Stephen F. Austin State University

ABET Syllabus:
EGR 305 – Mechanics of Materials (Selected Elective)

Course Description:
Topics include stress and strain, uniaxially loaded members, centroids and area moments of inertia, normal and shear stresses, beam deflections, buckling of columns, pressure vessels, combined stresses and failure criteria.

Prerequisites: EGR 250 or PHY 250

Co-Requisites: None

Credits: 3 Hours (Lecture: 3 Hours)

Instructor: Christopher J. Aul

Textbook: Mechanics of Materials
Authors: Hibbeler
Pearson, 10th Edition, 2017

Supplemental Materials: Engineering paper
Scientific calculator or better

Topics Covered:
Stress and strain relationships; axially loaded members; torsion and bending; shear and moment; combined loadings; stress and strain transformation; deflection of members; statically indeterminate members; buckling and failure criteria.

Course Learning Outcomes
By the end of the course, a successful student will be able to:
1. Understand the stress-strain behavior of ductile and brittle materials. (SO-2)
2. Understand the shear stress-strain behavior of homogeneous ductile materials. (SO-2)
3. Apply concepts of equilibrium and mechanics to members subjected to axial loads and determine displacement. (SO-1)
4. Apply concepts of equilibrium and mechanics to members under torsion and determine angle of twist. (SO-1)
5. Combine equilibrium, compatibility, and load-displacement relationships to understand support reactions for statically indeterminate members. (SO-1)
6. Analyze transverse shear and bending moment for beams deforming under load. (SO-1)
7. Determine complex models for analysis using methods detailed in combined loads including normal, shear, bending, and torsion. (SO-7)
8. Determine stresses in thin-walled spherical and cylindrical pressure vessels. (SO-1)
9. Calculate plane stresses at a point as well as plane-stress transformation to any specific direction for analysis. (SO-1)
10. Calculate plane strains at a point and at any orientation using general equations for plane-strain transformation. (SO-1)
11. Conduct analyses for design of prismatic beams (SO-c)
12. Analyze buckling of columns having various types of supports (SO-e)

**Student Outcomes**

Graduates of the program will show:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
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
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
Course Outline:

Engineering 305.001 – Fall 2018
Mechanics of Materials
Department of Physics and Astronomy, Stephen F. Austin State University

Instructor: Christopher J. Aul, PhD
Email: aulcj@sfasu.edu
Office: 207D Ed & Gwen Cole STEM Building
Phone: 936-468-1512
Office Hours: MW 9-9:50am, TR 9am-12pm, or by appointment
Class Meetings: MWF 12:00-12:50 PM, Room STEM 306
Course Home Page: http://d2l.sfasu.edu

Course Description
This is an introductory course in mechanics that builds upon lessons in statics to include material properties in design. Topics included are stress and strain relationships; axially loaded members; torsion and bending; shear and moment; combined loadings; stress and strain transformation; deflection of members; statically indeterminate members; buckling and failure criteria. Prerequisite: EGR 250 or PHY 250 - Statics (Free body diagrams, point and distributed loads, body forces, force and moment vectors)

Text and Materials
Mechanics of Materials
Hibbeler, Pearson, 10th Edition

It is necessary that you acquire this edition of the text. Homework and reading will be assigned assuming the student has this text. Hard copies of homework assignments will not be handed out to the student.

Other materials needed in the course:

- Engineering paper that is grid ruled (assignment submission)
- Scientific calculator (for exams and homework)

Grading Policy

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>15%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>15%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Homework &amp; Assignments</td>
<td>15%</td>
</tr>
<tr>
<td>Course Projects</td>
<td>20%</td>
</tr>
</tbody>
</table>

Letter grades are based on the following ranges:

- A 90.0 – 100%
- B 80.0 - 89.9%
- C 70.0 - 79.9%
- D 60.0 - 69.9%
- F < 60.0%

The grade is based on three mid-term exams, one comprehensive final exam, homework which will be assigned in class, as well as in-class assignments. Exams will be graded on a 100-point scale.
Attendance Policy
Attendance will be taken at the beginning of class by instructor. If you have 3 unexcused absences, then your final grade will be reduced one letter grade. If you have 4 unexcused absences, you will receive an “F” in the course. A written and signed notice is required for an excused absence within three class days of the absence. To make sure that you are going to arrive to class on time you can set your watch here: http://www.time.gov/. Being late to class will result in a “late” for the day. Two “late” recordings will be made into an absence.
Students who miss class without approval of their instructor will receive a grade of zero on the missed assignment. Authorized absences must be approved by your instructor in advance of the absence, unless you have an emergency or illness. Make-up work must be completed outside of normal class hours within one week following an excused absence. It is your responsibility to see your instructor and make arrangements for make-up work if you have an excused absence.

