Modeling
CSCI 4809 (3) Computer Animation

CVEN 3xxx or 4xxx – all upper-division CVEN courses not counting elsewhere toward degree requirements

ECEN 3030 (3) Electrical/Electronic Circuits Non-Major
ECEN 3170 (3) Electromagnetic Energy Conversion 1
ECEN 3250 (5) Microelectronics
ECEN 3300 (3) Linear Systems
ECEN 3303 (3) Introduction to Robotics
ECEN 3320 (3) Semiconductor Devices
ECEN 3350 (3) Programming Digital Systems
ECEN-3360 (3) Digital Design Laboratory
ECEN 3400 (3) Electromagnetic Fields and Waves
ECEN 3410 (3) Electromagnetic Waves and transmission
ECEN 4106 (3) Photonics
ECEN 4116 (3) Introduction to Optical Communications
ECEN 4138 (3) Control Systems Analysis
ECEN 4167 (3) Electromagnetic Energy Conversion 2
ECEN 4224 (3) High Speed Digital Design
ECEN 4242 (3) Communication Theory
ECEN-4324 (3) Fundamentals of Microsystem Packaging
ECEN-4341 (3) Bioelectromagnetics
ECEN-4375 (3) Microstructures Laboratory
ECEN-4517 (3) Power Electronics and Photovoltaic Power Systems Laboratory
ECEN-4532 (3) Digital Signal Processing Laboratory
ECEN-4553 (3) Compiler Construction
ECEN 4555 (3) Principles of Energy Systems and Devices
ECEN 4583 (3) Software System Development

ECEN-4593 (3) Computer Organization
ECEN-4606 (3) Undergraduate Optics Laboratory
ECEN-4616 (3) Optoelectronic System Design
ECEN-4633 (3) Hybrid Embedded Systems
ECEN-4634 (3) Microwave and RF Laboratory
ECEN-4638 (3) Control Systems Laboratory
ECEN-4643 (3) SW Engineering of Concurrent Systems
ECEN-4652 (3) Communication Laboratory
ECEN-4653 (3) Real-Time Digital Media
ECEN-4743 (3) SW Engineering of Distributed Systems
ECEN-4753 (3) Computer Performance Modeling
ECEN 4797 (3) Introduction to Power Electronics
ECEN-4811 (3) Neural Signals and Functional Brain Imaging
ECEN-4827 (3) Analog IC Design
ECEN 4831 (3) Brains, Minds, Computers
ECEN 5107 (3) Electric Power Grid

EMEN 4100 (3) Engineering Economics
EMEN 4110 (3) Supply Chain Management
EMEN 4120 (3) Managing Business Processes

EVEN 4100 (3) Environmental Sampling and Analysis

GEEN 3400 (3) Invention and Innovation

MCEN 3022 (3) Heat Transfer
MCEN 3025 (3) Component Design
MCEN 3030 (3) Computational Methods
MCEN 3032 (3) Thermodynamics 2
MCEN-4026 (3) Manufacturing Processes and Systems
MCEN-4037 (2) Measurements Lab
MCEN-4043 (3) System Dynamics
MCEN-4057 (3) Environmental Modeling
MCEN-4115 (3-4) Mechatronics and Robotics I
MCEN 4117 (3) Anatomy and Physiology for Engineers
MCEN 4123 (3) Vibration Analysis
MCEN 4124 (3) Mechanical Behavior of Materials
MCEN-4127 (3) Biomedical Ultrasound
MCEN 4131 (3) Air Pollution Control Engineering
MCEN 4133 (3) Biomechanics
MCEN 4135 (3) Wind Energy and Wind Turbine Design
MCEN-4137 (3) Anatomy and Physiology 2
MCEN 4141 (3) Indoor Air Pollution
MCEN 4151 (3) Flow Visualization
MCEN 4152 (3) Introduction to Combustion
MCEN-4154 (3) Biocolloids and Biomembranes
MCEN 4162 (3) Energy Conversion
MCEN-4173 (3) Finite Element Analysis
MCEN 4174 (3) Failure of Engineering Materials
MCEN 4183 (3) Mechanics of Composite Materials
MCEN 4194 (3) Electrochemical Energy Conversion and Storage
MCEN 4228 (3) Sp Tp: Renewable and Sustainable Energy

College of Arts & Sciences:
AIRR 3010 (3) Air Force Leadership Studies I

APPM 3010 (3) Chaos in Dynamical Systems
APPM 3050 (3) Scientific Computing in Matlab

