Purdue University
School of Materials Engineering

MSE 250 Physical Properties in Engineering Systems

Lecture: Tuesday and Thursdays from 1:30 to 2:45 in FRNY G124
Lecturer: Prof. Rodney W. Trice, ARMS 2227, 494-6405, rtrice@purdue.edu
                   Office Hours: TBD

Teaching Assistant: Xi "See" Chen, chen2086@purdue.edu
Office Hours: Monday 2:30 – 3:30 in ARMS 2222
                   Wednesday 2:30 – 3:30 in ARMS 2222

This class is directly intended to provide a connection between the math and science and engineering practice and applications. Foundational aspects of engineering problem solving, use of computer math tools (MathCad 15 or other) for engineering problem solving, basic engineering statics, strength of materials, and mechanics, group problem solving approaches, introductory aspects of design and materials selection.

Textbook: We will use a variety of sources including Powerpoint Lecture Notes, and two sets classic books (Engineering Mechanics by Hibbeler, and Mechanics of Materials by Beer and Johnson). These books will be placed in the Effron lounge and on hold in the Engineering Library). I have also made arrangements to have all the notes for the course bound in spiral notebook and this is available at **Copymat Services** at 135 S Chauncey Ave (i.e. in the village).

Website: Homework problems and solutions and important links to other resources will be available on Blackboard.

Examination Dates
        Exam 1: Thursday, February 2, 2016, During Class in FRNY G124
        Exam 2: Thursday, March 2, 2016, During Class in FRNY G124
        Exam 3: Thursday, April 6, 2016, During Class in FRNY G124
        Final Exam: TBD

Course Objectives for MSE 250 can be found at:
https://engineering.purdue.edu/MSE/Academics/Courses/MSE250/index.html

Procedures

Lectures: will be different than others you have had. Prof. Trice envisions spending approximately 50 minutes each lecture on discussing content, and the remaining time having students work in groups to solve problems and report them. Groups will be organized each class day and will be different from lecture to lecture. Have fun with it.

Lectures will be given from an IPad which allows Prof. Trice to annotate power point slides during lecture. Thus, all students need to either (1) print off copies of the lectures, which are available through Blackboard or (2) buy a bound set of class notes from Copymat Services (about $20). The provided slides are only "sketches" of the lectures, and you will need to add your own notes to them during class – thus, hopefully, we will avoid "death by Power Point".

Homework is available on Blackboard. Your homework solutions are due at the <u>beginning</u> of class. Late homework is not accepted without a valid excuse. Homework solutions will be posted on Blackboard before the exam.

Expected format for homework, quizzes and exams

1. Neat, legible, organized, and in sufficient detail to demonstrate that you understood and performed the calculations yourself. Many problems will require a moderate sized free body diagram. *Put problems in sequential order!*
2. Complete calculations in general form before substituting in numerical values.
3. Check the dimensions in any calculation and also that your answer makes physical sense.
4. Use reasonable precision in reporting the numerical value of calculations (e.g., not all 10 places of your calculator display) and use units consistently (SI unless otherwise given).
5. Use one side of paper, pen or dark pencil, adequate "white-space" for instructor comments and corrections, no spiral notebook remnants. Write your name on each page of homework and be sure to staple or clip multiple sheets.
6. Typing homework and/or using math software and computer graphing are not necessary, but not discouraged. On the other hand, the quizzes and exams require hand calculations, plotting, and sketching so you may want to practice these skills on the homework. If you do choose to submit computer-aided homework solutions, equations and variables must be clearly defined, graphs must have labeled axes with units and be reasonably scaled, and answers must be unambiguously identified. Copying the computer work of someone else is cheating.

PARTIAL CREDIT ON ANY HOMEWORK, QUIZ OR EXAM PROBLEMS IS DISCRETIONARY AND MAY NOT BE PROVIDED AT ALL OR PARTICULARLY IF THE RESULT DOES NOT MAKE PHYSICAL SENSE. IF YOU KNOW YOUR FINAL ANSWER IS RIDICULOUS INDICATE SO GIVING YOUR REASONING. UNDER THESE CIRCUMSTANCES PARTIAL CREDIT FOR CALCULATION ERRORS MAY BE GRANTED.

