Course Syllabus
E MCH 213 – Strength of Materials (3 credits)
World Campus – SU 2016 – Session III
6-29-2016 - 8-10-2016

Instructor:
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Instructor Information:

**Instructor:** James A. Hendrickson, P.E.

**Location:**
Penn State Beaver  
100 University Drive  
Monaca, PA 15061

**Web Resources:** [http://.cms.psu.edu](http://.cms.psu.edu) (Angel Website)

Course Description:

E MCH 213 **STRENGTH OF MATERIALS** (3) Axial stress and strain; torsion; stresses in beams; elastic curves and deflection of beams; combined stress; columns. Prerequisite: E MCH 211

Course Objectives:

- Develop understanding of relationship between external loads and internal forces/stress in structural and machine members.
- Develop familiarity to determine basic material properties from experimental stress/strain data.
- Demonstrate proficiency in calculation of basic fundamental stress quantities for situations involving bending, axial loading, torsional loading, transverse shear forces and combined load cases.
- Develop understanding of concepts of normal and shear strain and their application to problems of mechanics of materials.
- Demonstrate proficiency in calculations of deformations and deflections in problems involving axial, transverse, and torsional loadings.
- Demonstrate proficiency in the generation of shear, moment, force, and torque diagrams to facilitate engineering simulations for stress and deflection.
- Develop skills in stress transformation techniques for both stress and strain based on the Mohr’s circle analysis for 2D and 3D load cases. Specific detail will be presented for common scenarios of plane stress and plane strain analyses.
- Demonstrate proficiency in determination of moments and deflections of beams for a variety of load cases using principles of integral and differential calculus.
- Develop basic understanding of column design with specific focus on buckling criteria for common constraint conditions.
Course Materials

**Required Text:**

*Mechanics of Materials, 2nd Edition*
Pytel & Kiusalaas
Published by Brooks/Cole-Thomson Learning
*ISBN 978-0495-667759*

**Required Study Guide:**

Available for free download from Student Text Companion Website:

http://www.cengagebrain.com/cgi-wadsworth/course_products_wp.pl?fid=M20b&product_isbn_issn=9780495667759&token=8AFFE73E7EBCA3A79354C34FC619523CE304B3C1906D7AD6DC6FS90A132A25943D3EBA80D9BEAD6http://www.cengagebrain.com/cgi-wadsworth/course_products_wp.pl
Course Philosophy & Success Strategy

The 3-credit E Mch 213 Strength of Materials Course is typically delivered in a traditional 15 week semester format with 2-3 course meetings per week. In most cases a student can expect to spend 10-15 hours per week in the traditional offering working on homework problems outside of class. Over the course of a semester this accrues a minimum total of 150 hours devoted to reading the textbook and problem solving.

As the course objectives and outcomes, and earned credits are the same in the online offering of the course a student must realize that the same “semester-effort” must be realized within a compressed time interval of 6 weeks. If we prorate the anticipated time requirement to a 6 week course we realize a significant time investment of 25 hours per week. Each student will require a different amount of time to master the material but it important to acknowledge that this course may require from you a minimum of 20-30 hours per week over the 6-week duration in order to master the learning objectives prescribed. Each student is encouraged to realistically evaluate their ability to devote sufficient time for success prior to starting the course.

Strength of materials is a “foundational course”. The methods and concepts introduced in this course will be critically important in future courses in your engineering majors as well as your engineering careers. Beyond the course grade and graduation requirements you “need to know this stuff” to find success in future design tasks. Please keep this in mind as you consider the time you are able or willing to commit to the subject.

The majority of all of the problems in the E Mch 213 strength of materials course require you to quickly and accurately complete an equilibrium analysis solution of a structure or component before you can solve for the stresses and deformations introduced in this course. If you are “rusty” in statics or not confident in problem-solving in statics you will find this course to be difficult. Your interests may be better served by taking the course in a traditional full-semester format. This course is structured with the expectation that students can apply the foundational principles from statics efficiently.

I would suggest the following approach and sequence for learning the course material:

1. Read the textbook chapters associated with the course module
2. Watch the Instructor overview video (ANGEL) associated with the course module
3. Review the solved textbook chapter example problems
4. Complete the study-guide lessons identified for the course module #
5. Complete the suggested textbook homework problems identified for the course module
6. Review the solutions posted, as needed, for the textbook homework problems
7. Review the Instructor problem solving videos posted to the course Module Folders.
8. Take advantage of the ANGEL discussion board to post any remaining questions about the homework problems and/or provided solutions. I strongly encourage all students to post their course content questions to the ANGEL discussion board for the benefit of all of the students in the course.
9. Contact the course Instructor, only after making a reasonable attempt at solving the problem, with questions about problem solution approaches and techniques.
10. Review the assessment solutions posted by the Instructor following the homework assessment, quiz assessment, and midterm exam student activities.
11. DO NOT FALL BEHIND ON THE COURSE SCHEDULE - The primary purpose of the online homework assessments is to keep you on schedule in the course.
Grading

