Last Updated: **Friday, December 9, 2022**

Planned Course Rotation for CAE Courses

The actual course offerings can be viewed online using CaneLink. For planning purposes, the course rotations are shown on the following pages. These include:

* Civil Engineering courses: Structures / Geotechnical / Transportation
* Architectural Engineering courses: MEP and Construction
* Biomedical Engineering (BME), Industrial Engineering (IEN), and Mechanical & Aerospace (MAE) graduate courses relevant to CAE

1 Combined section of CAE 520 and CAE 620 should be offered.

Example rotation:

3 Sections of CAE 210 should be offered.

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| **Semester** | **Undergraduate** | | | | | | | | | | | | **Graduate** | | | |
| Spring 2021 | 210  210  210 | 211 | 212  212 |  | 313  313 | 310 | 321 | 450 | 370 | 371  371  371 | 402 | 404 | 520/620 | 590/690 | 604 | 711 |

Civil Engineering Courses: Structures / Geotechnical / Transportation

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| **Semester** | **Undergraduate** | | | | | | | | | | | | **Graduate†** | | | | | |
| ~~Spring 2021~~ | ~~210~~  ~~210~~  ~~210~~ | ~~211~~ | ~~212~~  ~~212~~ |  | ~~313~~  ~~313~~ | ~~310~~ | ~~321~~ | ~~450~~ | ~~370~~ | ~~371~~  ~~371~~  ~~371~~ | ~~402~~ | ~~404~~ | ~~520/620~~ | ~~523/623~~ | ~~570/670~~ | ~~604~~ | ~~714~~ |  |
| ~~Fall 2021~~ | ~~210~~  ~~210~~  ~~210~~ | ~~211~~ | ~~212~~  ~~212~~  ~~212~~ | ~~213~~  ~~213~~ |  | ~~310~~ | ~~320~~ | ~~350~~ | ~~470~~ |  | ~~402~~ | ~~403~~ | ~~521/621~~ | ~~525/625~~ |  |  | ~~712~~  ~~702~~  ~~729~~ | ~~744~~ |
| ~~Spring 2022~~ | ~~210~~  ~~210~~  ~~210~~ | ~~211~~ | ~~212~~  ~~212~~ |  | ~~313~~  ~~313~~ | ~~310~~ | ~~321~~ | ~~450~~ | ~~370~~ | ~~371~~  ~~371~~  ~~371~~ | ~~402~~ | ~~404~~ | ~~520/620~~ | ~~522/622~~ | ~~570/670~~ | ~~604~~  ~~605~~ | ~~711~~ |  |
| ~~Fall 2022~~ | ~~210~~  ~~210~~  ~~210~~ | ~~211~~ | ~~212~~  ~~212~~  ~~212~~ | ~~213~~  ~~213~~ |  | ~~310~~ | ~~320~~ | ~~350~~ | ~~470~~ |  | ~~402~~ | ~~403~~ | ~~521/621~~ | ~~511/611~~ |  | ~~605~~ | ~~716~~ | ~~744~~ |
| ~~Spring 2023~~ | ~~210~~ | ~~211~~ | ~~212~~  ~~212~~ |  | ~~313~~  ~~313~~ | ~~310~~ | ~~321~~ | ~~450~~ | ~~370~~ | ~~371~~  ~~371~~  ~~371~~ | ~~402~~ | ~~404~~ | ~~520/620~~ | ~~523/623~~ | ~~570/670~~ | ~~604~~  ~~605~~ | ~~714~~ |  |
| Fall 2023 | 210  210  210 | 211 | 212  212  212 | 213  213 |  | 310 | 320 | 350 | 470 |  | 402 | 403 | 521/621 | 525/625 |  | 605 | 712  729 | 744 |
| Spring 2024 | 210  210  210 | 211 | 212  212 |  | 313  313 | 310 | 321 | 450 | 370 | 371  371  371 | 402 | 404 | 520/620 | 522/622 | 570/670 | 604  605 | 711  702 |  |
| Fall 2024 | 210  210  210 | 211 | 212  212  212 | 213  213 |  | 310 | 320 | 350 | 470 |  | 402 | 403 | 521/621 | 511/611 |  | 605 | 716 | 744 |
| Spring 2025 | 210  210  210 | 211 | 212  212 |  | 313  313 | 310 | 321 | 450 | 370 | 371  371  371 | 402 | 404 | 520/620 | 523/623 | 570/670 | 604  605 | 714 |  |

