CE 201: Engineering Statics

Term: Fall 2026
Credits: 3.0
Lecture Times & Location: Tuesday & Thursday 8:00–9:15 a.m., Rowan Engineering Center 120
Modality: In-Person

Instructor Information

- **Instructor:** Dr. Adrian Holt (Assistant Teaching Professor of Civil & Environmental Engineering)
- **Email:** aholt@university.alkimi.ai
- **Office:** Rowan Engineering Center 312
- **Office Hours:**
  - Tuesday & Friday: 2:00–3:30 p.m. (In person, Rowan Engineering Center 312)
  - Wednesday: 10:00–11:00 a.m. (Virtual via Zoom; link posted in Canvas)
  - Also available by appointment.

Course Description

Force vectors, equilibrium of particles and rigid bodies, trusses, frames and machines, distributed loads, friction, centroids, and moments of inertia. CE 201 establishes the core principles of structural mechanics upon which all civil, structural, and geotechnical engineering coursework relies. Emphasizing rigorous vector mathematics and meticulous free-body diagrams, students learn to determine static equilibrium for particles and rigid bodies, compute internal member forces in trusses and frames, and construct shear and moment diagrams for beams under distributed loads. Taught from the perspective of professional structural practice, the course prepares students directly for subsequent courses in mechanics of deformable bodies and the national Fundamentals of Engineering (FE) exam.

Prerequisites

PHYS 121; MATH 141 (prior or concurrent).

Measurable Student Learning Outcomes

Upon successful completion of CE 201, students will be able to:

1. **Construct Rigorous Free-Body Diagrams:** Isolate civil structural systems and author complete, professional free-body diagrams clearly denoting all applied dead/live loads, reaction forces, and support constraints.
2. **Determine Equilibrium of Structural Systems:** Apply the equations of static equilibrium to solve for external support reactions in statically determinate two- and three-dimensional civil engineering structures.
3. **Analyze Structural Trusses and Frames:** Calculate tension and compression forces in bridge and roof trusses using the method of joints and method of sections, and evaluate internal pin forces in multi-force frames.

4. **Construct Shear and Moment Diagrams:** Determine internal normal forces, shear forces, and bending moments along beam spans and sketch corresponding shear and moment diagrams for diverse load distributions.
5. **Compute Section Properties for Civil Shapes:** Calculate centroids, centers of gravity, and moments of inertia for standard structural steel and reinforced concrete composite cross-sections using the parallel-axis theorem.

Required Course Materials & Approximate Costs

1. **Beer, Ferdinand P., E. Russell Johnston Jr., David F. Mazurek, and Phillip J. Cornwell. *Vector Mechanics for Engineers: Statics*. 12th ed., McGraw-Hill, 2019.** Approx. $80 digital rental ($190 purchase; reserve copies available in Alkimi Library).
2. **Engineering calculation pad (8.5 x 11 green quadrille) and straightedge.** Approx. $12.
3. **Total estimated cost:** Approx. $12 to $92 depending on textbook acquisition preference.

Generative AI Policy (AI Level 1: AI Not Permitted for Graded Work)

In accordance with Alkimi University Academic Policies (Student Handbook §5.8), CE 201 operates under **AI Level 1**.

- **What is permitted:** Students may use AI chatbots solely as supplementary conceptual study aids to explain physical principles, clarify vector calculus definitions, or discuss real-world civil engineering infrastructure examples outside of assigned course work.
- **What is prohibited:** Generative AI must not be used to construct free-body diagrams, solve weekly problem set calculations, or complete structural truss and frame analyses. The use of AI tools or any unauthorized digital devices during quizzes and examinations is strictly forbidden.
- **Disclosure:** If an AI model is used to clarify the theoretical background of any problem set topic, students must provide a brief handwritten disclosure statement at the top of the assignment citing the prompt and tool consulted.

Grading Components and Weights

- **Weekly Problem Sets:** 15% (Due Wednesdays at 11:59 p.m. in Canvas (weeks 2–14; lowest dropped))
- **Biweekly In-Class Concept Quizzes:** 10% (Administered in class on alternate Thursdays (weeks 3, 5, 9, 13; lowest dropped))
- **Midterm Exam 1 (Force Systems, Equilibrium & Trusses):** 20% (In class, Thursday, October 1)
- **Midterm Exam 2 (Frames, Internal Forces & Friction):** 20% (In class, Thursday, November 5)
- **Highway Truss Bridge Analysis Project:** 10% (Due Friday, November 20 at 11:59 p.m.)
- **Comprehensive Final Examination:** 25% (Thursday, December 17, 2026, 10:30 a.m.–12:30 p.m.)

Grading Scale (Alkimi University Standard)

- **A:** 93–100% | **A-:** 90–92%
- **B+:** 87–89% | **B:** 83–86% | **B-:** 80–82%
- **C+:** 77–79% | **C:** 73–76% | **C-:** 70–72%
- **D+:** 67–69% | **D:** 60–66% | **F:** Below 60%
- **Extra credit:** No individual extra credit assignments are offered in CE 201.

