THE UNIVERSITY OF ARIZONA
COLLEGE OF ENGINEERING
Civil & Architectural Engineering & Mechanics

CE215 – Mechanics of Solids (CE 215 SP19 001 010)

POLICY & SYLLABUS - Spring 2019

Catalog Description: (3 units) Material behavior; relationship between external forces acting on elastic and inelastic bodies and the resulting behavior; stress and deformation of bars, beams, shafts, pressure vessels; stress and strain; combined stresses; columns.

Prerequisite: CE 214 – Statics

Learning outcomes:

- Students should be able to apply mechanics of materials concepts to calculate forces, moments, displacements, stresses, and strains in structural members such as: bars or rods (axially loaded members); members subjected to pure shear; circular torsional shafts; beams in bending; thin-walled pressure vessels; columns subject to buckling instabioity.
- Students should understand the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.
- Students should become able to determine principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element. Students should learn how to construct the Mohr's for a specific state of (plane) stress and understand its meaning.

Learning outcomes support ABET program outcomes:

Primary

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Realized through the analysis of basic structures and structural elements using first principles of math/physics and engineering and by reference to experiments. Actual problems are identified and solved. The methodology and process of solving the problems are emphasized.

Secondary

3. an ability to communicate effectively with a range of audiences

Realized through the indication of transfer of information to other engineers and drafters.

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

Realized through team-based problem solving in a collaborative learning environment.

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Realized through extension of knowledge pursued individually. Examples include the extension of column buckling to beam-column buckling; the extension of Mohr's circle in plane stress to that of general 3-D case.

Instructor: George N. Frantziskonis, Room 206A, Civil Engineering Building
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Lecture: MWF 11:00-11:50 ILC, Room 125

Office hours:	M 1:00 – 2:00pm, W 1:00-2:30pm. See TA office hours for recitations and homework.

Teaching Assistant:	Yousef Nikravesh, Room TBA, Civil Engineering building
Email	nikravesh@email.arizona.edu
Office hours	Mondays 1:00pm-2:30pm and Wednesdays 9:00am-10:30am, in Civil Engineering building room 220F
Grader:	TBA
Recitations	Listed in course schedule

Textbook: Essentials of the Mechanics of Materials, by G. N. Frantziskonis, 3rd Edition, DesTech Publications (electronic or hard copy version).

Weights for course grade:
10 points – homework,
50 points – 3 tests @ 16.67 points each,
24 points – final exam,
8 points – attendance (main lecture and recitations)
8 points – quizzes

Scale for final grade:

A	Outstanding	90 - 100
B	Above Average	80 < 90
C	Average	70 < 80
D	Below Average	60 < 70
E	Failure	< 60

The cutoffs for grades may be lower, but will not be higher (I will not raise the standards mid-semester). The course grades are not curved. I feel very strongly that learning should be measured with a standard (maybe a high standard, but a standard none the less) and that you should not be directly competing with anyone other than yourself. I fully expect everyone in the course to be successful and if you are having problems, then you must initiate a process for improvement.

COURSE CONTENT
Day 1 (1/9/2019): Watch Introduction Video.
Day 2 (1/11/2019): Read Modules 1 and 2, Normal Stress and Strain in Content. Then Watch Video for these modules, and work on the practice problems. Take relevant quiz before class when applicable.
Day 3 (1/14/2019): Read Module 3, Hooke's law and Bar behavior in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 4 (1/16/2019): Read Module 4, Poisson effects and Safety Factor in Content. There is no video corresponding to module 4, but there are practice problems to work on in Module 4. Take relevant quiz before class when applicable.
Day 5 (1/18/2019): Read Module 5, Nonuniform Bars in Content. Then Watch Video for this module, and work on the practice problems in Module 5. Take relevant quiz before class when applicable.
Day 6 (1/23/2019): Read Module 6, Statically Indeterminate Bars in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 7 (1/25/2019): Read Module 7, Temperature Effects in Bars in Content. Then Watch Video

