EGRM 202 – Mechanics of Deformables
Spring 2003

Time:	Location:	Instructor:	Teaching Assistant:
TR 11:00-2:15	ENGRB 401	Karla Mossi, Ph.D. Assistant Professor Mechanical Engineering Office: ENGRB 314 Office Phone: 827-5275 E-mail: kmmossi@vcu.edu Office Hours: Tuesday from 2-4 pm and Wednesday from 3-6 pm or by appointment	Leah Lovell Office: Room 316 E-mail: lovellls@mail1.vcu.edu Office Hours: Monday 1-2p.m.

Course Description: An introductory course covering the mechanics of deformable solids. Subjects include stress, strain and constitutive relations; bending of beams; torsion; shearing; deflection of beams; column buckling; fatigue; failure theory; analysis and design of bar-type members.

Text: Mechanics of Materials, 5th Edition, R. C. Hibbeler, Prentice Hall, 2003.

Prerequisites:

ENGR 102 Engineering Statics
MATH 200 Calculus with Analytic Geometry I
MATH 201 Calculus with Analytic Geometry II

Students must make a "C" or better in ENGR 102 and must pass both MATH 200 and MATH 201 in order to register for EGRM 202. Students not meeting these requirements will be dropped from the course.

Online Course Info: Blackboard will be used for posting grades, announcements and other material. Students can access Blackboard at http://blackboard.vcu.edu/. Announcements may be made via e-mail. Students must use a VCU e-mail address and should check their e-mail frequently.

Reading Assignments: Assignments are listed on the schedule at the end of this document. For example, prior to coming to the Thursday January 16th class, you should have read Chapter 1 Sections 1.1-1.6.
Students should not underestimate the amount of time that must be dedicated to this course in order to meet more than the minimum requirements. Significant time outside of class is necessary to fulfill the reading assignments and solve homework problems.

Course Content: The field of mechanics deals with the way different types of media (solids and fluids) respond to external stimuli (forces). Statics is the foundation course from which branch off the rest of the mechanics courses (dynamics, mechanics of deformables, fluid mechanics). This course presents a study of stress (a measure of internal force intensity) and strain (a relative measure of deformation) in deformable solids with applications primarily to linear elastic materials. It introduces basic

concepts regarding internal forces, deformations, and the relationships between them. These theories are applied to structural components.

Topics include:

- definition of normal and shear stress,
- definition of normal and shear strain,
- relations between stress and strain for brittle and ductile materials, Hooke's law,

- analysis of bars subjected axial load and shafts subjected torsion,
- bending of beams - stresses and deflections, transverse shear in beams, combined loadings, stress and strain transformations,
- column buckling.

Course Objectives: By the end of this course, students should:

- Develop of an intuitive understanding of stress and strain
- Develop an understanding of how to analyze the load carrying capacity and deformation of structural members
- Develop a strong set of modeling and problem solving skills.

Specifically, students are expected to learn how to:

1) model a stated problem (FBDs, etc.),
2) know and be able to utilize the applicable theory,
3) properly transfer appropriate information from a model into theory and carry out the necessary operations,
4) utilize proper boundary conditions as necessary, and
5) obtain a correct solution.

Grading Policy: Students will be assessed and evaluated on the following:

3 Exams @ 15% each	45%
Final Exam	20%
Quizzes	15%
Homework	15%
Class participation /Attendance	5%
	100%

One objective of this course is to prepare future mechanical and biomedical engineers, a profession where punctuality and integrity are key characteristics. Therefore, students are expected to meet all deadlines and arrive to class on time.

Exams: Three exams plus a comprehensive final exam will be given. Most exam problems must be solved WITHOUT the use of the textbook or notes. Partial credit will be

given for most problems, but only if all work is shown. Make-up exams will NOT be given.

