COURSE NUMBER – COURSE NAME
ENGS 203 – Engineering Strengths of Materials
CIP Code: 14.1101

Created by: Arthur Hurlbut, Ph.D., P.E.
Updated by: Dr. Lucas Craig

Canino School of Engineering Technology
Department: Engineering Science
Semester/Year: Spring 2025
A.  **TITLE:** Engineering Strengths of Materials

B.  **COURSE NUMBER:** ENGS 203

C.  **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

   # Credit Hours: 3
   # Lecture Hours: 2 per week
   # Lab Hours: 2 per week
   Other: 

   Course Length: 15 Weeks

D.  **WRITING INTENSIVE COURSE:** Yes ☐  No ☒

E.  **GER CATEGORY:** None: ☒  Yes: GER

   *If course satisfies more than one: GER*

F.  **SEMESTER(S) OFFERED:** Fall ☐  Spring ☒  Fall & Spring ☐

G.  **COURSE DESCRIPTION:**

   This course is designed to introduce elementary analysis of deformable bodies subjected to various loading including strength, deformation, and stability analyses. Students will also be introduced to more advanced concepts to use sound judgment regarding the design of structures and components.

H.  **PRE-REQUISITES:** None ☐  Yes ☒  If yes, list below:

   ENGS 201, or permission of instructor

   **CO-REQUISITES:** None ☒  Yes ☐  If yes, list below:
I. **STUDENT LEARNING OUTCOMES:** *(see key below)*

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>Program Student Learning Outcome [PSLO]</th>
<th>GER [If Applicable]</th>
<th>ISLO &amp; SUBSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate competence in the elementary analysis of deformable bodies subjected to various loading scenarios</td>
<td>a, k</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA IA PS Subsets</td>
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<tr>
<td>Determine the allowable strength, deformation, and system stability.</td>
<td>a, k</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA IA PS Subsets</td>
</tr>
<tr>
<td>Calculate the normal and shearing stresses in complex loading schemes</td>
<td>a, k</td>
<td>2-Crit Think 1-Comm Skills ISLO</td>
<td>CA IA PS W</td>
</tr>
<tr>
<td>Determine internal shear, bending moment, and deflection in loaded systems.</td>
<td>a, c, e, k</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA IA PS Subsets</td>
</tr>
<tr>
<td>Identify stress and deformation in torsional loading</td>
<td>a, c, k</td>
<td>2-Crit Think 1-Comm Skills ISLO</td>
<td>CA IA PS Subsets</td>
</tr>
<tr>
<td>Apply Euler's equations in column loading</td>
<td>a, c, e, k</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA IA PS Subsets</td>
</tr>
<tr>
<td>Apply Mohr's circle in 2D and 3D stress and strain scenarios</td>
<td>a, c, k</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA PS IA Subsets</td>
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**KEY**

<table>
<thead>
<tr>
<th>ISLO #</th>
<th>Institutional Student Learning Outcomes [ISLO 1 – 5]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Communication Skills</strong>&lt;br&gt;Oral [O], Written [W]</td>
</tr>
<tr>
<td>2</td>
<td><strong>Critical Thinking</strong>&lt;br&gt;Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
</tr>
<tr>
<td>3</td>
<td><strong>Foundational Skills</strong>&lt;br&gt;Information Management [IM], Quantitative Lit./Reasoning [QTR]</td>
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<tr>
<td>4</td>
<td><strong>Social Responsibility</strong>&lt;br&gt;Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</td>
</tr>
<tr>
<td>5</td>
<td><strong>Industry, Professional, Discipline Specific Knowledge and Skills</strong></td>
</tr>
</tbody>
</table>
J. **APPLIED LEARNING COMPONENT:**  
Yes ☒  No ☐  
If YES, select one or more of the following categories:  
- Classroom/Lab ☒  
- Internship ☐  
- Clinical Placement ☐  
- Practicum ☐  
- Service Learning ☐  
- Community Service ☐  
- Civic Engagement ☐  
- Creative Works/Senior Project ☐  
- Research ☐  
- Entrepreneurship (program, class, project) ☐  

K. **TEXTS:**  

L. **REFERENCES:**  

M. **EQUIPMENT:**  
None ☐  Needed: ☒

N. **GRADING METHOD:**  
A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**  
- Exams  
- Quizzes  
- Homework

P. **DETAILED COURSE OUTLINE:**  
I. Review of Statics: Equilibrium, Internal Forces  
II. Concepts of Stress and Strain (1.1-5)  
III. Analysis of Elementary Loading Conditions  
   a. Axial Loads (2.1-13)  
      i. Stress and Strain Distribution  
      ii. Deflections  
      iii. Statically Indeterminate Cases  
   b. Torsional Loads (3.1-5)  
      i. Stress and strain Distribution  
      ii. Deflections  
      iii. Statically Indeterminate Cases  
   c. Pure Bending and Transverse Loads (4.1-5, 7-9) (5.1-3)  
      i. Analysis of Loading: Shear and Moment Diagrams  
      ii. Stress and Strain Distribution Due to Bending  
      iii. Stress and Strain Distribution Due to Transvers Loads  
      iv. Discussion of Advanced Topics: composite beams & unsymmetric bending  
   d. Deflections of Beams (6.1-5)
i. Differential Equations of Elastic Curve
ii. Relation Between Load, Shear, Moment, Slope, Deflection
iii. Moment Area Method
iv. Singularity Functions
v. Statically Indeterminate Cases

e. General State of Stress and Strain (7.1-6), (8.1-3), (9.1-2, 4)
i. Stresses on Inclined Planes
ii. Principal Stresses and Strains
iii. Mohr’s Circle
iv. Analysis of Combined Loadings
v. Discussion of Advanced Topics: three dimensional state of stress

f. Columns (10.1, 3, 4)
i. Stability and Buckling
ii. Support Conditions
iii. Euler’s Formula
iv. Discussion of Advanced Topics: other column formula, imperfect columns.

Q. LABORATORY OUTLINE: None Yes x

a. Axial Loads
b. Torsional Loads
c. Pure Bending and Transverse Loads
d. Deflections of beams
e. General State of Stress and Strain
f. Columns