EASTERN ARIZONA COLLEGE
Mechanics of Materials
Course Design
2017-2018

Course Information

Division	Mathematics
Course Number	EGR 233
Title	Mechanics of Materials
Credits	3
Developed by	Tom Palmer
Lecture/Lab Ratio	3 Lecture/0 Lab

Transfer Status

ASU	NAU	UA
Valid thru Fall 2016: CEE 213, MAE 213	CENE 253	CE 215

Activity Course	No
CIP Code	14.0101
Assessment Mode	Pre/Post Test (10 Questions/100 Points)
Semester Taught	Upon Request
GE Category	None
Separate Lab	No
Awareness Course	No
Intensive Writing Course	No

Prerequisites

EGR 214 or higher with a grade of "C" or higher

Educational Value

This course is typically required at four-year institutions for civil, mechanical, aerospace/aeronautical engineering, and other majors.

Description

Students will learn the fundamental concepts of stresses and strains, deformations and displacements, elasticity and inelasticity, strain energy, and load carrying capacity. Students will also analyze and design structural members subjected to tension, compression, torsion, and bending.

Supplies

Engineering paper

Ruler

Calculator

Competencies and Performance Standards

1. Demonstrate an understanding of tension, compression, and shear forces and the resulting deflections and strains.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of stress, strain, and material properties.

b. Solve problems related to elasticity.

c. Demonstrate an understanding of allowable stresses and loads and be able to perform design calculations.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands normal stresses and strains and can relate their relationships to the mechanical properties of materials
- learner understands linear elasticity, Hooke's law, and Poission's ratio
- learner understands shear stresses and strains
- learner understands allowable stresses and loads and relevant design calculations

2. Demonstrate an understanding of the stresses and resulting strains and behaviors of axially loaded members.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of uniform and non-uniform bars, and thermal effects.

b. Demonstrate an understanding of strain energy, impact loading, and fatigue.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands changes in length of axially loaded members
- learner understands strain energy, impact loading, and fatigue

3. Demonstrate an understanding of torsion and deformations resulting from torsion.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of torsion in a circular bar.

b. Solve problems related to stresses and strains in pure shear using E and G.

c. Demonstrate an understanding of power transmission by circular shafts.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands the concepts of uniform and non-uniform torsion
- learner understands stresses and strains in pure shear
- learner understands transmission of power by circular shafts

4. Demonstrate an understanding of shear forces and bending moments.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of beams, loads, and reactions.

b. Draw shear load, shear force, and bending moment diagrams.

Performance Standards

Competence will be demonstrated:

- during class discussions
- on the pre/post test
- on quizzes and homework

Performance will be satisfactory when:

- learner understands types of beams, loads, and reactions
- learner understands relationships between loads, shear forces, and bending moments

5. Demonstrate an understanding of stresses in beams and design of beams for bending stresses.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of pure bending and non-uniform bending.

b. Demonstrate an understanding of the relationships between stresses and strains in beams.

c. Demonstrate an ability to design beams subject to bending stresses.

d. Demonstrate an ability to determine shear stresses in beams of various cross sections.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands pure bending and non-uniform bending
- learner understands relationships between stresses and strains in beams
- learner understands the principles behind beam design
- learner understands shear stresses in beams of various cross sections

6. Demonstrate an understanding of analysis of stresses and strains.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of plane stress, principal stresses, and maximum shear stresses.

b. Draw Mohr's circle for various problems and demonstrate Hooke's Law for plane strain.

c. Demonstrate an understanding of tri-axial stress.

d. Demonstrate an understanding of plane strain.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands plane stress, principal stresses, and maximum shear stresses
- learner understands Mohr's circle and Hooke's law for Plane stress
- learner understands tri-axial stress
- learner understands plane strain

7. Demonstrate an understanding of the applications of plane stress to pressure vessels, beams, and combined loadings.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of stresses and strains in spherical and cylindrical pressure vessels.

b. Calculate maximum stresses in beams.

c. Demonstrate an understanding of the effects of combined loadings.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands stresses and strains in spherical and cylindrical pressure vessels
- learner understands maximum stresses in beams
- learner understands the effects of combined loadings

8. Demonstrate an understanding of deflections of beams.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of the calculation of deflections by integrating the bending-moment equation and shear-force and load equations.

b. Demonstrate an understanding of deflection by the methods of superposition and moment-

area.

c. Demonstrate an understanding of the strain energy of bending.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands the calculation of deflections by integrating the bending-moment equation and shear-force and load equations
- learner understands deflection by the methods of superposition and moment-area
- learner understands the strain energy of bending

9. Demonstrate an understanding of the behaviors of columns.

Learning objectives

What you will learn as you master the competency:

a. Demonstrate an understanding of buckling and stability.

b. Demonstrate an understanding of columns supported and loaded in various ways.

c. Demonstrate an understanding of elastic and inelastic column behavior.

d. Demonstrate an understanding of design formulas for columns.

Performance Standards

Competence will be demonstrated:

- on assigned activities
- on written exams
- on a two-hour cumulative final exam

Performance will be satisfactory when:

- learner understands buckling and stability
- learner understands columns supported and loaded in various ways
- learner understands elastic and inelastic column behavior
- learner understands design formulas for columns

Types of Instruction

Lecture/Discussion

Grading Information

Grading Rationale

Each instructor has the flexibility to develop evaluative procedures within the following parameters.

1. Written Exams must represent at least 60% of the final course grade.
2. Final Exam must represent at least 20% of the final course grade.
3. The Post Test is to be embedded in the final exam and must represent at least 10% of the final course grade (i.e., 50% of the Final Exam).
4. Other Activities may represent at most 20% of the final course grade.

Grading Scale

A 90%-100%

B 80%-89%

C 70%-79%

D 60%-69%

F Below 60%