In keeping with the class objectives, exam problems will not be simple variations of homework problems, rather students will need to understand the basic principles and apply them in various ways. Students should expect different sorts of problems on exams; problems will not mimic the homework assignments. The goal of the exams is to evaluate the student's basic understanding of the subject and test her/his problem solving abilities-***the ability to resolve new problems***. Do you really understand? Or do you just "pattern-match" solutions from those you've seen before?

Quizzes: At least two unannounced quizzes will be given during lecture sessions. Quizzes may include problems and brief questions about the assigned reading. Quiz grades will not be dropped.

Homework: Students will usually have one week to complete homework assignments. Cooperation in solving homework problems is allowed and encouraged; however, copying homework is not permitted and may result in a failing grade for the course. All homework problems will count equally, and partial credit may or may NOT be given. Assignments will be collected at the BEGINNING of class on the prescribed due date.

LATE ASSIGNMENTS WILL NOT BE ACCEPTED.

One aspect of being an engineer is being able to effectively communicate one's work to others. Therefore, the following standards apply to all student work that is being evaluated (sample attached):

1. Problems should be clearly and neatly worked out in full.
2. Complete on engineering graph paper with name of student, section number, and problem number on each page.
3. All sheets must be numbered and stapled together.
4. Use only one side of the paper.
5. Start each new problem on a separate sheet of paper.
6. The problem must be clearly and briefly stated and must include a diagram (when appropriate).
7. Sketch clear and complete free-body diagrams and/or other diagrams as needed. Drawings must be done using a straight edge, ruler, French curve etc.
8. Assumptions must be clearly stated.
9. All work must be shown and the reasoning behind each step clearly stated.
10. Analysis and mathematical equations must follow a logical procession to completion.
11. Numerical answers must have units and an appropriate number of significant figures.
12. The solution must be clearly identified with a box around it.

NO CREDIT WILL BE GIVEN FOR WORK NOT CONFORMING TO ABOVE CRITERIA.

Do NOT come to the instructor's office with homework questions if you have not read ALL of the assigned reading associated with the homework assignment. You

must make a legitimate effort to compete a homework problem before coming to the instructor's office.

Partial Credit: As homework problems become more intricate, opportunities for errors increase. Thus, partial credit will be awarded to recognize that some portion of the work is correct. However, partial credit grading is only practical if the work is clearly developed, with clear and well-marked diagrams (Free-Body Diagrams), with the appropriate equations prominently displayed, where the substitutions into the equations are quite clear, and the assumptions used are obvious to the grader. That is, it is the student's responsibility to present her/his work so clearly that the grader can quickly ascertain the location and nature of the error(s) and can follow the subsequent work through. If this is not clear on the work submitted, credit cannot be given (then or later). ***Partial credit is assigned at the discretion of the grader.*** It is therefore always in your best interest to practice clarity and completeness in your solutions when working homework problems. This is applicable to exam problems as well. The student must therefore lead the grader through her/his thought process on the exam page.

Attendance: Students are expected to attend class. Lack of regular class attendance, for any reason, will be detrimental to a student's final grade.

Tips for Success: 1. Participate! Attend all classes and ask questions. ***Use the instructor's office hours***. Communicate in advance any problems you may have with homework, quizzes, exams and attendance.

2. Do not fall behind! Complete all homework problems as they are assigned. Keep current with textbook reading assignments. Review class notes. If you do not, your understanding of new material will suffer and you will probably not be able to catch up for the tests. Seek help from classmates only after exhausting your own mental resources for solving a problem. Simply using the solutions of others does not develop the necessary thinking skills for success in this course.

3. Solve the example problems from the book. Due to limited class time and numerous topics, we may not be able to solve many types of problems. The best way to understand the course material is to practice by solving problems on your own!

4. Solve extra problems from the textbook and other sources as part of your preparation for tests. It will enable you to set up a wider variety of problems than those listed for homework. Usually, the ability to set up the solution to a problem is the key to success.

5. Expect to see different sorts of problems on exams. The instructor is interested in evaluating your ability to solve many types of problems, not just the ones that were assigned for homework. This ability comes easily to those who understand the basics. Those who don't set up their own solutions or copy the solutions of others typically perform below their expectations on tests because they have not developed the necessary problem recognition and solving skills that they would have developed if they had solved the problems unaided.