Course Schedule (Fall 2026)

Week	Dates	Topics & Readings	Assignments & Deadlines
Week 1	Aug 27	**Introduction to Civil Mechanics and Vector Operations:** Principles of statics, SI and US customary units, vector and	*First day of classes: Wed Aug 26.*

Week	Dates	Topics & Readings	Assignments & Deadlines
		scalar quantities, parallelogram law, Cartesian coordinate systems, and position vectors. *Reading: Beer et al. Ch. 1, 2.1–2.8*	
Week 2	Sep 1, 3	**Equilibrium of Particles in 2D and 3D:** Resultant forces, free-body diagrams of concurrent force systems, cable tensions, pulley mechanics, and three-dimensional particle equilibrium equations. *Reading: Beer et al. Ch. 2.9–2.15*	*Wed Sep 2: Add/section change deadline.*
Week 3	Sep 8, 10	**Rigid Bodies and Equivalent Systems of Forces:** External vs. internal forces, principle of transmissibility, cross products, moment of a force about a point, Varignon's theorem, and moment about a specified axis. *Reading: Beer et al. Ch. 3.1–3.11*	*Mon Sep 7: Labor Day (no classes). Wed Sep 9: Census date (last day to drop without a W).*
Week 4	Sep 15, 17	**Force Couples and System Reduction:** Couples and couple moments, equivalent couples, reduction of a force system to a single force and couple at an origin, and wrench resultants. *Reading: Beer et al. Ch. 3.12–3.20*	—
Week 5	Sep 22, 24	**Equilibrium of Rigid Bodies in Two and Three Dimensions:** Reactions at supports (rollers, pins, fixed supports), equations of static equilibrium, static determinacy and stability, and 3D equilibrium conditions. *Reading: Beer et al. Ch. 4.1–4.9*	—
Week 6	Sep 29, Oct 1	**Planar Trusses and Midterm Exam 1:** Definition of trusses, simple trusses, method of joints, zero-force member identification, and administration of Midterm Exam 1 in Thursday lecture. *Reading: Beer et al. Ch. 6.1–6.5*	**Midterm Exam 1 (Force Systems, Equilibrium & Trusses) (in class).**
Week 7	Oct 6, 8	**Method of Sections and Space Trusses:** Method of sections for bridge and roof trusses, evaluation of internal member forces, and introduction to three-dimensional space truss analysis. *Reading: Beer et al. Ch. 6.6–6.8*	—
Week 8	Oct 15	**Frames and Engineering Machines:** Structures containing multi-force members, free-body diagrams of individual components, Newton's third law at pins, and mechanical advantage. *Reading: Beer et al. Ch. 6.9–6.12*	*Oct 12–Oct 13: Fall break (no classes). Fri Oct 16: Midterm grades due.*
Week 9	Oct 20, 22	**Internal Forces in Structural Members:** Axial force, shear force, and bending moment in beams; sign conventions; differential equilibrium relations between distributed load, shear, and moment. *Reading: Beer et al. Ch. 7.1–7.3*	—
Week 10	Oct 27, 29	**Shear and Bending Moment Diagrams:** Graphical construction of shear and bending moment diagrams for simply supported and cantilever beams under concentrated and uniformly distributed loads. *Reading: Beer et al. Ch. 7.4–7.6*	—
Week 11	Nov 3, 5	**Friction and Midterm Exam 2:** Coulomb dry friction laws, static and kinetic friction coefficients, angles of friction, wedge mechanisms, and administration of Midterm Exam 2 in Thursday lecture. *Reading: Beer et al. Ch. 8.1–8.4*	*Fri Nov 6: Last day to withdraw (W) or elect Pass/No Pass.* **Midterm Exam 2 (Frames, Internal Forces & Friction) (in class).**
Week 12	Nov 10, 12	**Centroids and Centers of Gravity:** Center of gravity, centroids of lines, areas, and volumes by integration; centroids of composite structural areas (I-beams, channels, angles). *Reading: Beer et al. Ch. 5.1–5.5*	—
Week 13	Nov 17, 19	**Moments of Inertia of Structural Shapes:** Second moment of area, polar moment of inertia, radius of gyration, parallel-axis theorem, and moment of inertia of composite shapes; Project due Friday. *Reading: Beer et al. Ch. 9.1–9.7*	**Highway Truss Bridge Analysis Project due Fri Nov 20 at 11:59 p.m.**
Week 14	Nov 24	**Mass Moments of Inertia and Product of Inertia:** Mass moment of inertia of thin plates and 3D bodies, parallel-axis theorem for mass, products of inertia, and principal axes of inertia. *Reading: Beer et al. Ch. 9.11–9.15*	*Nov 25–Nov 27: Thanksgiving break (no classes).*