Course Requirements
Exams
There will be three mid-term exams and a final, each covering a specific set of lecture, text, and homework material that will be communicated to the student in class. Each mid-term exam (Exams 1, 2, and 3) will be held at night and is shown on the course calendar. The final exam will be comprehensive to the material covered in the course. The tentative dates of these exams are listed in the course outline shown in this document. Students will have one week after each exam to review the exams and discuss the grades. No make-up exams will be given except in the case of an excused absence. An official written notice is required for an excused absence within three days of the exam. Any makeup exam must be taken within three days of the missed exam. The style of exam as well as allowed materials for the four exams will be communicated to the student in-class.

Homework Assignments
Homework will be assigned from the required text for the course. Homework assignments will be given to the student in class along with the due dates. When completing homework, the following guidelines must be followed:
1. Always restate the problem and draw a diagram if needed – make sure to label appropriately
2. Make sure to outline what values are given and the values you are trying to solve for
3. Use engineering style paper that is grid ruled, or equivalent electronic version
4. Use only one side of the paper (typically the side facing you on the pad)
5. Include your name and page number on each page
6. Use a ruler to set up your diagrams or in drawing elements, or appropriate electronic equivalent
7. Show the progression of your solution, clearly identify appropriate units when necessary
8. Indicate final answers by placing a surrounding box, don’t forget the units!!
9. Scan your homework document clearly for submission through D2L
The above criteria, as well as accuracy of the information, will be used to grade your homework. Treat this as if I am your client and you need to impress me with your engineering calculations. Homework will be turned in at the due-date via D2L dropbox. Homework due dates and times will be communicated to the student in class. No late homework will be accepted unless you have an excused absence.

In-Class Assignments
All in class assignments must be completed by the end of the class period. This may include working out example or homework problems on the board or separate assignments given throughout the class. The student may also be asked to present completed homework to the rest of the class in a “flipped class” manner. This is done to assess the communication and presentation skills of the student. The grade for these assignments and participation will be averaged with homework to give 15% of your final grade. It is the discretion of the instructor to grant additional time if deemed necessary.
Course Projects
The course will include two projects using laboratory equipment and involving data manipulation using MATLAB. Details on these projects will be provided to the student in class. The final grade for these projects will constitute 20% of the final grade in this course.

Email Communication
All official course communication will be made using your SFA email account. You must use your SFA email account for all communications. You will be notified via your SFA email account about grades and attendance. You can look up your SFA email account or setup email forwarding using this link: http://www.sfasu.edu/mysfa/o365/forwarding-email/

It is important to practice good email communications in college courses. Use "EGR305" in the subject of your email messages. Use complete sentences and capitalization when appropriate. The body of your email messages should begin with your instructor's name and end with your name.

Classroom Policies
For the benefit of your fellow students and your instructor, you are expected to practice common courtesy with regard to all course interactions. For example:

- Be considerate toward your classmates and instructor and arrive to class on time.
- Do not leave class early and do not rustle papers in preparation to leave before class is dismissed.
- Avoid classroom distractions. Be attentive in class: stay awake, do not read newspapers, etc.
- If you are late to class or must leave early please inform your instructor in advance (enter or leave quietly, don't walk across the front of the classroom (use the side aisles) and don’t walk in front of the projector).
- Cell phones, pagers and other communication devices must be turned off during class.
- Play well with others. Be kind and respectful to your fellow students and your teachers.

Academic Integrity (A-9.1)
Collaboration on examinations, in class assignments, and homework assignments is forbidden except where specifically specified as "Team" activities. For example, homework assignments can be worked on as a team but must be completed separately. In general, one team may not collaborate with another team on "Team" activities. Students violating this policy will be subject to procedures described in the Stephen F. Austin State University Policies and Procedures Manual.

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp
Withheld Grades Semester Grades Policy (A-54)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

Students with Disabilities
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Program Learning Outcomes
These are consistent with the “Student Outcomes” earlier in the syllabus document.

Student Learning Outcomes
These are consistent with the “Course Learning Outcomes” earlier in the syllabus document.

General Education Core Curriculum Objectives/Outcomes (EEO)
This course is not included in the general education core curriculum. Therefore, please see the learning outcomes above rather than any Exemplary Educational Objectives (EEOs).
### EGR 305 – Mechanics of Materials Class Schedule

Course schedule is **tentative** and subject to change depending on pace of the class. Homework will be assigned based on material covered in class and in the assigned reading. Homework and due dates will be given in class.