APPM 3170 (3) Discrete Applied Mathematics
APPM 3310 (3) Matrix Methods and Applications
APPM-3350 (3) Advanced Engineering Calculus
APPM 4120 (3) Introduction to Operations Research – *counts toward CEAE Engineering Science Track*
APPM 4350 (3) Methods in Appl Math: Fourier Series/Boundary Value Prob – *counts toward CEAE Engineering Science Track*
APPM 4360 (3) Methods in Appl Math: Complex Variables & Applications
APPM 4380 (3) Modeling in Applied Mathematics
APPM-4390 (3) Modeling in Mathematical Biology
APPM 4440 (3) Undergraduate Applied Analysis 1
APPM 4450 (3) Undergraduate Applied Analysis 2
APPM 4560 (3) Markov Processes, Queues, and Monte Carlo Simulations
APPM 4650 (3) Intermediate Numerical Analysis 1
APPM 4660 (3) Intermediate Numerical Analysis 2
APPM 4720 (3) Open Topics in Applied Mathematics

For AREN students who do not take CVEN 3227, APPM 3570 Applied Probability or APPM 4570 Statistical Methods can be taken as a tech elective.

ASTR/ATOC 3720 (3) Planets and Their Atmospheres
ASTR-3730 (3) Astrophysics 1 - Stellar and Interstellar
ASTR-3740 (3) Cosmology and Relativity
ASTR-3750 (3) Planets, Moons, and Rings
ASTR-3760 (3) Solar and Space Physics
ASTR-3830 (3) Astrophysics 2 - Galactic and Extragalactic
ASTR-4330 (3) Cosmochemistry

ATOC/GEOL 3070 (3) Introduction to Oceanography
ATOC 3180 (3) Aviation Meteorology
ATOC 3300 (3) Analysis of Climate and Weather Observations
ATOC 3500 (3) Air Chemistry and Pollution
ATOC 3600 (3) Principles of Climate
ATOC/ASTR 3720 (3) Planets and Their Atmospheres
ATOC-4200 (3) Biogeochemical Oceanography
ATOC/ASEN 4215 (3) Descriptive Physical Oceanography
ATOC-4700 (3) Weather Analysis and Forecasting
ATOC 4720 (3) Intro to Atmospheric Dynamics
ATOC 4750 (3) Desert Meteorology and Climate

CHEM 3311 (4) Organic Chemistry 1
CHEM 3321 (1) Laboratory in Organic Chemistry 1
CHEM 3331 (4) Organic Chemistry 2
CHEM 3341 (1) Lab in Organic Chemistry 2
CHEM 4011 (3) Modern Inorganic Chemistry
CHEM 4021 (3) Inorganic Laboratory
CHEM-4131 (3) Chemistry of Global Health
CHEM-4141 (3) Environmental Water and Soil Chemistry
CHEM 4171 (3) Instrumental Analysis
CHEM 4181 (4) Instrumental Analysis Lecture and Laboratory 2
CHEM-4251 (3) Materials Chemistry and Properties
CHEM-4261 (3) Organic Materials: Structures and Functions
CHEM-4271 (3) Chemistry of Solar Energy
CHEM 4531 (3) Physical Chemistry 2
CHEM 4581 (1) Physical Chemistry Lab 1
CHEM 4591 (2) Physical Chemistry Lab 2
CHEM 4611 (3) Survey of Biochemistry
CHEM 4621 (3) Genome Databases: Mining and Management
CHEM 4711 (3) Foundations of Biochemistry
CHEM 4751 (3) Current Topics in Biochemical Research

CHEM 4761 (4) Biochemistry Laboratory
CHEM 4791 (3) Bioorganic Chemistry in Biotechnology