ANGEL Proctored Midterm Exam (1) – 200 points
ANGEL Proctored Final Exam – (1) – 350 points
ANGEL Online Quizzes (5) – 75 points each -Low Quiz Score Dropped
ANGEL Online Homework Assessments (6) – 25 points each

Total Points Available in the course: 1000 points

Letter grades will be assigned based on the cumulative earned points of the activities listed above. The grades will be determined as follows:

<table>
<thead>
<tr>
<th>Percentage of available points (%)</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-93</td>
<td>A</td>
</tr>
<tr>
<td>92.9-90</td>
<td>A-</td>
</tr>
<tr>
<td>89.9-86</td>
<td>B+</td>
</tr>
<tr>
<td>85.9-81</td>
<td>B</td>
</tr>
<tr>
<td>80.9-77</td>
<td>B-</td>
</tr>
<tr>
<td>76.9-72</td>
<td>C+</td>
</tr>
<tr>
<td>71.9-67</td>
<td>C</td>
</tr>
<tr>
<td>66.9-60</td>
<td>D</td>
</tr>
<tr>
<td>Below 60</td>
<td>F</td>
</tr>
</tbody>
</table>

Notes Relative to Course Assessments:

1. Refer to the course schedule on ANGEL for the dates of all homework, quiz, and exam assessments. Please do not make requests to reschedule them. If a documented medical or personal emergency arises that prevents you to not complete an assessment please contact the course Instructor within 24 hours of the closing time of the assessment. Typically you will only be able to access the assessments for a 24 hour period on the date identified on the course schedule. All times identified on the course schedule represent US Eastern Standard Time.

2. All of the course assessments will be completed online on ANGEL and automatically graded by ANGEL. The coverage for the homework and quiz assessments will be focused on the course module identified in the course schedule though some of the course elements are cumulative in nature. You will find that many of the quiz problems are quite similar to those found in the text, solved example problems, and study guide. You will find the homework assessments to be in many cases identical in problem structure and format to the assigned course homework problems. You will want to take full advantage of the opportunities to earn points on the homework and quiz assessments. The course midterm exam will be will cover all of the material in course modules 1-3. The final exam will be comprehensive in nature and cover all course material from modules 1-7 inclusive.
3. All assessment solutions, (homework, quizzes, and midterm exam), will be posted on ANGEL and the solutions will provide sufficient detail to reinforce student learning of the material. Students should also consider the assessments to reflect the Instructor’s expectation of appropriate student mastery of the course material at the time of the assessment. **Falling behind on the course schedule will not be a successful strategy!**

4. The course assessments in the course will all be provided in a multiple choice and true/false formats. Partial credit has been incorporated in the grading algorithm based on your selected responses for the multiple choice format questions therefore you will want to carefully check your work and units before selecting your responses. Typically each multiple choice question will have five answer options including: "**none of the choices are within 5% of the correct value**". The 5% response is intended to avoid any potential small differences in calculated values which may arise due to rounding errors. You will want to be specifically focused on maintaining the correct units in your computations. As you work on homework problems in the course I encourage you to follow the best practices of engineering problem solving by following a logical sequence in your problem execution:
   a. Define a coordinate system
   b. Generate complete free-body diagram(s) as appropriate
   c. List any stated assumptions you are making
   d. Start with the fundamental definitions applicable to your problem
   e. Derive and develop necessary equations using variables to the full extent possible
   f. Complete solution by substituting numerical values into your equations and checking unit consistency in your final results.

5. This online course is very large with students distributed across many time zones. **Students shall not post any questions and/or comments concerning the homework, quiz, or exam assessments during the active 24 hour period in which the assessments are open and live.**
Important Notes concerning Grading and General Course Policy!

1. The proctored midterm exam, proctored final exam, online quizzes, and homework assessments must be taken on the specified dates as published on the course schedule! No exceptions or extensions will be granted. Please be aware of this policy before starting the course. Both Exams are closed book/closed notes with equations sheets provided by your proctor. You are permitted to have a clean printed copy of the equations sheet to use during the online quizzes and homework assessments. For the homework assessments only; you are permitted to refer to your own solutions and work from your own notes in addition to the equations sheet. A link is provided to the equation sheet on the ANGEL site. You should familiarize yourself with it prior to the examinations.

