Course Registration Numbers: 13056; Course credit hours - 3

Schedule: Tuesdays and Thursdays at 4:30 - 5:45 pm in ME 1061

Instructor: Michael D. Sangid; Email: msangid@purdue.edu
Office: 2027 ARMS; Telephone: 765-494-0146
Office Hours: Thursdays 3:30 – 4:30 pm
Additionally, I will be available by scheduling an appointment.
Appointments will be scheduled within a week of the request.

For assistance with HW or technical questions please send an email to:
aae204spring2020@gmail.com

TAs: Ronald Agyei Email: ragyei@purdue.edu
Ajey Venkataraman Email: venkata3@purdue.edu

Office Hours and Recitations:

The TAs will hold recitation sessions from 4 to 8 pm on Mondays in Phys202.

Due to holidays, recitation will not be held on Jan. 20 & March 16.

Please note: To ensure that everyone has the same access to questions/answers, please seek the TAs assistance during the recitation periods or post a question on the Slack message board. Please avoid asking the generic 'how do I do problem X', asking if an answer is correct, or posting answers. During recitation, please come prepared with specific questions and prior attempts and thought into solving the problems. In other words, do not show up without prior work and expect the TAs to solve the problems for you.

Supplemental Instructor:

Purdue offers supplemental instruction for AAE204. Please visit https://www.purdue.edu/asc/si/ for more information.

Graders: Please note, we will have a grader that will grade the HW assignments. Hence, the TAs are not necessarily the people grading your HWs. Moreover, only selected questions part of the HW will be graded each week.

Prerequisites: AAE 203 – Aeromechanics I

Required Text: Mechanics of Materials, by James M. Gere, 8th ed. ISBN 9781111577735, Cengage Learning.

Course Website: We will be using Blackboard, which includes class announcements, updated schedule, syllabus, lecture notes, and supplementary information.

Discussion Board: We have set up a discussion board on Slack for this class - AAE204-Spring2020. The invite link to join this workspace is: **https://tinyurl.com/yf9bksj7**
Students are encouraged to use the Discussion board for dialogue (with TA or among themselves) but if HW solutions are directly provided or any other unethical behavior is exhibited, the instructor reserves the right to disable this feature.

Course Description: This course is to introduce aerospace engineering students to the mechanics of solids concepts of force/stress/equilibrium, deformation/strain/compatibility, and stress/strain material behaviors. These concepts, through examples, are applied to basic aerospace structural components of rods in tension and compression, shafts in torsion, beams in bending and shear, and thin walled vessels under pressure.

Student Learning Outcomes: On completing this course, the student shall be able to:

1. Describe the material behavior of deformable bodies when subjected to loads
2. Create and use free-body diagrams to compute resultant support forces and moments
3. Compute internal force and moment distributions
4. Properly select and use materials based upon their mechanical properties
5. Compute stresses, strains, deformation, and displacements of basic structural components
6. Predict structural integrity based on the calculations
7. Apply these ideas for analysis of components related to aerospace applications

Topics:

1. Introductions and Review of Statics and Equilibrium: Introduction and Fundamentals of Mechanics. Forces and Moments. Equilibrium and Free-Body Diagrams. 3-D Equilibrium and Structural Analysis. Statics of Structures and Internal Forces. Distributed Loads and Geometric Properties. (7 lectures)
2. Mechanical Behavior of Materials: Normal Stress and Strain. Material Properties and Behavior. Shear Stress and Strain. Allowable Loads, Failure. (5 lectures)
3. Axially-Loaded Members: Uniform Bars, Statically Determinate Structures. Axial Deformation. Nonuniform Bars, Statically Indeterminate Structures, Thermal Effects. Inclined Sections, Strain Energy. Repeated Loading and Fatigue, Stress Concentrations. (6 lectures)
4. Torsion of Shafts: Torsion of Circular Shafts. Geometry of deformation. Nonuniform Torsion. Stress and Strain in Pure Shear. Statically Indeterminate Shafts. Strain Energy in Torsion. Torsion of Thin-Walled Shafts. (6 lectures)
5. Transverse Loading of Beams: Types of Beams, Loads and Reactions. Shear Force and Bending Moment Diagrams. Bending, Stress and Strain in Beams. Design of Beams, Nonprismatic Beams, Shear Stresses. Shear Webs, Built-Up Beams, Axial Loads. Composite Beams. (9 lectures)

6. Plane Stress and Applications: Analysis of Stress and Strain. Plane Stress Topics, Principal Stresses, Maximum Shear Stress. Plane Strain. Pressure Vessels. Combined Loadings. (6 lectures)

Approach: Active learning – classes are a mixture of lecture and discussion, as well as problem solving (both in groups and individual). Some of the lecture material will be pre-recorded (via ITaP Video Express) and distributed to the students via URL, in which students are expected to watch prior to lecture. It is required that students attend lectures.

