COURSE NUMBER – COURSE NAME
ENGS 203 – Engineering Strengths of Materials

Created by: Arthur Hurlbut, Ph.D., P.E.
Updated by: J. Miles Canino, Ph.D.

Canino School of Engineering Technology
Department: Engineering Science
Semester/Year: Fall/2018
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: 3 per week
   - # Lab Hours: per week
   - Other: per week

   **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 in order to use sound judgment regarding the design of structures and components.

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

   ENGS 205, 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>
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</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</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</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</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</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</td>
<td>CA PS IA Subsets</td>
</tr>
</tbody>
</table>

#### KEY

<table>
<thead>
<tr>
<th>ISLO #</th>
<th>Institutional Student Learning Outcomes [ISLO 1 – 5]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication Skills [O, W]</td>
</tr>
<tr>
<td>2</td>
<td>Critical Thinking [CA, IA, PS]</td>
</tr>
<tr>
<td>3</td>
<td>Foundational Skills [IM, QTR]</td>
</tr>
<tr>
<td>4</td>
<td>Social Responsibility [ER, GL, IK, T, JT]</td>
</tr>
<tr>
<td>5</td>
<td>Industry, Professional, Discipline Specific Knowledge and Skills [ISLO 1 – 5]</td>
</tr>
</tbody>
</table>
J. APPLIED LEARNING COMPONENT: Yes ☑ No ☐

If YES, select one or more of the following categories:

☑ Classroom/Lab ☐ Civic Engagement
☐ Internship ☐ Creative Works/Senior Project
☐ Clinical Placement ☐ Research
☐ Practicum ☐ Entrepreneurship (program, class, project)
☐ Service Learning ☐ Community Service

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  
v. Discussion of Advanced Topics: other column formula, imperfect columns  

Q. LABORATORY OUTLINE: None ☒ Yes ☐