**†** Note: CAE 703 and CAE 704 are typically offered every semester

Architectural Engineering Courses: MEP and Construction\*

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| **Semester** | **Undergraduate** | | | | | | **Graduate†** | | | | | | | | | |
| ~~Spring 2021~~ | ~~380~~ | ~~381~~ | ~~404~~ | ~~460~~ |  |  | ~~604~~ | ~~560/660~~ |  | ~~665~~ | ~~581/681~~ | ~~582/682~~ | ~~761~~ | ~~762~~ |  |  |
| ~~Fall 2021~~ | ~~361~~ |  | ~~403~~ |  | ~~480~~ | ~~481~~ |  |  | ~~561/661~~ |  |  |  |  | ~~762~~ | ~~782~~ | ~~781~~ |
| ~~Spring 2022~~ | ~~380~~ | ~~381~~ | ~~404~~ | ~~460~~ |  |  | ~~604~~ | ~~560/660~~ |  | ~~665~~ | ~~581/681~~ | ~~582/682~~ | ~~761~~ | ~~762~~ |  |  |
| ~~Fall 2022~~ | ~~361~~ |  | ~~403~~ |  | ~~480~~ | ~~481~~ |  |  | ~~561/661~~ |  |  |  |  | ~~762~~ | ~~782~~ |  |
| ~~Spring 2023~~ | ~~380~~ | ~~381~~ | ~~404~~ | ~~460~~ |  |  | ~~604~~ | ~~560/660~~ |  | ~~665~~ | ~~581/681~~ | ~~582/682~~ | ~~761~~ |  |  |  |
| Fall 2023 | 361 |  | 403 |  | 480 | 481 |  |  | 561/661 |  |  |  |  | 762 | 782 |  |
| Spring 2024 | 380 | 381 | 404 | 460 |  |  | 604 | 560/660 |  | 665 | 581/681 | 582/682 | 761 |  |  |  |
| Fall 2024 | 361 |  | 403 |  | 480 | 481 |  |  | 561/661 |  |  |  |  | 762 | 782 |  |
| Spring 2025 | 380 | 381 | 404 | 460 |  |  | 604 | 560/660 |  | 665 | 581/681 | 582/682 | 761 |  |  |  |
| Fall 2025 | 361 |  | 403 |  | 480 | 481 |  |  | 561/661 |  |  |  |  | 762 | 782 |  |

**†** Note: CAE 703 and CAE 704 are typically offered every semester

Graduate Course Groups

Courses in gray font are not regularly offered.

Courses in blue font are offered by the CET department.

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| **A** | **Group A: 700-level lecture-based CAE courses in civil and architectural engineering** | | |
| **Course** | | **Title** | **Credits** |
| CAE 702 | | Finite Element Methods [consider MAE 705 or BME 687 instead] | 3 |
| CAE 711 | | Theory of Elasticity | 3 |
| CAE 712 | | Structural Reliability | 3 |
| CAE 714 | | Structural Dynamics | 3 |
| CAE 716 | | Fracture Mechanics | 3 |
| CAE 720 | | Concrete Materials Science | 3 |
| CAE 729 | | Molecular Modeling of Materials | 3 |
| CAE 744 | | Risk Management and Resilience | 3 |
| CAE 761 | | Building Information Modeling II | 3 |
| CAE 762 | | Construction Project Management | 3 |
| CAE 782 | | Control Theory and HVAC Applications | 3 |
| CAE 790 | | Advanced Topics | 1-3 |
| CET 735 | | WWE: Treatment and Reuse | 3 |