Grading: 3 Credit Hours – HW (21%), Midterm 1 (21%), Midterm 2 (21%), Final (25%), In-class exercises (12%). In general, we will have a 90%|80%|70%|60% grade scale with +/- grades. Depending on how the class performs on its assignments and tests, the instructor reserves the right to curve the scale in the favor of the class, if necessary, based on his discretion. Grades will never be curved downward.

Homework: Assigned weekly on Tuesday (provided by Blackboard) and due on the following Tuesday by 4:30 pm EST. An electronic copy of your HW must be turned in via Gradescope. HW submitted by other means (hard copy in class, slipped under the door, in a mailbox, emailed directly to TA/instructor) will not be accepted, unless prior consent is given. Please start early on the assignment and check solutions and files before submitting. Late HW will not be accepted. You are allowed to drop the lowest score out of the 12 HW assignments.

The purpose of homework assignments is for students to gain further understanding of classroom principles through application to practical problems. A critical aspect is problem solving and thinking about strategies to solve each question. This training is important to your overall understanding of the material and the ability to do well on the exams. Some of the HW problems will be graded in detail, based on the methodology, approach, effort, and answer. While other HW problems will either not be graded or graded based on whether thought and effort has been put into the solution and the student is on the right track. If the question is not attempted, minimal effort is given, the student gives a flippant response, or the trajectory towards the solution is completely off path, then no credit will be given for this question. The grades will be posted on blackboard. A detailed HW solution will be given to the students after the HW is submitted. This HW solution can be used as a study guide towards the exam. It is against the University conduct policy and copyright restrictions to place any HW solutions on third party websites.

Exams: There will be two midterm exams and one final exam. Exams will be accumulative, while the focus of the exams will be heavily geared towards new material. Midterms will be held at night, to allow students more time and space. A non-communicating calculator is permitted. But the exam will be closed book, closed notes, and no crib sheet. Students are expected to know any relevant equations. The material on the exam will be closely related to the lectures and types of questions asked on the HW and in class assignments. Prior to the exam, the TAs will host an in-class review. Please do not focus your questions about asking what material will be on the exam, instead the review should be focused on clarifying and solidifying course topics. The exam dates are:

- Midterm I – Monday, February 17th, 8 to 9:30 pm in PHYS 114

- Midterm II – Monday, March 9th, 8 to 9:30 pm in PHYS 114
- Final Exam – TBD during the week of May 4th-8th

The exam solutions will not be distributed to the students, but will be reviewed in class. Exam grades will not be openly discussed. If the students have grade appeals, they must submit a written appeal along with the original copy of their graded exams within one week of the exams being returned. The exam will be re-graded, which may reduce the overall grade, as any grading that was too generous may be corrected.

Definition of Academic Dishonesty: Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty" (*University Regulations*, Part 5, Section III, B, 2, a). Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest" (University Senate Document 72-18, December 15, 1972).

Academic Integrity: "Purdue University values intellectual integrity and the highest standards of academic conduct. To be prepared to meet societal needs as leaders and role models, students must be educated in an ethical learning environment that promotes a high standard of honor in scholastic work. Academic dishonesty undermines institutional integrity and threatens the academic fabric of Purdue University. Dishonesty is not an acceptable avenue to success. It diminishes the quality of a Purdue education which is valued because of Purdue's high academic standards" (S. Akers, *Academic Integrity, A Guide for Students*, 1995, revised 1999). Also, see PURDUE UNIVERSITY CODE OF HONOR

Purdue Honors Pledge: *"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."*

Nondiscriminatory Policy Statement:
Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the

procedures and limitations as set forth in Purdue's Equal Opportunity, Equal Access and Affirmative Action policy which provides specific contractual rights and remedies. Additionally, the University promotes the full realization of equal employment opportunity for women, minorities, persons with disabilities and veterans through its affirmative action program.

Students with Disabilities: Students with disabilities requiring additional assistance should make themselves known to the instructor. Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247." http://www.purdue.edu/drc/faculty/syllabus.html

CAPS Information: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Commercial Websites:
In general, notes, homeworks, and homework solutions are considered to be *'derivative works'* of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials." As such, they cannot be sold or bartered without express written permission of the instructor.