2. “There will not be any opportunities for “extra-credit” in this course. Your course grade will be solely based on the total points that you accrue on the midterm exam, best 4/5 online ANGEL quizzes, six, 6, Homework Assessments and the final exam. As a student, your current point total will be available to you at all times on the ANGEL course site therefore you will have full knowledge of your grade performance level. Please do not contact the course Instructor to ask what your current grade is in the course!

3. All course communications will be via the ANGEL course website. Please do not email me outside of ANGEL; I do not want to miss your messages! I will not respond to any emails that are not sent outside of the course ANGEL site. Please do not contact me for issues dealing with proctors, course scheduling, your current course grade, registrar bills, or general University policy. The appropriate contacts in the Continuing and Distance Education Department are provided on ANGEL. I am a course specific resource for you to provide feedback, direction, and assistance relative to the course content.

4. Due to the large class size I encourage all students to take advantage of the course ANGEL discussion board so that we can all share questions and suggestions relative to problem solutions. I will monitor the discussion board and post comments when appropriate.

5. Any inappropriate use of the course ANGEL email utility or ANGEL discussion board will be referred to the office of student conduct for review and potential disciplinary sanctions. Examples of inappropriate use would include any non-professional communications containing content offensive to other students or the course instructor, personal attacks directed at other students or the course instructor and/or commercial solicitation of any type.

6. A special note concerning course prerequisites and the expectation of prerequisite course knowledge:

I have taught the EMch 213 course for many years both in online format and in the traditional classroom environment. It has been my experience that the majority of student difficulties in EMch 213 stem from their insufficient mastery of content knowledge from their Statics, (EMch 211), background. Please be prepared to review and refresh your knowledge of foundational principles from your engineering statics course.
Academic Integrity:

“All students are expected to act with civility and personal integrity; respect other student’s dignity, rights and property; and help create and maintain an environment in which all can succeed through the fruits of their own efforts. An environment of academic integrity is requisite to respect for self and others in a civil community. Academic integrity includes a commitment to not engage in or to tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty include cheating or copying, plagiarizing, submitting another person’s work as one’s own, using Internet sources without citation, fabricating field data or citations, “ghosting” (taking or having another student take an exam), stealing examinations, tampering with the academic work of another student, facilitating other student’s acts of academic dishonesty, etc. In an online environment any act that results in a student gaining an unfair advantage over other students in the course will expressly be prohibited. In an online course environment the expectations, responsibilities, and obligations remain at the same high standard. The ANGEL online environment is considered to be no different than a classroom quiz environment. In this course if a student consistently scores very high on the independent ANGEL homework and quiz assessments yet does not demonstrate the ability to solve similar problems on the proctored exam assessments will find that they will draw attention to themselves and need to provide an explanation to the course Instructor. Students charged with a breach of academic integrity will receive due process and, if the charge is found valid, academic sanctions may range, depending on the severity of the offense, from F for the assignment to F for the course.” Please know that it has been my policy to apply the highest level of academic sanctions allowed by the offense without hesitation. Please know that your Proctor selection is critical and they are obligated to act in my stead to maintain the integrity of the exam environment. It is incumbent upon you to review the Penn State University Academic Integrity Policy. The “G9” policy link follows: http://www.psu.edu/dept/oue/aappm/G-9.html
Course Specific Parameters Related to Academic Integrity

Violation of any of the following course parameters will initiate an academic integrity due process in accordance with the University G9 policy.

1. A clean printed copy of the course equation sheet is permitted for use on all course assessments. No additional annotations are permitted on the course equation sheet. On the midterm and final exam these will be provided to you by your proctor or provided to you online. On the quiz and homework assessments it is your responsibility to print a copy of the equation sheet for yourself prior to starting the quiz.

2. For the homework assessments only you are permitted to refer to your own handwritten problem solutions based on your own work. All other sources of reference materials are forbidden; including textbooks-books, study guides, solution manuals, ANGEL and/or any other online content of any kind, and consultation with other parties. For online quizzes and the proctored exams the clean printed form of the course equation sheet will be the only permitted reference to be used.

3. Any calculator may be used on all course assessments. It is expressly forbidden to store and/or program any problem solutions into your calculator to facilitate execution of the assessment.

4. For each course assessment the student will be required to select “True” to the following declaration statement. Failure to accept “True” to the declaration statement will prevent the student from accessing the assessment content and result in a grade of “0” for the assessment.

In order to access the Homework Assessment content you will need to acknowledge that you are aware of the University G9 Academic Integrity Policy and are fully aware of the course parameters related to online homework assessments, online quizzes, and proctored online exams. Specifically

1. For online Homework Assessments you are permitted to have only a printed version of the course equation sheet and your physical homework problem work as references. Absolutely no ANGEL course content, textbooks, solution manuals, textbook study guide, additional electronic devices of any type beyond a calculator, or other reference sources are permitted.