Participation in class will be scored. <u>Attendance is essential</u>; you cannot participate unless you attend.

Examinations

All examinations (three in-class exams and the final exam) are closed-book but you may use up to 1 sheet of <u>handwritten</u> notes (8.5" x 11", two sides). Besides this crib sheet, the <u>only other things</u> allowed for the exams are writing implements, eraser, straight edge (ruler), and a calculator. *Exams will be given during normal class time*.

   In case of emergency, e-mail Prof. Trice or call my office as soon as possible at 494-6405 and leave a message. Messages are recorded 24 hours a day.

   Make-up exams or quizzes will be given only for the following verifiable reasons: serious illness, family emergencies, direct conflict with another scheduled exam (must inform instructor no later than two weeks prior), or official university absence. <u>Do not</u> schedule travel without knowing the final exam schedule.

Grading appeals will be considered up to <u>one week</u> after an exam (or quiz) is returned to you. <u>Make no additional marks on the paper.</u> Return the entire exam or quiz along with a brief, logical explanation of the basis for your appeal written on a separate sheet of paper.

Campus Emergency Policy
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Any such changes will be posted to the course website on *Blackboard or emailed to you directly.*

Academic Dishonesty
Purdue University Regulations, Part 5, Section III-B-2-a describes the formal policies governing academic dishonesty. A guide providing specific examples, tips, and consequences is available from the Office of the Dean of Students at:

http://www.purdue.edu/odos/osrr/academicintegritybrochure.php .

These rules cover not only exams and quizzes, but also the graded homework. Copying or sharing any part of the homework solutions is a clear violation of university policy. Transcribing, paraphrasing or following the outline of someone else's solution(s) is cheating. The test is simple: If you write down your solution after reading or hearing someone else's solution you are cheating. Likewise, if you share or exchange your solutions with another student, in written or spoken form, you are cheating. Discussion between students of the concepts and general approach to homework problems is encouraged but the solutions you turn in for grading must be your own original work. *Specific assignments and activities in MSE are assigned on a group basis and these will be clearly indicated.*

Advice on homework in MSE 250: The homework solutions are worth only ∼15% of the final grade. The benefits of learning from mistakes made in thinking for yourself on the homework far outweigh the risks of cheating. By copying down a correct homework solution without really learning the concepts, you are effectively trading away points on an exam or quiz for minimal points on the homework. By copying an incorrect solution (a common way copying is detected) you greatly increase the risk of being caught. *We understand that discussing a solution and sharing with classmates approaches for solving homework is normal and expected. By failing to insure that you put your own originality into solutions and in particular, in written discussions to qualitative homework solutions you will penalize yourself and hinder your own learning.*

The MSE 250 teaching staff will diligently monitor academic dishonesty in exams, quizzes and homework. Students found to engage in academic dishonesty are subject to sanctions. For a first offense, the student will receive a zero score for the assignment, quiz or exam and a letter will be placed in your MSE file. Depending on the severity of the offense, the case may be referred to the Office of the Dean of Students for further action. If there is already such a letter in your file from a prior MSE class then your case will automatically be referred to the Office of the Dean of Students. A second offense in this class can result in a failing grade for MSE 250 and will involve referral to the Office of the Dean of Students.

Grade Determination
Team Projects: 6%
Homework, Participation: 12%
Exam I: 17%
Exam II: 20%
Exam III: 20%
Final Exam: 25%

Note that small adjustments may be made to these percentages based on the number of projects. Prof. Trice anticipates having at least 2 team projects, each worth 2.5% of the total grade. The exam percentages will not change.

