

**COURSE DESCRIPTION****Instructor:**

Dr. Francisco Castro  
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Office: AEC 215  
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**Class Sessions:** AEC204 MW: 8-9:50AM

**Office Hours:** AEC215 MW: 10-11AM, TR: 8-9AM, 1-2PM

**Course Prerequisites:** ENGR 263: Mechanics of Solids

**Textbook:** Machine Design by Robert L. Norton, 5<sup>th</sup> Edition

**Other Sources:**

References on text book

Other class textbooks: Statics, Materials, Mechanics of Solids, etc

**Software/Hardware:**

Calculator

Solid Works, Excel, MATLAB: all are installed on AEC computers

**Course Objective:**

This class includes the application of mechanics and materials science to the detailed design of various machine elements including shafts, bearings, gears, brakes, springs, and fasteners. The course emphasizes application and open-ended design problems.

**SYLLABUS****PART I: FUNDAMENTALS**

1. Introduction to Design
2. Materials and Processes
  - a. Material Properties
  - b. Processes
3. Load Determination
  - a. Static and Dynamic Loads
  - b. Vibration and Impact
4. Stress, Strain and Deflections
  - a. Axial, Shear and Bending Stress
  - b. Combined Stress
5. Static Failure Theories
  - a. Failure of Ductile Materials
  - b. Failure of Brittle Materials
  - c. Fracture Mechanics
6. Fatigue Failure Theories
  - a. Failure Criteria
  - b. Stress Concentrations
7. Surface Failure
  - a. Wear and Friction
  - b. Contact Stress
8. Introduction to FEA

**PART II: MACHINE DESIGN**

9. Shafts, Keys, and Couplings
10. Bearings and Lubrication
11. Spur Gears
  - a. Gear Trains
  - b. Stresses in Spur Gears
12. Helical, Bevel, and Worm Gears
13. Spring Design
14. Screws and Fasteners
  - a. Geometry
  - b. Pre-Loads
15. Weldments
  - a. Configurations
  - b. Static and Dynamic Loads
16. Clutches and Brakes
  - a. Types
  - b. Specifications and Materials

## **GRADING**

Three different aspects will be used to obtain the final grade.

No late assignments allowed unless extraordinary circumstances. If this happens, let instructor know as soon as possible, before it is due.

Class attendance is expected and highly recommended.

### **1. Quizzes: 5%**

Requires individual work.

Given during class (5-10min) and randomly performed.

Focused on concepts rather than numerical problems.

Closed books, notebooks and no calculators.

### **2. Homework: 20%**

Requires individual work but discussion among colleagues is encouraged.

Ten (10) sets of homework will be assigned on Mondays and they will be due a week later.

Focus on concepts and numerical problems.

Lowest score will be dropped.

### **3. Exams: 75%**

Exam 1 and 2, 15% each

Exam 3, 20%

Final Exam: TBA, Finals Week 25%

Books, notebooks and calculators are allowed.

**PROPOSED SCHEDULE**

WEEK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	16-Jan	17	18	19	20
			Introduction		
2	23 Hwk1	24	25	26	27
	Materials		Loads		
3	30 Hwk2	31-Jan	1-Feb	2	3
	Loads		Stress-Strain		
4	6	7	8	9	10
	Stress-Strain		EXAM 1		
5	13 Hwk3	14	15	16	17
	Fatigue Failure		Fatigue Failure		
6	20 Hwk4	21	22	23	24
	Fatigue Failure		Surface Failure		
7	27 Hwk5	28-Feb	1-Mar	2	3
	Surface Failure		Shafts		
8	6	7	8	9	10
	Shafts		EXAM 2		
9	13 Hwk6	14	15	16	17
	Keys		Couplings		
10	20	21	22	23	24
	SPRING BREAK				
11	27 Hwk7	28	29	30	31-Mar
	Bearings		Bearings		
12	3-Apr Hwk8	4	5	6	7
	Gears		Gears		
13	10	11	12	13	14
	Springs		EXAM 3		
14	17 Hwk9	18	19	20	21
	Screws		Fasteners		
15	24 Hwk10	25	26	27	28-Apr
	Welding		Welding		
16	1-May	2	3	4	5
	Clutches/Brakes		Clutches/Brakes		
17	8	9	10	11	12-May
			EXAM 4		

## **COURSE POLICIES: UNIVERSITY OF COLORADO – BOULDER**

### **Classroom Behavior**

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. Faculty will gladly honor your request to address you by an alternate name or gender pronoun. Please advise faculty of this preference early in the semester so that we may make appropriate changes to the records. For more information, see the policies on classroom behavior (<http://www.colorado.edu/policies/student-classroom-and-course-related-behavior>) and the student code. ([http://www.colorado.edu/osccr/sites/default/files/attached-files/studentconductcode\\_16-17-a.pdf](http://www.colorado.edu/osccr/sites/default/files/attached-files/studentconductcode_16-17-a.pdf))

### **Honor Code**

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the academic integrity policy (<http://www.colorado.edu/policies/academic-integrity-policy>) of the institution. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-735-2273). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at [honorcode.colorado.edu](http://honorcode.colorado.edu).

### **Accommodation for Disabilities**

If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu).

If you have a temporary medical condition or injury, see temporary injuries (<http://www.colorado.edu/disabilityservices/students/temporary-medical-conditions>) guidelines under the Quick Links at the Disability Services website (<http://www.colorado.edu/disabilityservices/>) and discuss your needs with your professor.

## **Religious Holidays**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance.

See the campus policy regarding religious observances for full details.

(<http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams>)

## **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

The University of Colorado Boulder (CU Boulder) is committed to maintaining a positive learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU's Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU Boulder's Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the OIEC website

(<http://www.colorado.edu/institutionalequity/>).