2. For online Quiz Assessments you are permitted to have only a printed version of the course equation sheet. No other reference materials, textbooks, solution manuals, textbook study guide, additional electronic devices of any type beyond a calculator, or access to ANGEL course content or any other websites is permitted.

3. For online Exam Assessments you are permitted to have only a printed version of the course equation sheet. No other reference materials, textbooks, solution manuals, textbook study guide, additional electronic devices of any type beyond a calculator, or access to ANGEL course content or any other websites is permitted.

If you choose to not accept the course declarations you are in non-compliance with the defined parameters for this course and will receive a grade of “zero” for the assessment.

1. I have read and understand the declaration statement and agree to comply with the course parameters as defined.
   
   ☐ A) True  ☐ B) False
Disabilities:

“The Pennsylvania State University is committed to providing access to a quality education for all students, including those with documented disabilities. If a student has a disability and wants to request an accommodation for a course, it is the responsibility of the student to first obtain a University accommodation letter confirming the disability and suggesting appropriate remedies. This letter can be obtained from the Penn State Office for Disability Services or the campus Disability Contact Liaisons. The contact person at Penn State Beaver is the campus nurse whose office is located in the Ross Administration Building, (724) 773-3955. Students are encouraged to request their accommodation needs early in the semester, and once identified, a reasonable accommodation will be implemented in a timely manner. Students may also access the website for the Office of Disability Services at University Park.”

http://www.equity.psu.edu/ods
Course Schedule and Important Dates:

The course schedule is available on the course ANGEL site as a separate document. It is incorporated herein for reference and convenience.

<table>
<thead>
<tr>
<th>Module # &amp; Starting Date</th>
<th>Text Reading Assignments</th>
<th>Study Guide Lessons</th>
<th>Suggested Textbook Homework Problems</th>
<th>ANGEL - Course Assessment Activities/Dates</th>
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<tbody>
<tr>
<td>Module 1 June 29</td>
<td>Chapter 1 - Stress</td>
<td>1,2</td>
<td>Chap 1: 1,11,16,19,34,35,39,40,41,42</td>
<td>Late Drop Begins 7-6-16</td>
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<td>Module 2 July 4</td>
<td>Chapter 2 - Strain</td>
<td>3,4,5,6</td>
<td>Chap 2: 13,15,22,29,39,49,63,68,78,81,82,92</td>
<td>HWM1 Assessment - 7-6-16</td>
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<td>Q3M1 Assessment – 7-8-16</td>
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<td>Module 3 July 11</td>
<td>Chapter 3 - Torsion</td>
<td>7.8</td>
<td>Chap 3: 1,15,19,22,29,33,39,40,43,48,50,63</td>
<td>HWM2 Assessment - 7-13-16</td>
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<td>Exclude Article 5.4</td>
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<td>Q3M2 Assessment – 7-15-16</td>
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<td>Module 4 July 18</td>
<td>Chapter 4 - Shear/Moment Diagrams</td>
<td>9,10,11,12,13,14,15</td>
<td>Chap 4: 3,7,21,31,45,66</td>
<td>HWM3 Assessment - 7-20-16</td>
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<td>Chapter 5 - Beam Stresses</td>
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<td>Chap 5: 1,3,16,41,50,59,65,83,92</td>
<td>Q3M3 Assessment – 7-22-16</td>
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<td>Module 5 July 25</td>
<td>Chapter 6 - Deflection of Beams</td>
<td>16,17,19,20,21,23</td>
<td>Chap 6: 3,6,10,19,28,43,71,82,91</td>
<td>Midterm Exam Assessment 7-25-16 (Proctored) Modules 1-3</td>
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<td>Chap 7: 1,8,13,20,41,54</td>
<td>HWM4 Assessment – 7-27-16</td>
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<td>Chapter 7 - Statically Indeterminate Beams</td>
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<td>Q3M4 Assessment – 7-29-16</td>
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<td>Module 6 August 1</td>
<td>Chapter 8 – Stresses due to Combined Loads</td>
<td>24,25,26,27,28</td>
<td>Chap 8: 1,8,12,18,29,46,49,50,58,67,71,88,94,99,138</td>
<td>HWM5 Assessment – 8-3-16</td>
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<td>Q3M5 Assessment – 8-5-16</td>
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<td>Module 7 August 8</td>
<td>Chapter 10 - Columns</td>
<td>35</td>
<td>Chap 10: 1,3,5,6,7,8,10,12,13,14</td>
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<td>Final Exam Assessment 8-11-16 (Proctored) Modules 1-6</td>
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<td>Late Drop Deadline 8-2-16</td>
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