EBIO 3040 (4) Conservation Biology
EBIO 3080 (4) Evolutionary Biology
EBIO 3110 (3) Population and Community Ecology
EBIO 3170 (3) Mountain Ecology and Conservation
EBIO 3180 (3) Global Ecology
EBIO 3190 (3) Tropical Marine Ecology
EBIO 3240 (4) Animal Behavior
EBIO 3270 (3) Ecosystem Ecology
EBIO-3400 (3) Microbiology
EBIO 3630 (4) Parasitology
EBIO 3850 (4) Animal Diversity: Invertebrates
EBIO 4030 (3) Limnology
EBIO 4060 (3) Landscape Ecology
EBIO-4080 (4) Freshwater Phycology
EBIO 4090 (2) Coral Reef Ecology
EBIO 4100 (3) Advanced Ecology
EBIO 4120 (2-4) Advanced Ecology
EBIO 4140 (3) Plant Ecology
EBIO 4150 (1-2) Techniques in Ecology
EBIO 4160 (3) Introduction to Biogeochemistry
EBIO 4175 (3) Scientific Basis for Ecosystem Management Public Lands
EBIO 4290 (3) Phylogenetics and Comparative Biology
EBIO 4410 (4) Biometry
EBIO-4440 (4) Animal Developmental Diversity
EBIO 4500 (4) Plant Biodiversity and Evolution
EBIO 4510 (4) Plant Anatomy and Development
EBIO-4520 (4) Plant Systematics
EBIO-4530 (4) Functional Plant Biology
EBIO-4550 (4) Plant Eco-Evo-Devo
EBIO 4640 (2-4) Plant Field Studies
EBIO 4660 (4) Insect Biology
EBIO 4740 (3) Biology of Amphibians and Reptiles
EBIO 4750 (4) Ornithology
EBIO 4760 (4) Mammalogy

ENVS 3001 (3) Sustainable Solutions Consulting
ENVS/EBIO 3040(4) Conservation Biology
ENVS/PHYS 3070 (3) Energy and the Environment
ENVS/CVEN 3434 (3) Introduction to Applied Ecology
ENVS/GEOL 3520 (3) Energy and Climate Change: An Interdisciplinary Approach
ENVS/ATOC 3600/GEOG 3601 (3) Principles of Climate
ENVS 4050 (3) Field Methods in Environmental Sciences
ENVS/GEOL/EBIO 4160 (3) Intro to Biogeochemistry
ENVS/GEOG 4201 (3) Biometeorology
ENVS-4795 (3) Field Methods in Zoology and Botany

GEOG 3053 (4) Cartography: Visualization and Information Design
GEOG 3251 (3) Mountain Geography
GEOG 3301 (3) Analysis of Climate and Weather Observation
GEOG 3351 (3) Biogeography
GEOG 3412 (3) Conservation Practice and Resource Management
GEOG 3511 (4) Introduction to Hydrology
GEOG 3601 (3) Principles of Climate
GEOG 4023 (4) Introduction to Quantitative Methods in Human Geography
GEOG 4043 (4) Cartography 2: Interactive & Multimedia Mapping

GEOG 4093 (4) Remote Sensing of the Environment
GEOG 4103 (4) Introduction to Geographic Information Science
GEOG/ENVS 4201 (3) Biometeorology
GEOG 4203 (4) Geographic Information Science: Modeling Applic
GEOG 4241 (4) Principles of Geomorphology
GEOG 4251 (4) Fluvial Geomorphology
GEOG 4303 (4) GIS Programming for Spatial Analysis
GEOG 4311 (3) Watershed Biogeochemistry
GEOG 4321 (3-4) Snow Hydrology
GEOG 4331 (3-4) Mountain Climatology
GEOG 4371 (3) Forest Geography: Principles and Dynamics
GEOG 4401 (3) Soils Geography
GEOG 4501 (3) Water Resources & Water Management of Western US

GEOL 3010 (3) Introduction to Mineralogy
GEOL 3020 (3) Petrology
GEOL 3030 (3) Introduction to Hydrogeology
GEOL 3040 (3) Global Change: The Recent Geological Record
GEOL 3050 (2) GIS for Geologists
GEOL/ATOC 3070 (3) Introduction to Oceanography
GEOL 3120 (4) Structural Geology
GEOL 3300 (3) Extraterrestrial Life
GEOL 3320 (3) Introduction to Geochemistry
GEOL 3410 (3) Paleobiology
GEOL 3430 (4) Sedimentology and Stratigraphy
GEOL 3520 (3) Energy and Climate Change: An Interdisciplinary Approach
GEOL 3540 (3) Introduction to Petroleum Geology
GEOL 3720 (3) Evolution of Life: The Geological Record
GEOL 3950 (3) Natural Catastrophes & Geologic Hazards
GEOL 4060 (4) Oceanography
GEOL 4093 (4) Remote Sensing of the Environment
GEOL 4130 (3) Principals of Geophysics
GEOL 4160 (3) Introduction to Biogeochemistry
GEOL 4241 (4) Principles of Geomorphology
GEOL 4270 (3) Marine Chemistry and Geochemistry
GEOL 4474 (4) Vertebrate Paleontology
GEOL 4550 (3) Petroleum Reservoir Characterization & Modeling
GEOL 4670 (3) Isotope Geology
GEOL 4711 (2) Igneous and Metamorphic Field Geology
GEOL 4712 (2) Structural Field Geology
GEOL 4714 (2) Field Geophysics
GEOL 4715 (2) Field Techniques in Hydrogeology
GEOL 4716 (2) Environmental Field Geochemistry
GEOL 4717 (2) Field Seminar in Geology and Tectonics