Campus Emergency: 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 beyond the instructor's control.

Additional Information: This class will uphold Purdue University's policies on 'Bereavement or Military Absence', 'Adverse Weather', 'Campus Emergency', etc. Please consult purdue.edu for more information.

Class Schedule: A detailed schedule will be posted on Blackboard and updated regularly. The topics covered during each lecture will be summarized during the announcements. Below is an outline of topics with reading in parentheses, which correspond to sections in the *Mechanics of Materials* text.

			Topic	**Reading**	**HW due**
	Week 1				
1	Tues	14-Jan	Class Introductions		
2	Thur	16-Jan	Equilibrium and Free Body Diagrams		
	Week 2				
3	Tues	21-Jan	Moments and couples		1
4	Thur	23-Jan	Trusses		
	Week 3				
5	Tues	28-Jan	Normal stresses	1.1, 1.2	2
6	Thur	30-Jan	Stress-Strain Relationships	1.3-1.5	
	Week 4				
7	Tues	4-Feb	Lateral strains and shear stresses/strains	1.6	3
8	Thur	6-Feb	Allowable stresses	1.7, 1.8	
	Week 5				
9	Tues	11-Feb	Axial loads & Statically Indeterminate Structures	2.1-2.4	4
10	Thur	13-Feb	Thermal Loads	2.5	
	Week 6				
	Mon	***17-Feb***	***Exam I: 8 to 9:30 pm in PHYS 114***		
11	Tues	18-Feb	Thermal Loads and Inclined Sections	2.6, 2.7	
12	Thur	20-Feb	Strain Energy and Stress Concentration	2.7, 2.10	
	Week 7				
13	Tues	25-Feb	Fatigue and Torsion***	2.9,3.1-3.3	5
14	Thur	27-Feb	Torsion as pure shear***	3.4-3.6	
	Week 8				
15	Tues	3-Mar	Thin walled tubes and statically indeterminacy	3.8-3.10	6
16	Thur	5-Mar	Beams in Shear and Bending	4.1 - 4.3	
	Week 9				
	Mon	***9-Mar***	***Exam II: 8 to 9:30 pm in PHYS 114***		
	Tues	10-Mar	*Class canceled*		
17	Thur	12-Mar	Shear Force & Bending Moment Diagrams***	4.4, 4.5	
	Week 10				
	Tues	17-Mar	*No class - Spring Break*		
	Thur	19-Mar	*No class - Spring Break*		

Class Schedule (continued):

			Topic	Reading	HW due
	Week 11				
18	Tues	24-Mar	Centroids and Moments of Inertia***	12.1 - 12.5	7
	Thur	26-Mar	*Class canceled*		
	Week 12				
19	Tues	31-Mar	Beam Bending	5.1 - 5.6, 5.8	8
20	Thur	2-Apr	Shear Stresses in Webs of Beams	5.9 - 5.10	
	Week 13				
21	Tues	7-Apr	Built up beams	5.11, 5.12	9
22	Thur	9-Apr	Composite beams	6.2	
	Week 14				
23	Tues	14-Apr	Plane Stress and Principal Stress	7.1 - 7.3	10
24	Thur	16-Apr	Mohr's Circle	7.4	
	Week 15				
	Tues	21-Apr	*Class canceled*		11
25	Thur	26-Apr	Hooke's Law, Triaxial, 3D Stress, Plane Strain	7.5, 7.6	
	Week 16				
26	Tues	27-Apr	Pressure Vessels	8.1 - 8.3	12
27	Thur	30-Apr	Buckling	11.1 - 11.4	
	Week 17				
	TBD		Finals TBD		
		***	Indicates Guest Lecturer		

Appendix A - Guidelines for Academic Integrity

In a society that increasingly questions the value of higher education upholding academic integrity takes on added significance. The time and effort necessary to champion high expectations of academic integrity are well understood, and the University is in full support of faculty and instructors who uphold these standards. Please consider these five steps for your class.