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| **B** | **Group B: 600-level lecture-based CAE courses in civil and architectural engineering** | | |
| **Course** | | **Title** | **Credits** |
| CAE 610 | | Structural Mechanics [consider MAE 607 instead] | 3 |
| CAE 611 | | Advanced Structural Analysis | 3 |
| CAE 620 | | Advanced Design of Concrete Structures | 3 |
| CAE 621 | | Advanced Design of Steel Structures | 3 |
| CAE 622 | | Design of Prestressed Concrete Structures | 3 |
| CAE 623 | | Design of Masonry Structures | 3 |
| CAE 625 | | Timber Structural Systems | 3 |
| CAE 660 | | Sustainable Construction | 3 |
| CAE 661 | | Computer Aided Architectural Engineering Design | 3 |
| CAE 670 | | Advanced Foundation Engineering | 3 |
| CAE 681 | | Energy-Efficient Building Design | 3 |
| CAE 682 | | Building Energy Modeling and Simulation | 3 |
| CAE 690 | | Special Topics | 1-3 |
| CET 633 | | Water-Quality Control in Natural Systems | 3 |
| CET 640 | | Environmental Chemistry | 3 |
| CET 641 | | Engineering Systems for Disease Control and Bioremediation | 3 |
| CET 643 | | Air Pollution Control Engineering | 3 |

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| **C** | **Group C: 600- or 700-level CAE courses in Construction Management** | | |
| **Course** | | **Title** | **Credits** |
| CAE 665 | | Facilities Operation and Management | 3 |
| CAE 669 | | Construction Management Seminars | 1 |
| CAE 691 | | Special Topics in Construction Management | 1-3 |
| CAE 762 | | Construction Project Management | 3 |
| CAE 765 | | Construction Accounting and Finance | 3 |
| CAE 766 | | Forensic Engineering | 3 |
| CAE 769 | | Construction Management Capstone | 3 |
| CAE 791 | | Advanced Topics in Construction Management | 1-3 |

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| **D** | **Group D: Any pre-approved graduate course in any UM department, except CAE and UMI** |

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| **E** | **Group E: CAE Independent Study (Special Problems)** | | |
| **Course** | | **Title** | **Credits** |
| CAE 695 | | Special Problems | 1-3 |
| CAE 795 | | Special Problems | 1-3 |

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| **F** | **Group F: CAE Master's Thesis** | | |
| **Course** | | **Title** | **Credits** |
| CAE 810 | | Master's Thesis | 1-6 |

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| **G** | **Group G: CAE Master's Design Project** | | |
| **Course** | | **Title** | **Credits** |
| CAE 604 | | Master's Design Project (only allowed for students in the 5-year BS/MS program) | 3 |
| CAE 605 | | Master's Project | 3 |

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| **H** | **Group H: CAE PhD Dissertation** | | |
| **Course** | | **Title** | **Credits** |
| CAE 830 | | Pre-Candidacy Doctoral Dissertation | 1-12 |
| CAE 840 | | Post-Candidacy Doctoral Dissertation | 1-12 |

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| **I** | **Group I: CAE Professional Development** | | |
| **Course** | | **Title** | **Credits** |
| CAE 703 | | Seminars in Civil and Architectural Engineering | 1 |
| CAE 704 | | Graduate Teaching | 1-3 |

Graduate Courses Relevant to CAE

* Biomedical Engineering (BME)

**BME 522/622 Scanning Electron Microscopy for Engineers**;3 credits Spring Semester

Physics of transmission and scanning electron microscopy including x-ray spectroscopic analysis. Students will learn to independently operate and use the SEM for imaging in its role in research and engineering. Each student will be responsible for several imaging assignments and an independent research project related to their field of interest.

**BME 587/687 Finite Element Analysis for Engineers**;3 credits Fall & Spring Semester

Introduction to the finite-element method. Hands-on applications of FEMLAB software to the analysis of structural, thermal, chemical, electro-magnetic, optical, and fluid flow problems. PREREQUISITE: MTH 311

* Mechanical and Aerospace Engineering (MAE)

**MAE 501/601 Methods of Engineering Analysis;** 3 credits Fall Semester

Analysis of engineering systems in equilibrium and motion. Examples considered from mechanical, electrical, thermal and fluids engineering. Mathematical theory and computer methods for obtaining numerical solutions are developed for various cases involving discrete and continuous systems. Lecture, 3 hours.

