THE UNIVERSITY OF IOWA

Course Pack for Statics

Engineering Fundamentals I – ENGR 2110

Professor Wilfrid Nixon

5/20/2013

Course Syllabus for Engineering Fundamentals I: Statics 59:007//ENGR2110

For the CIMBA Italy Offering, May-June2013

Instructor Contact Information:

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Office hours and location to be determined

General Outline

3 semester hours

Course description: Vector and scalar treatment of coplanar and non-coplanar force systems; resultants of forces, couples, and moments; two- and three-dimensional equilibrium of a particle and of rigid bodies; applications to simple trusses, frames, machines, cables, and arches; distributed loading; principles of friction; internal forces, shear and bending moment diagrams; centroids, centers of gravity, and moments of inertia; virtual work.

Course Goals:

Students who successfully complete this course will be able to:

- Express forces, relative locations, and moments or couples as vector quantities in Cartesian reference frames;
- Determine resultant forces and moments for general force-couple systems, and find equivalent force-couple systems;
- Construct suitable mechanical models for simple engineering structures (including simple trusses, frames, machines, cable supported structures and arches) in equilibrium, and the individual component elements of each structure;
- Draw a proper free-body diagram for each element of the system model, and write the corresponding equations of equilibrium;
- Write appropriate kinematic auxiliary conditions, and eliminate extraneous kinematic unknowns from the equations of equilibrium;
- Solve systems of simplified equilibrium equations for unknown kinematic and/or kinetic quantities;
- Locate fictitious “centers” of discrete and continuous scalar distributions, such as centers of length, area, volume, charge, mass, parallel discrete forces, and parallel continuous force distributions;
- Determine area moments of inertia for simple geometrical figures, and for complex figures composed of a number of simple geometric shapes, using the parallel-axis theorem;
- Analyze equilibrium states of mechanical systems in the presence of dry (Coulomb) friction;

- Calculate and draft shear and bending moment diagrams for statically determinate beams under simple loading;
- Apply the principles of virtual work to calculate forces and moments in statically determinate machines; and
- Solve typical statics problems on the Fundamentals of Engineering (FE) examination.

Course Texts:

Meriam, J.L. and Kraige, L.G, Engineering Mechanics - Statics, 7th Ed., Wiley, 2011. (Note: an electronic version of this text may be used rather than a paper version).

Attendance, Assignments and Examinations

Attendance at all classes and CIMBA sanctioned activities is MANDATORY. All unexcused absences will have the following consequences:

a. 1st absence will result in a loss of a 1/2 of a letter grade in that class
b. 2nd (cumulative) absence will result in a loss of an entire letter grade in that class
c. 3rd (cumulative) absence will result in a dismissal from the program

Absences due to illness require a note from the CIMBA Office Staff. If a student is sick and cannot attend class, he/she must inform the CIMBA Staff immediately. Failure to do so will result in an unexcused absence.

Three types of assignments will be given: homework, in-class problems, and in-class tests.

- Homework will be assigned daily and must be done by each student individually (see below for misconduct policy).
- Students will work in-class problems in teams during regular class time. These problems will be graded. Obviously, collaboration between team members is required for this type of assignment!
- There will be in-class tests once each week to determine student progress. These test problems must be done by each student individually.

No exams, quizzes or other tests are scheduled outside of class time.

Grading Procedures

The class will be graded using letter grades, with +/- modifications to the grades. The following table indicates the grades and the percentages (rounded to 0.1%) associated with each grade.

To Get this grade	Get more than this percentage
A+	96.7
A	93.3
A-	90.0
B+	86.7
B	83.3
B-	80.0
C+	76.7

C	73.3
C-	70.0
D+	66.7
D	63.3
D-	60.0

Any percentage of 60.0 or below will receive a grade of F.

As noted above, there are three types of assignments in the class: homework, in-class problems, and in-class tests. The following is the assigned percentages of the final grade to each of these assignment types:

- Homework – 30%
- In-Class Problems (teamwork) – 30%
- In-Class Tests (individual work) – 40%

Accommodating Students with Disabilities/Academic Accommodations

PLEASE NOTE: If you have a disability that may require some modification of seating, testing, or any other class requirement, please let me know as soon as possible so that appropriate arrangements can be made. Similarly if you have any emergency medical information about which I should know, or if you need special arrangements in the event the building must be evacuated, please let me know. Please see me after class hours or during my scheduled office hours or schedule an appointment. I would also remind you that the Office of Student Disability Services is available to assist you.