IPHY 3060 (4) Cell Physiology
IPHY 3410 (3) Introduction to Human Anatomy
IPHY 3415 (2) Human Anatomy Laboratory
IPHY 3430 (3) Human Physiology
IPHY 3435 (2) Physiology Laboratory
IPHY 3450 (3) Comparative Animal Physiology
IPHY 3460 (5) Comparative Vertebrate Anatomy
IPHY 3470 (3) Human Physiology 1
IPHY 3480 (3) Human Physiology 2
IPHY 3500 (2) Applied Clinical Research
IPHY 3660 (3) Dynamics of Motor Learning
IPHY 3800 (3) Forensic Biology
IPHY 3810 (1) Forensic Biology Laboratory

IPHY 4200 (3) Physiological Genetics and Genomics
IPHY 4440 (3) Endocrinology
IPHY 4470 (3) Biology of Human Reproduction
IPHY 4480 (3) Comparative Reproduction
IPHY 4740 (3) Theory of Motor Skills Learning

MATH 3110 (3) Introduction to Theory of Numbers
MATH 3140 (3) Abstract Algebra 1
MATH 3170 (3) Combinatorics 1
MATH 3210 (3) Euclidean and Non-Euclidean Geometries
MATH 4000 (3) Foundations of Mathematics
MATH 4120 (3) Introduction to Operations Research
MATH 4140 (3) Abstract Algebra 2
MATH 4230 (3) Differential Geometry of Curves and Surfaces
MATH 4330 (3) Fourier Analysis
MATH 4440 (3) Mathematics of Coding and Cryptography
MATH 4450 (3) Introduction to Complex Variables
MATH 4470 (3) Partial Differential Equations
MATH 4510 (3) Introduction to Probability Theory
MATH 4520 (3) Introduction to Mathematical Statistics
MATH 4540 (3) Introduction to Time Series
MATH 4650 (3) Intermediate Numerical Analysis 1
MATH 4660 (3) Intermediate Numerical Analysis 2
MATH 4730 (3) Set Theory

NAVR 4010 (3) Leadership and Management I

PHYS/ENVS 3070 (3) Energy and the Environment
PHYS 3210 (3) Classical Mechanics and Mathematical Methods 2
PHYS 3220 (3) Quantum Mechanics
PHYS 3310 (3) Principles of Electricity and Magnetism 1
PHYS 3320 (3) Principles of Electricity and Magnetism 2
PHYS 3330 (2) Electronics for the Physical Sciences
PHYS 4130 (3) Biological Electron Microscopy: Principles and Recent Advances
PHYS 4150 (3) Plasma Physics
PHYS 4410 (3) Quantum Mechanics 2
PHYS 4420 (3) Nuclear and Particle Physics
PHYS 4510 (3) Optics

PSYC 4165 (4) Psychology of Perception

STAT 4520/5520 Introduction to Mathematical Statistics
STAT 4540 (3) Introduction to Time Series
STAT 4610 (3) Statistical Learning

THTR 3055 (3) Stage Lighting Design 1 – ***approved as a technical elective only for AREN students focusing in Lighting & Electrical Systems***

Leeds School of Business:
Business Minor courses approved as technical electives

BUSM 3001 (3) Managing Innovation in Organizations
BUSM 3002 (3) Business and Financial Analytics
BUSM 3010 (1.5) Managing Innovation I
BUSM 3011 (1.5) Managing Innovation II
BUSM 3020 (1.5) Business and Financial Analytics I
BUSM 3021 (1.5) Business and Financial Analytics II

Program in Environmental Design:

ENVD 3009 (6) Urban Site Analysis & Design in Rome (global seminar) – ***approved for 3 credits of technical electives***
ENVD 3152 (3) Introduction to Computer Graphics Applications: Geographic Info Systems
ENVD 3300 (6) Special Topics: Praxis Studio – ***Solar Decathlon sections ONLY are approved for 3 credits of technical electives***
      Spring 2019: ENVD 3300 section 070/071

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