PREREQUISITE: MAE 412, MTH 311 OR PERMISSION OF THE INSTRUCTOR.

**MAE 502/602 Vibrations;** 3 credits Fall Semester

Basic theory of free and forced vibrations of mechanical systems with and without damping. Applications to systems with one and several degrees of freedom are included. PREREQUISITE: MAE 202, 207, 412 OR PERMISSION OF INSTRUCTOR.

**MAE 507/607 Advanced Mechanics of Solids;** 3 credits Spring Semester

Course discusses the basic elements of elasticity, plasticity, and viscoelasticity. Application to mechanical systems at rest and in motion are included.

PREREQUISITE: MAE 202, 207, SENIOR STANDING OR PERMISSION OF INSTRUCTOR.

**MAE 512/612 Intermediate Fluid Mechanics;** 3 credits Fall Semester

Course topics include conservation of mass, momentum, and energy, potential flow, viscous laminar and turbulent flows, the Reynolds analogy, and Boundary-layer approximations. Gas dynamics are also discussed. PREREQUISITE: MAE 309.

**MAE 516/616 Introduction to Composite Materials** 3 credits Offered By Announcement Only

Course provides an introduction to composite materials and terminology. Topics include advantages offered by composite materials, current aerospace, automotive, and bio-mechanics applications, experimental results, analytical models, and effects of impact and fatigue loads. The environment’s impact on composite materials’ performance and design procedures are discussed. Case studies examining composite materials as efficient replacements are also included.

**MAE 705 Finite Element Methods in Mechanical and Aerospace Engineering;** 3 credits Spring Semester

Finite-element analysis methods for static and dynamic analysis of mechanical and aerospace structures, heat transfer analysis, and fluid flow applications. Primary emphasis is placed on underlying mechanics and numerical techniques. Consideration is also given to the use of existing programs, such as ANSYS, NASTRAN and FIDAP, designing proper meshes, and choosing the proper element. A term project is included. PREREQUISITE: MAE 501, 507 OR PERMISSION OF INSTRUCTOR.

**MAE 706 Experimental Methods in Fluid Mechanics**; 3 creditsOffered By Announcement Only

Course topics include methods of flow visualization, laser techniques in measurement of wall motions, conduit compliance, Newtonian and non-Newtonian properties of fluids, measurement of unsteady flow and pressure, laser Doppler anemometry, ultrasound Doppler velocimetry, electro-magnetic flowmetry, measurement of steady and unsteady wall sheer stresses and boundary layers. PREREQUISITE PERMISSION OF INSTRUCTOR.

**MAE 714 Computational Fluid Dynamics;** 3 credits Spring Semester

Incompressible flow equations in rectangular co-ordinates. Topics include basic computational methods for incompressible flow, three dimensional flows, compressible flow equations in rectangular coordinates, basic computational methods for compressible flows, treatment of shocks, artificial viscosities, convergence, other mesh systems, programming, testing, and information processing. PREREQUISITE: MAE 512.

* Industrial and Systems Engineering (ISE)

**ISE 712 Design of Experiments**; 3 credits Fall Semester

Design and analysis of experiments, randomized blocks, Latin Squares, factorials, multiple correlation and regression, and application to response surfaces are discussed. PREREQUISITE: ISE 311 or MAS 311 or equivalent.

* Mathematics (MTH)

**MTH 624 Introduction to Probability**; 3 credits Fall Semester

Probability spaces, random variables, expectation, limit theorems. PREREQUISITE: MTH 224, MTH 310.

**MTH 642 Statistical Analysis**; 3 credits Fall Semester

Statistical inference about one or two populations from interval, ordinal and categorical data; analysis of variance; simple and multiple linear regression; designing research studies. PREREQUISITE: MTH 210, MTH 224