Student Misconduct:

- The University of Iowa College of Engineering Policy on Student Misconduct will be strictly followed. This policy can be accessed here: http://www.engineering.uiowa.edu/ess/current-students/academic-policies-standards/academic-misconduct
- Cheating on an in-class test is an **automatic** course grade of **F** for **all** students involved.
- Homework copying is a **zero** and a reprimand the first time, and a **zero** grade on **all** homework the second time for **all** students involved.

Other University Policies

The College of Engineering and the University of Iowa are committed to providing students with an environment free from sexual harassment. If you feel that you are being or have been harassed or you are not sure what constitutes sexual harassment, we encourage you to visit the University website, http://www.sexualharassment.uiowa.edu/index.php, and to seek assistance from department chairs, the dean's office, or the University's Office of the Ombudsperson (ombudsperson@uiowa.edu). Student concerns regarding this course should first be discussed with me, the faculty member teaching this course. If we can't resolve the complaint, you may contact the Associate Dean of the College of Engineering for Academic Programs, Keri Hornbuckle, at 319-335-6086, or by email at keri-hornbuckle@uiowa.edu

Tentative Class Schedule:

This schedule is based on four regular length class sessions each week (90 minutes in length) and one long class session each week (3 hours in length). Since the long session will be on a different day each week depending on the class rotation selected (A, B, or C) this schedule simply assumes six ninety minute sessions each week.

Week #	Session #	Topic
1	1	Introduction, General Principles, Vectors
1	2	Two- and three-dimensional equilibrium of a particle
1	3	Moments and Force-Couple Systems
1	4	Distributed Force Systems and Rigid Body Equilibrium
1	5	Equilibrium of a body in two- and three-dimensional systems
1	6	In-Class Test
2	1	Forces in Trusses – zero force members and method of joints
2	2	Forces in Trusses – method of sections and space trusses
2	3	Forces in frames and Machines
2	4	Forces in cables
2	5	Forces in Arches
2	6	In-Class Test
3	1	Frictional Forces and types of friction problems
3	2	Impending Motion and other friction problems (screws etc.)
3	3	Center of Gravity (and other “centers”) by Integration
3	4	Center of Gravity by Composite Section
3	5	Moments of Inertia by Integration
3	6	In-Class Test
4	1	Moments of Inertia by Composite Bodies and Mass Moment of Inertia
4	2	Internal forces and moments in beams
4	3	Shear Force and Bending Moment Diagrams
4	4	The Principle of Virtual Work
4	5	Application of Virtual Work
4	6	Application of Virtual Work
4	Final	In-Class Test

Week 1: Basic Equilibrium

Remember we are Block C!
Class 1: Tuesday May 21, 9:35 – 11:05 a.m.
Introduction, General Principles, Vectors pp. 3-73

- Why are the right units important?
  - http://en.wikipedia.org/wiki/Mars_Climate_Orbiter
  - http://www.washingtonpost.com/wp-srv/national/longterm/space/stories/orbiter100199.htm
  - http://www.cnn.com/TECH/space/9909/30/mars.metric/
- In class problem 2/112
- Homework problem 2/103
- Review problem format
- Review calculator policy – see http://ncees.org/exams/calculator-policy/ for a list of acceptable calculators, also provided at the end of this document.