Week	Dates	Topics & Readings	Assignments & Deadlines
Week 15	Dec 1, 3	**Virtual Work and Energy Methods:** Work of a force and couple, principle of virtual work for particles and rigid bodies, potential energy, and stability of equilibrium states. *Reading: Beer et al. Ch. 10.1–10.6*	—
Week 16	Dec 8	**Structural Mechanics Synthesis and FE Exam Review:** Comprehensive review connecting rigid body equilibrium, internal beam forces, and section properties to Fundamentals of Engineering (FE) exam standards. *Reading: Review Beer et al. Ch. 2–7, 9*	*Wed Dec 9: Last day of classes. Thu Dec 10: Reading Day.*
Finals	Dec 17	**Comprehensive Final Examination:** Thursday, December 17, 2026, 10:30 a.m.–12:30 p.m., Rowan Engineering Center 120.	Comprehensive.

Course Policies

Attendance Policy

Class attendance at every lecture session is mandatory. Mastery of engineering statics requires active participation in whiteboard derivations and practicing proper free-body diagram formatting under faculty guidance. If illness or approved university business requires an absence, notify Dr. Holt prior to class. Students who miss the first two class meetings without notifying the instructor may be dropped. Students may miss class for religious observance without penalty if they notify the instructor in writing within the first two weeks of the semester (by Wednesday, September 9, 2026). Absences for university-sponsored activities (athletics, performances, conferences) are excused with a letter from the sponsoring office at least one week in advance.

Late Work Policy

Homework problem sets submitted after the Wednesday 11:59 p.m. deadline incur a 20% penalty per 24 hours, accepted up to 48 hours late. After 48 hours, detailed solutions will be posted on Canvas and no further submissions will be accepted. The lowest homework set score and lowest quiz score are dropped.

Final Exam Policy

The final examination (Thursday, December 17, 2026, 10:30 a.m.–12:30 p.m.) is scheduled by the University Registrar and can't be moved without the Dean's written approval (Faculty Handbook §5.5). A student with three or more final exams on the same calendar day may reschedule one of them. Requests go to the instructor of the middle exam by the last day of classes. For this term, send the request by Wednesday, December 9, 2026 (Student Handbook §6.4).

Academic Integrity

Alkimi University is an academic community devoted to rigorous scholarship, open intellectual inquiry, and uncompromising ethical conduct. All students are subject to the regulations of the Alkimi University Academic Integrity Policy. Academic dishonesty—including plagiarism, cheating on examinations, unauthorized collaboration, fabrication of empirical data, and unauthorized submission of academic work generated by artificial intelligence—undermines the integrity of the university and carries severe disciplinary sanctions. Sanctions range from a failing grade on an assignment or exam to an administrative course failure recorded as an 'XF' on the official transcript, academic suspension, or expulsion. Suspected violations are formally investigated and resolved through the Office of Academic Integrity in accordance with Faculty Handbook §6. For detailed information, consult the Office of Academic Integrity, Lovell Hall 315, (555) 555-0163, integrity@university.alkimi.ai.

Accessibility Services

Alkimi University is committed to providing equitable educational access and reasonable accommodations for all students with documented disabilities, including physical, sensory, psychological, learning, and chronic health conditions. Students requesting academic accommodations must formally register with the Office of Accessibility Services, Harlan Hall 204, (555) 555-0155, access@university.alkimi.ai. Once approved, students will receive an official Faculty Accommodation Letter detailing approved accommodations. Students should present this letter to the instructor as early in the semester as possible, and at least one week prior to any exam or assignment requiring accommodation. Accommodations cannot be applied retroactively.

Student Wellness and Mental Health

Your physical health, psychological well-being, and mental health are essential to your academic success. If you experience heightened stress, anxiety, depressive symptoms, personal trauma, or academic burnout, free, confidential counseling and medical care are available through the Hollis Health & Counseling Center, located in the Hollis Center. Routine appointments are available Monday–Friday 8:00 a.m.–6:00 p.m. and Saturday 10:00 a.m.–2:00 p.m. during the semester by calling (555) 555-0190 or emailing health@university.alkimi.ai. Urgent, 24/7 crisis psychological counseling is accessible immediately at (555) 555-0199.

Campus Student Support Services

- **Academic Advising Center:** Lovell Hall 101 | (555) 555-0158 | advising@university.alkimi.ai
- **Writing Center:** Whitcombe Library 3rd Floor | Free consultations on papers, reports, and research projects at any stage.
- **Whitcombe Library:** Whitcombe Library, Main Floor | (555) 555-0170 | askalibrarian@university.alkimi.ai
- **Hollis Health & Counseling Center:** Hollis Center | (555) 555-0190 | 24/7 Counseling Line: (555) 555-0199 | health@university.alkimi.ai
- **Civil Engineering Mechanics Tutoring:** Rowan Engineering Center 140 | Drop-in statics and structural mechanics tutoring available Tuesday and Thursday 4:00–7:00 p.m.