<table>
<thead>
<tr>
<th>Week #</th>
<th>Week of:</th>
<th>Topic</th>
<th>Chapter Reading</th>
<th>Important Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/27/18</td>
<td>Stress, Review of Equilibrium, Design</td>
<td>1.1 - 1.6</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/10/18</td>
<td>Axial Load: Saint-Venant's, Superposition</td>
<td>4.1 - 4.4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9/17/18</td>
<td>Statically Indeterminate Members, Centroids Review</td>
<td>4.5 - 4.7, A.1 &amp; A.2</td>
<td>Exam 1 (CH 1 - 3), 9/19/2018, 6-8pm</td>
</tr>
<tr>
<td>5</td>
<td>9/24/18</td>
<td>Torsion, Power Transmission, Angle of Twist</td>
<td>5.1 - 5.5</td>
<td></td>
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<tr>
<td>6</td>
<td>10/1/18</td>
<td>Shear/Moment Diagrams</td>
<td>6.1 &amp; 6.2</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10/8/18</td>
<td>Bending Deformation, Flexure Formula</td>
<td>6.3 &amp; 6.4</td>
<td><strong>Project 1 Due</strong></td>
</tr>
<tr>
<td>8</td>
<td>10/15/18</td>
<td>Shear: Shear Formula, Shear Flow</td>
<td>7.1 - 7.3</td>
<td>Exam 2 (CH 4 - 6), 10/17/2018, 6-8pm</td>
</tr>
<tr>
<td>9</td>
<td>10/22/18</td>
<td>Combined Load, Thin-Walled Pressure Vessels</td>
<td>8.1 &amp; 8.2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10/29/18</td>
<td>Stress Transformation, Mohr's Circle - Plane Stress</td>
<td>9.1 - 9.4</td>
<td></td>
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<tr>
<td>11</td>
<td>11/5/18</td>
<td>Plane Strain, Mohr's Circle - Plane Strain</td>
<td>10.1 - 10.3</td>
<td></td>
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<tr>
<td>12</td>
<td>11/12/18</td>
<td>Strain Rosettes, Beam Design</td>
<td>10.5, 11.1</td>
<td>Exam 3 (CH 7 - 9), 11/14/2018, 6-8pm</td>
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<tr>
<td></td>
<td>11/19/18</td>
<td>Thanksgiving Break</td>
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<tr>
<td>13</td>
<td>11/26/18</td>
<td>Beam Design, Deflection of Beams and Shafts</td>
<td>11.2, 12.1 &amp; 12.2</td>
<td><strong>Project 2 Due</strong></td>
</tr>
<tr>
<td>14</td>
<td>12/3/18</td>
<td>Buckling of Columns</td>
<td>13.1 - 13.3</td>
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<tr>
<td></td>
<td><strong>12/12/2018 - Final Exam, Comprehensive (50% new material)</strong></td>
<td><strong>1-3 pm</strong></td>
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<td></td>
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</tbody>
</table>
EGR 305 – Homework Problems

Homework problems are tentative and subject to change in the course.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Homework Problems per Chapter</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1-9, 1-11, 1-21, 1-34, 1-38, 1-42, 1-71, 1-77, 1-86</td>
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<tr>
<td>2 &amp; 3</td>
<td>2-5, 2-9, 2-29, 3-1, 3-7, 3-9, 3-11, 3-18, 3-23, 3-26, 3-29, 3-31</td>
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<td>4</td>
<td>4-3, 4-8, 4-13, 4-29, 4-34, 4-42, 4-51, 4-59, 4-71, 4-78, 4-91, 4-93</td>
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<tr>
<td>5</td>
<td>5-3, 5-7, 5-18, 5-38, 5-42, 5-49, 5-59, 5-65, 5-81, 5-85</td>
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<td>6</td>
<td>6-3, 6-10, 6-18, 6-21, 6-29, 6-35, 6-49, 6-61, 6-62, 6-67, 6-75, 6-87, 6-110, 6-114</td>
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<td>7</td>
<td>7-5, 7-10, 7-12, 7-14, 7-26, 7-27, 7-33, 7-37</td>
</tr>
<tr>
<td>8</td>
<td>8-2, 8-5, 8-10, 8-13, 8-29, 8-30, 8-37, 8-55</td>
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<tr>
<td>10</td>
<td>10-10, 10-17, 10-18, 10-19, 10-25, 10-26</td>
</tr>
<tr>
<td>11</td>
<td>11-5, 11-7, 11-14, 11-27, 11-30</td>
</tr>
<tr>
<td>12</td>
<td>12-9, 12-19, 12-21, 12-23</td>
</tr>
<tr>
<td>13</td>
<td>13-2, 13-13, 13-23, 13-33</td>
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