Class 2: Wednesday May 22, 9:35 – 11:05 a.m.
Two- and three-dimensional equilibrium of a particle pp. 109-171 (partial)

- In class problems 3/13; special topic in class
- Homework problem 3/62

Class 3: Thursday May 23, 9:35 – 11:05 a.m.
Moments and Force Couple Systems pp. 74-108

- In class problems 2/91; 2/162
- Homework problem 2/157 (due Friday)

Class 4: (Double session) Thursday May 23, 2:00 – 5:00 p.m.
Distributed Force Systems and 2-D Equilibrium of a Body pp. 121-144

- In class problems Special topic in class; 3/41
- Homework problem 3/40

Class 5: Friday May 24, 9:35 – 11:05 a.m.
3-D Equilibrium of a Body pp. 145-171

- In class problem 3/93
- Homework problem 3/66

Week 2: Applied Equilibrium – Trusses, Frames, Machines, Cables, Arches

Class 1: Monday May 27, 11:10 a.m. – 12:40 p.m.
Forces in Trusses – Zero Force Members and Method of Joints pp. 173-187

- In class problems 4/21; 4/26
- Homework problem 4/22

Class 2: Tuesday May 28, 11:10 a.m. – 12:40 p.m.
Method of Sections and 3-D Trusses pp. 188-203

- In class problems 4/35; 4/59
- Homework problem 4/36

Class 3: Wednesday May 29, 11:10 a.m. – 12:40 p.m.
Forces in Frames and Machines pp. 204-231

- In class problems 4/84; 4/91
- Homework problem 4/80 (due Thursday)

Class 4: (Double session) Wednesday May 29, 2:00 – 5:00 p.m.
Frames and Machines and Forces in Cables pp. 291-305

- In class problems 4/143; 5/156
- Homework problem 5/155

Class 5: Thursday May 30, 11:10 a.m. – 12:40 p.m.
Forces in Arches

- Both in-class and homework problems are special topics – not in the book.

Week 3: Friction and Centers of Gravity

Class 1: Monday June 3, 9:35 – 11:05 a.m.
Frictional Forces and Types of Friction Problems pp. 335-356

- In class problems 6/1; 6/15
- Homework problem 6/3 (Due Tuesday)

Class 2: (Double session) Monday June 3 , 2:00 – 5:00 p.m.
Impending Motion and other friction problems pp. 357-394

- In class problems 6/5; 6/32; 6/60
- Homework problem 6/66

Class 3: Tuesday June 4, 9:35 – 11:05 a.m.
Centers of Gravity by Integration pp. 233-253

- In class problems 5/13; 5/34; 5/38
- Homework problem 5/15

Class 4: Wednesday June 5, 9:35 – 11:05 a.m.
Centers of Gravity by Composite Bodies pp. 254-263

- In class problems 5/51; 5/58
- Homework problem 5/57

Class 5: Thursday June 6, 9:35 – 11:05 a.m.
Moments of Inertia by Integration pp. 441-455

- In class problems A/16; A/26
- Homework problem A/15

Week 4: Moments of Inertia, Internal Forces, Virtual Work

Class 1: Monday June 10, 8:00 – 9:30 a.m.
Moments of Inertia by Composite Bodies pp.456-463

- In class problem A/44
- Homework problem A/40

Class 2: Tuesday June 11, 8:00 – 9:30 a.m.
Internal Forces and Moments in Beams pp. 279-290

- In class problem 5/132
- Homework problem 5/126 (Due Wednesday)

Class 3: (Double session) Tuesday June 11,
Shear Force and Bending Moment Diagrams

- In class problem 5/135; 5/142
- Homework problem 5/138

Class 4: Wednesday June 12, 8:00 – 9:30 a.m.
Virtual Work pp. 397-416

- In class problems 7/6; 7/10
- Homework problem 7/1

Class 5: Thursday June 13, 8:00 – 9:30 a.m.
Virtual Work pp. 417-439

- In class problem 7/35; 7/42

Final Exam: Thursday June 13, 4:30 – 6:30 p.m.

Calculator Policy

In order to ensure exam integrity, only one of the following calculators may be used:

Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name. Examples of acceptable Casio fx-115 models include (but are not limited to):

- fx-115 MS
- fx-115 MS Plus
- fx-115 MS SR
- fx-115 ES
- fx-115 ES Plus

Hewlett Packard: The HP 33s and HP 35s models, but no others.

Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name. Examples of acceptable TI-30X and TI-36X models include (but are not limited to):

- TI-30Xa
- TI-30Xa SOLAR
- TI-30Xa SE
- TI-30XS Multiview
- TI-30X IIB
- TI-30X IIS
- TI-36X II
- TI-36X SOLAR
- TI-36X Pro