for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 8 (1/28/2019): Read Module 8, Shear Stress, Shear Modulus in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 9: (1/30/2019) Read Module 9, Shear Stress, Bearing Stress in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 10: (2/1/2019) Read Module 10, Torsional Shafts in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 11 (2/4/2019): Read Module 11, Shafts versus Bars in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Exam 1, 2/6/2019
Day 12 (2/8/2019): Read Module 12, Nonuniform Shafts in Content. Then Watch Video for this module, and work on the practice problems. Take relevant quiz before class when applicable.
Day 13 (2/11/2019): Read Module 13, Pure Shear and the Shear Modulus of Elasticity in Content. Then Watch Video for this module. Take relevant quiz before class when applicable.
Days 14-16 (3 days, 2/13/2019, 2/15/2019, 2/18/2019): Read Modules 14-16 in Content. Then Watch the Video for these modules and work on the practice problems.
Day 17 (2/17/2019): Read Module 17, Beam deflection and Curvature in Content. Then Watch Video for this module.
Days 18-19 (2 days, 2/22/2019, 2/25/2019): Read Modules 18-19, Normal Stresses in Beams in Content. Then Watch the Video for these modules and work on practice problems.
Day 20 (2/27/2019): Read Module 20, Shear Stresses in Beams in Content. Then Watch the Video for this module and work on the practice problems.
Day 21 (3/11/2019): Read Module 21, Shear Flow in Built-up Beams in Content. Then Watch the Video for this module and work on the practice problems.
Days 22-23 (2 days, 3/13/2019 and 3/15/2019): Read Modules 22-23, Plane Stress and Stress Transformation in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Days 24-25 (2 days, 3/18/2019 and 3/20/2019): Read Modules 24-25, Mohr's Circle for Stress Transformation in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Exam 2, 3/22/2019
Day 26 (3/25/2019): Read Module 26, Plane Strain in Content. Then Watch the Video for this Module. Take relevant quiz before class when applicable.
Day 27 (3/27/2018): Read Modules 27, Pressure Vessels in Content. Then Watch the Video for this module and work on practice problems. Take relevant quiz before class when applicable.
Day 28 (3/29/2019): Read Module 28, Pressure Vessels in Content. Then Watch the Video for this module and work on practice problems. Take relevant quiz before class when applicable.
Days 29-30 (2 days, 4/1/2019, 4/3/2019): Read Modules 29-30, Combined Stresses in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Days 31-33 (3 days, 4/5/2019, 4/8/2019, 4/10/2019): Read Modules 31-33, Beam Deflections in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Exam 3, 4/12/2019
Days 34-35 (2 days, 4/15/2019, 4/17/2019): Read Modules 34-35, Statically Indeterminate Beams in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Days 36-37 (2 days, 4/19/2019, 4/22/2019): Read Modules 36-37, Buckling and Stability in

Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Days 38-39 (2 days, 4/24/2019, 4/26/2019): Read Modules 38-39, Buckling and Stability in Content. Then Watch the Video for these modules and work on practice problems. Take relevant quiz before class when applicable.
Day 40 (4/29/2019): Read Module 40, Course Review in Content. Then Watch Video for this module. Take relevant quiz before class when applicable.
Final Exam: 5/6/2019, 10:30am - 12:30 pm

HOMEWORK

Homework problems will be submitted in D2L as assignments. Due dates will be posted in D2L and will be communicated via email. The homework solution should be converted to a single PDF file and uploaded in D2L as an assignment. The submitted homework will be graded and grades will be posted in D2L. Homework should be done in a neat, orderly fashion. Late homework is not accepted and receives a grade of zero.

Failure to comply with the policy on homework may result in downgrading and/or refusal to accept the work.

EXAMINATIONS

You must take three examinations during the semester and a final examination. All examinations will be held during the regular class session in the lecture room assigned to this course. All exams are closed book and calculators are permitted. However, only calculators approved by the Civil Engineering department are allowed. A list of approved calculators will be emailed to all students shortly. The list can also be found in:
http://ncees.org/exams/calculator/

No credit is given for correct answers obtained by incorrect reasoning and/or compensating errors. Partial credit will be given for work that pertains to the correct solution. The final exam is mandatory and there will be no change in time as this would be a violation of University policy. A similar policy holds in this class for the tests, yet under exceptional circumstances other arrangements may be made, on a case-by-case basis. There will be no make up for missed examinations. The final examination score will be adjusted for, at most, one acceptable excused missed examination. An unexcused missed examination or a second missed examination is scored as zero.

Examinations are regarded as engineering reports. Procedures and presentation of solutions should be precise and legible. Penalties are assessed for:

(I) algebra and arithmetic errors;
(II) answers presented without proper units, sign or direction;
(III) incomplete free body diagram; and
(IV) messy or illegible presentation.

A summary of your grades will be posted regularly in D2L. You must check that your grades are correct. You must notify the instructor of any omission or error within 10 days after grades are posted. Changes may not be accepted after that.

ACADEMIC INTEGRITY

One sanction for dishonest academic work permitted under the University CODE OF ACADEMIC INTEGRITY is a failing grade in the course. The grade of E will be assigned for dishonest academic work.

ATTENDANCE POLICY

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Absences may affect a student's final course grade. For those courses in which enrollment is limited, missing the first class session may be interpreted as excessive absence. If this action is filed in the Registrar's Office by the end of the fourth week of classes, it will result in cancellation of registration in the course. If the student is administratively dropped after the end of the fourth week of classes, it will result in a failing grade being awarded in that course.

Policy of this class:

- If you need to be absent from the class for justifiable reasons (sickness, family obligations, etc.), you must inform the instructor in advance or immediately after the day of absence.
- It is required that you attend all classes and recitations. The instructor may report to the Registrar's Office if absence is excessive, which may result in administrative drop from the class. Attendance accounts for 8% of the course grade.

Auditors are also expected to attend the classes.

Students are expected to check their official UA email daily.

***THIS POLICY WILL BE STRICTLY ENFORCED*.**