

# IOWA STATE UNIVERSITY

Department of Ag & Biosystems Engineering

## TSM 443: Statics and Strength of Materials for Industrial Technology

### SYLLABUS

**Catalog Description:** (2-2) Cr. 3. Statics and Strength of Materials. Application of the standard analytic techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design. This includes plastics and metals.

#### Class Meeting Times & Locations:

Lecture: TBD

Lab: TBD

**Instructor:** Prof. D. Grewell

Office: Davidson 132A

Office Phone: 294-2036

Email: [dgrewell@iastate.edu](mailto:dgrewell@iastate.edu)

Office Hours: Appointment

#### Teaching & Lab Assistant:

**Course Text:** Statics and Strengths of Materials, 2<sup>nd</sup> edition, Fa-Hwa Cheng, McGraw-Hill (978-0-02-803067-8)

**Lab Fee:** None

**Purpose of the Course:** The purpose of this course is to provide students with knowledge on material testing, material properties, design and how manufacturing processes can affect material properties.

**Course Objectives:** Upon completing this course, the student will:

1. Use standard analytical techniques in solving problems related to force and moments.
2. Determine stresses and angular deformation.
3. Determine various stresses in a beam subjected to various loads and be able to design structures based on these determinations.
4. Understand common methods of structural analyses.
5. Become familiar with various material properties and testing.
6. Become familiar with FEA fundamentals and methods.
7. Understand some basic principles of materials properties and testing.
8. Develop or enhance a background in materials and processes, which can be carried to other courses, later research, and employment in manufacturing and design.

#### Grading:

Assessment	Points	Weight (with Finals)	Weight (without Finals)
Exam 1	150	15%	21.43%
Exam 2	150	15%	21.43%
Comprehensive Final Exam (optional)	300	30%	-
Exercises/Homework (5 @ 50 points)	200	20%	28.56%
Class participation (1 point per ball)	20	2%	2.86%
Short Quiz (4 @20points)	80	8%	11.43%
West Point Bridge Design	100	10%	14.29%
<b>TOTAL</b>	<b>1000</b>	<b>100%</b>	<b>100%</b>

Class participation will be monitored by collecting “balls” during class. Each ball is equivalent to 1 point. Thus, to achieve 20 points, you must participate 20 times during the semester. If a student has participated more than 20 times during the semester, each point beyond 20 points will be added to the final grade at the end of the semester.

Percentage Scale for Letter Grades

A	95-above	A-	90-94		
B+	87-89	B	84-86	B-	80-83
C+	77-79	C	74-76	C-	70-73
D+	67-69	D	64-66	D-	60-63
F	59-below				

Extra Credit. No extra credit.

<b>Week</b>	<b>Activity</b>	<b>Topic/Comments</b>
1	Lecture (chapter 1)	Introduction/ Principle of statics
1	Lecture	Force/Newton’s Laws
1	Lab	MathCad-units
2	<b>No class</b>	
2	Lecture	Numerical calculations
2	Lab	MathCAD – units/equations
3	Lecture (chapter 2)	Resultants of coplanar force systems
3	Lecture	Moments of a force
3	Lab	MathCAD-linear algebra
4	Lecture (page 73)	Distributed loads
4	Lecture (Chapter 3)	Nonconcurrent force
4	Lab	SolidWorks
5	Lecture (Chapter 4)	Structures
5	Lecture	Machines
5	Lab	SolidWorks
6	Lecture	Friction
6	Lecture	Friction
6	Lab	<b>Mid-Term 1</b>
7	Lecture	Spatial force
7	Lecture	Center of gravity
7	Lab	Friction
8	Lecture	Center of gravity
8	Lecture	Moments of inertia
8	Lab	Ansys
9	Lecture	Stress and strain
9	Lecture	Shear and bending moment in beams (3)
9	Lab	West Point Bridge

	<b>Spring break</b>	<b>No class</b>
10	Lecture	Stress/strain
10	Lecture	Materials
10	Lab	Stress/strain
11	Lecture	Torsion
11	Lecture	Shear force in beams
11	Lab	<b>Mid-term 2</b>
12	Lecture	Stress in beam
12	Lecture	Designing of beams
12	Lab	Ansys
13	Lecture	Deflection of beams
13	Lecture	Deflection of beams
13	Lab	Ansys
14	Lecture	Strain gauges
14	Lecture	Strain gauges
14	Lab	Strain gauges
15	Lecture	Columns
15	Lecture	Columns
15	Lab	Strain gauges
16		<b>FINAL</b>

### **Course Policies:**

Attendance not required but insight into exams are provided during lectures. Labs are required.

Absence from Exams: Make up exams will be provided and administered during off-hours by myself or a TA, provided that the absence is excusable.

Absence from Labs: Every 5 unexcused absences will result in a deduction of 5% from your final grade percentage. For example, if you have 5 to 9 absences, you will lose 5% off your final grade percentage; if you have 10 to 14 absences, you will lose 10%. I will contact you personally to discuss any excessive absences. Make-up work or special circumstances will be considered at my discretion, and excused absences will be dismissed.

Late Work Without permission, late homework will not be considered.

Disability Statement. Iowa State University complies with the American with Disabilities Act and Section 504 of the Rehabilitation Act. Any student who requires an accommodation under such provisions should contact me as soon as possible, with the proper documentation from the Disability Resources office. No retroactive accommodations will be provided in this class. See your academic advisor for help with obtaining documentation.

Basic Safety Rules & Concepts. The statements below apply to safe, orderly use of laboratory facilities; in all cases the instructor or lab assistant has the right to take action as they deem necessary in cases where a student's attitude and actions regarding safety is below standard.

1. Students are required to read the safety manual and pass the safety examination before performing any activities in the metals or test laboratories. All safety rules in the safety manual shall be observed.
2. Industrial quality eye protection must be worn in this laboratory. Even if not using a piece of machinery yourself, particles may fly across room without warning from unguarded machines or various processes.
3. Closed-toe shoes are to be worn in the laboratories. No sandals!
4. Long pants are to be worn in the laboratories.
5. Long sleeves, loose clothing, and long hair shall be secured to prevent them from being caught in the machinery. No ties!
6. Additional safety gear – i.e., gloves, aprons, hoods – shall be worn as prescribed by the instructor or project manuals.
7. Students not properly prepared per rules 1 through 6 shall be asked to correct the situation immediately. This may include being asked to leave the class to obtain proper clothing or safety gear.

Industrial Eye Protection. The department requires ALL persons working in the laboratories to provide themselves with industrial quality eye protection. These must be worn whenever you are in any laboratory of this course, even if you are not operating or watching a machine.

Student Requirements (Summary)

- Textbook
- Printout of lecture notes before each class
- Safety glasses (if you want your own style)
- Work clothes, coveralls, or street clothes with long pants, no loose sleeves
- Boots or closed-toed shoes (no sandals)
- Calculator (for lab and exams)