1. Define academic dishonesty for your class in your syllabus. A faculty guide is located at https://www.purdue.edu/odos/osrr/resources/documents/responding_to_academic_dishonesty.html . I encourage you to emphasize this part of your syllabus on the first day of class. You also may wish to revisit your expectations at key junctures of the semester (e.g., before an exam or term project).
2. Provide greater clarity to students about what is acceptable and unacceptable. Some classes routinely use team assignments and encourage collaboration for projects, labs, or homework. Yet at other times of the term, students are expected to work independently. Be very clear about your expectations for each assignment.
3. Students should to be told prior to – and as part of – the instructions on each test what is acceptable in terms of notes, phones, calculators, etc. From class to class our practices vary widely so, here again, it's important to be very clear in your expectations.
4. Fourth, define what penalties that be enforced a student is caught. One example might be:

   > Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

5. At a minimum, if you penalize a student's grade by deducting points, report the instance of scholastic dishonesty to the Office of Student Rights and Responsibilities (OSSR). One reason it is important to report all incidents to ensure consistent treatment both at the course level and across the institution. Staff members from OSRR are available to consult on an individual basis. Their office is in B50 of Schleman Hall, and their phone is 494-1250.

6. Finally, faculty and instructors have raised concerns about student academic integrity. At the same time, students have indicated that some instructors appear reluctant to uphold academic standards. I ask that you be clear in your syllabus on the steps you will take in your class to uphold academic integrity. *In addition, students should be made aware that they can report issues of academic integrity that they observe, either through the Office of the Dean of Students (purdue.edu/odos), call 765-494-8778 or email integrity@purdue.edu .*

Appendix B: EMERGENCY PREPAREDNESS LECTURE

1. *Prior to the first day of class, obtain a copy of the building emergency plan for each building in which you will be teaching. Note the evacuation route and assembly area, as well as the shelter in place locations. BEPs are located on the Emergency Preparedness website* https://www.purdue.edu/ehps/emergency_preparedness/emergency/building-plan.html
2. *On the first day of class, the following information is required to be presented to students:*

As we begin this semester I want to take a few minutes and discuss emergency preparedness. Purdue University is a very safe campus and there is a low probability that a serious incident will occur here at Purdue. However, just as we receive a "safety briefing" each time we get on an aircraft, we want to emphasize our emergency procedures for evacuation and shelter in place incidents. Our preparedness will be critical IF an unexpected event occurs!

Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus. Let's review the following procedures:

- For any emergency text or call 911.
- There are more than 300 Emergency Telephones (aka blue lights) throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected right away.
- If we hear a fire alarm we will immediately evacuate the building and proceed to_____ (location).
    - **Do not use the elevator.**
    - Go over evacuation route…see specific Building Emergency Plan.
- If we are notified of a Shelter in Place requirement for a tornado warning we will stop classroom or research activities and shelter in the lowest level of this building away from windows and doors. Our preferred location is _____.
- If we are notified of a Shelter in Place requirement for a hazardous materials release we will shelter in our classroom shutting any open doors and windows.
- If we are notified of a Shelter in Place requirement for an active threat such as a shooting we will shelter in a room that is securable preferably without windows. Our preferred location is _____.

(NOTE: Each building will have different evacuation & shelter locations. The specific Building Emergency Plan will provide specific locations and procedures)

Attached to the syllabus is an "Emergency Preparedness for Classrooms" sheet that provides additional preparedness information. Please review the sheet and the Emergency Preparedness website for additional emergency preparedness information.

EMERGENCY PREPAREDNESS SYLLABUS ATTACHMENT

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept – if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside.

- **Indoor Fire Alarms** mean to stop class or research and immediately **evacuate** the building.
  - Proceed to your Emergency Assembly Area away from building doors. **Remain outside** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.
- **All Hazards Outdoor Emergency Warning Sirens** mean to immediately seek shelter (**Shelter in Place**) in a safe location within the closest building.
  - "Shelter in place" means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. **Remain in place** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

**In both cases, you should seek additional clarifying information by all means possible…Purdue Emergency Status page, text message, Twitter, Desktop Alert, Albertus Beacon, digital signs, email alert, TV, radio, etc…review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/ehps/emergency_preparedness/warning-system.html*

EMERGENCY RESPONSE PROCEDURES:

- Review the **Emergency Procedures Guidelines** https://www.purdue.edu/emergency_preparedness/flipchart/index.html
- Review the **Building Emergency Plan** (available on the Emergency Preparedness website or from the building deputy) for:
  - evacuation routes, exit points, and emergency assembly area
  - when and how to evacuate the building.
  - shelter in place procedures and locations
  - additional building specific procedures and requirements.

EMERGENCY PREPAREDNESS AWARENESS VIDEOS

- "Shots Fired on Campus: When Lightning Strikes," is a 20-minute active shooter awareness video that illustrates what to look for and how to prepare and react to this type of incident. See: http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campus-video.cfm (Link is also located on the EP website)

MORE INFORMATION

Reference the Emergency Preparedness web site for additional information: https://www.purdue.edu/ehps/emergency_preparedness/