These are the specific topics to be covered in class:
● Free body diagrams, vector formulations (2d and 3d), force rotation, catenary structures
● Mathcad usage (I am flexible if student uses other solver programs)
● Moments (2d and 3d), scalar and vector formulations, moments around a point and axis, couples
● Modeling force and moment reactions in 2d and 3d
● Axial, shearing and bearing stresses and simple design analysis based on allowable stresses, buckling
● Beams with simple, cantilevered and distributed loadings, shear and moment diagrams for beams
● Bending and transverse shear stresses in beams, calculations of I for simple shapes and non-uniforms shapes, neutral axis location, Q (for transverse shear), and beam design
● Axial loading, stress distribution, strain, deflection, thermal stress and CTE, 3d formulation for stress and strain
● Torsional stress and strain, Brittle and ductile failure in torsion
● Tensor introduction, rotation in 3d using Euler angles, Pressure vessel introduction
● Analysis of complex loading schemes with regards to axial, transverse shear, bending and torsional stresses, ability to formulate the stress tensor, then solve for principle stresses and calculate Von Mises predicted yielding
● Throughout the class we connect lectures to foundation materials knowledge gained in MSE 230 when possible.

The exam dates are set. The rest of the topics are tentative. Expect 11 homework sets and two group projects.

Week	Meeting	Date	Topics	Homework Due
1	L1	Jan 10	Syllabus/KC Skywalk Failure/Force in 2D/3D	
	L2	Jan 12	Force Vectors in 2D/3D	
2	L3	Jan 17	Equilibrium of a Particle/Free Body Diagrams in 2D and 3D	
	L4	Jan 19	Equilibrium of a Particle/Free Body Diagrams in 2D and 3D	
3	L5	Jan 24	Equivalent Force Systems/Moments	
	L6	Jan 26	Mathcad – Meet in MSE Undergraduate Lab	
4	L7	Jan 31	Equivalent Force Systems/Moments and Couples	
	L8	Feb 2	Exam I - In Class	
5	L9	Feb 7	Exam Return/Moments in 3D	
	L10	Feb 9	FBD and Moments – 2D	
6	L11	Feb 14	FBD and Moments – 3D (Vector Formulations)	
		Feb 16	Stress Overview	
7	L12	Feb 21	Stress Overview – Axial, Shear, Bearing	
	L13	Feb 23	Stress Overview/Buckling/Beam Theory/V-M Diagrams	
8	L14	Feb 28	Beam Theory/V-M Diagrams	
	L15	Mar 2	Exam II – In Class	
9	L16	Mar 7	Exam Return/Bending Stress and Transverse Shear in Beams	
	L17	Mar 9	Bending Stress and Transverse Shear in Beams	
10	H	Mar 14	Spring Break	
	H	Mar 16	Spring Break	
11	L18	Mar 21	Finish Beams/Axial Loading Stress and Strain	
	L19	Mar 23	Axial Loading Stress and Strain	
12	L20	Mar 28	Torsion	
	L21	Mar 30	Torsion	
13	L22	Apr 4	Tensor Introduction	
		Apr 6	Exam III – In Class	
14	L23	Apr 11	Tensor Introduction Complex Loading States to Stress Tensor (including Pressure Vessels)	
	L24	Apr 13	Complex Loading States to Stress Tensor	
15	L25	Apr 18	Complex Loading States to Stress Tensor	
	L26	Apr 20	Design based on Yield Criterion	
16	L27	Apr 25	Working Problems/Review	
	L28	Apr 27	Working Problems/Review	
17	**Final**	**May**	**Final Exam!**	**Comprehensive**

My Grades Worksheet

Homework #	Grade	Fract. of 1
1 (1)		
2 (1)		
3 (1)		
4 (1)		
5 (1)		
6 (1)		
7 (1)		
8 (1)		
9 (1)		
10 (1)		
11 (1)		
Total Points		

Exam #	Grade	Fract. of Exam Pts
I (17)		
II (20)		
III (20)		
Final (25)		

Group	Grade	Fract. of 3
A (3)		
B (3)		

In the parenthesis are the points each assignment/exam counts on a 100 point basis. Participation is worth 1 point.