6. Devote appropriate time to studying notes and solving practice problems (rule of thumb: at least three hours of homework/study time for each hour of class).

Disabilities:

Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 require Virginia Commonwealth University to provide academic adjustments or accommodations for students with documented disabilities. Students seeking academic adjustments or accommodations must self-identify with the Coordinator of Services for Students with Disabilities on the appropriate campus. After meeting with the Coordinator, students are encouraged to meet with their instructors to discuss their needs and, if applicable, any laboratory safety concerns related to their disabilities. The instructor can ONLY provide accommodation upon presentation of an official memorandum from the Coordinator. Isolated areas, for those who require it, will be provided. Students who require exam modifications using auxiliary services or aids such as readers, proctors or scribes should make arrangements for those modifications through the Office of Services for Students with Disabilities. A minimum of 72 hours of advanced notice to this office is required.

Services for Students with Disabilities:
http://www.vcu.edu/safweb/rg/rglaccess.html

Access VCU: A handbook for Students with Disabilities at:
http://www.vcu.edu/provost/eeoaa/pubs/stuada.htmll

Academic Integrity:

Virginia Commonwealth University recognizes that honesty, truth, and integrity are values central to its mission as an institution of higher education. As such, academic dishonesty will be dealt with seriously. Any student found to have cheated on a quiz, test, laboratory assignment or examination will be referred to the Honor System Coordinator and the Office of the Dean and Associate Vice Provost for Student Affairs for disciplinary action. Students are cautioned that the academic and disciplinary sanctions for academic dishonesty can be quite severe.

The Honor System document (Rev. Fall 2002) is available in the Resource Guide and on the VCU Web at http://www.students.vcu.edu/rg/policies/rg7honor.html.

EGRM 202-001 Course Schedule
Spring 2003

DATE	CONTENT	READING
Jan 14	Introduction to the course. Review of terms	
Jan 16	Review of Statics and Stress	1.1-1.6
Jan 21	Shear Stress and Deformation	1.7, 2.1
Jan 23	Shear and Normal Strain	2.1, 2.2
Jan 28	Mechanical Properties of Materials Stress-Strain and Hooke's Law	3.1, 3.2
Jan 30	Poisson's Ratio and Shear Stress-Strain	3.3-3.8
Feb 4	Axial Load: Elastic Deformation	4.1, 4.2
Feb 6	Axial Loading: Superposition	4.3-4.5
Feb 11	Thermal stresses Stress concentrations and Review	4.6, 4.7
Feb 13	Exam No. 1	Ch 1 thru 4
Feb 18	Torsional Deformation; Power Transmission	5.1-5. 3
Feb 20	Twist; Statically Indeterminate Torsion	5.4, 5.5, 5.8
Feb 25	Bending: Shear and Moment Diagrams	6.1
Feb 27	Graphical Methods	6.2
	Dr. Mossi is out of town from March 2-7	
March 4	Bending Deformations. Flexure Formula	6.3-6.5, 6-9
March 6	Transverse Shear	7.1, 7.2
	Spring Break. March 8 - 16	
March 18	Shear Stresses in Beams	7.3; 7.4
March 20	Beam Design:	11.1, 11.2
March 21	Last Day to Withdraw	
March 25	Review	
March 27	Exam No. 2	Ch 5, 6, 7, 11
April 1	Combined Loadings	8.1; 8.2
April 3	Plain Stress	9.1; 9.2
April 8	Mohr's Circle	9.3; 9.4
April 10	Stress in Shafts	9.5
April 15	Material-Property Relationships- Review	10.6
April 17	Exam No. 3	Ch 8, 9, 10
April 22	Deflection of Beams	12.1- 12.3
April 24	Buckling of Columns	13.1-13.3
April 29	Review	
May 6th, Tuesday	Final Exam	Ch 1 thru 13

.