COURSE SYLLABUS

71957 ENGR M16 - Engineering Statics & Strength of Materials, 4.0 Units
Prerequisites: PHYS M20A/M20AL
Class Time: T & Th 8:00 AM - 9:50 AM; **Classroom:** PS 203

INSTRUCTOR & DEPARTMENT INFORMATION

Instructor: Scarlet Relle, Ph.D.
Office: PS-235
Office Hours: **M** 11-1 & 3-4; **T** 10-11; **W** 10-11; **Th** 10-12
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Chair: Prof. Ronald Wallingford ; Office PS-236
Dean: Julius Sokenu, Ed. D. ; Office AC-232
Phone: (805) 378-1572

COURSE OVERVIEW

This course examines the relationships which exist between two important branches of mechanics, namely, statics and strength of materials. Principles of statics are used to determine the forces that act both on and within a body, whereas principles of strength are used to investigate the effect of these forces on the stability and deformation of the body. In particular, principles of statics are used for analysis of two- and three-dimensional force systems in equilibrium, including frictional forces, trusses, beams, distributed forces, shear and bending moment diagrams, center of gravity, centroids, and area moments of inertia. Principles of strength are used for analysis of stresses, strains and deformations associated with axial, torsional and flexural loading of bars, shafts and beams, as well as pressure loading of thin-walled pressure vessels. The course also covers stress and strain transformation, Mohr's Circle, statically indeterminate systems, ductile and brittle failure theories, and the buckling of columns.

COURSE OBJECTIVES

Upon completion of the course student should be able to:

1. Demonstrate ability to mathematically manipulate vector quantities.
2. Apply appropriate knowledge of mathematics and physics to calculate and manipulate resultant force and moment of a force about a point or an axis in a vector form.
3. Apply appropriate engineering problem solving techniques, including free body diagrams and identification of applicable laws of physics, shear and bending moment diagrams to problems that do not result in rigid body motion including static equilibrium, frictional forces, and statically indeterminate systems.
4. Use the geometric properties of bodies such as center of gravity, centroid, and area moment of inertia appropriately to calculate resultant forces and internal loadings.
5. Discuss and calculate mechanical properties related to stress-strain diagrams, including Mohr's circle, for commonly used engineering materials.

INSTRUCTIONAL MATERIALS

Textbook: R.C. Hibbeler, Statics and Mechanics of Materials, Third Edition, 2011, Pearson.
Handouts: Occasionally, handouts and other reference material will be provided to aid your understanding of the subject matter.
Lecture Notes and Lecture Slides: Summary lecture notes of the topics and concepts to be covered during each class session and accompanying lecture slides will be provided. These are to serve as study guides and to help you stay organized.

EVALUATION & GRADING POLICY

The following rubric will be used in determining your final grade in this course:

Homework	(15%)
Quizzes	(20%)
Exams/ Design Project	(30%)
Final Exam	(35%)

A: (90-100%) **B**: (80-89%) **C**: (70-79%) **D**: (60 - 69%) **F**: (below 59%)

HOMEWORK ASSIGNMENTS

Homework will be assigned each week and the solutions will be made available the day the homework is due. Homework assignments will be collected and graded for thoroughness and completeness. You are STRONGLY ENCOURAGED AND EXPECTED to complete your homework assignments as this is the best way to learn the material! The assigned problem sets are only a representative set of the type of problems that you should know how to solve. Therefore, it is STRONGLY RECOMMENDED that you attempt to solve other problems of similar nature. As this course has a tight timeline, and since solutions to the homework problems will be made available immediately after their due date, late homework will not be accepted.

QUIZZES

Solutions to quizzes will be made available. For take home quizzes late work will not be accepted. Occasionally, there may be pop-quizzes. These pop-quiz points will be counted as bonus quiz points towards your final grade. As participation in my class is mandatory, these will be for the benefit of those students who are present and are participating. As such, if you are absent, you cannot make-up a pop-quiz.

EXAMS

There will be 3 exams covering material from first, second, and third parts of the course. You will have the entire class period to complete each exam (unless noted otherwise). The final exam will cover selected topics from the entire course, and you will have 2 hours to complete the final exam. All exams will consist of problem sets, and perhaps some short answers and multiple-choice questions. Bring your own scientific calculator to class as you may not share calculators during exams. Please note that programmable or graphing calculators are not allowed in class during exams. I will provide you with a study guide prior to each exam.

DESIGN PROJECT

As engineers often work in teams, in groups of 2 or 3 students will design, analyze, and build a truss-bridge according to a set of specifications provided by the professor. The construction of the bridge will be entirely out of Popsicle sticks and non-toxic, all-purpose white glue, not exceeding 100 Popsicle sticks. The strength of the bridge will be tested by loading the bridge deck with weights until the point of failure as defined in the rules. A written report, complete force analysis of each member of the truss, building of a prototype bridge, and failure analysis of

the bridge (discussing reasons for failure) will all be requirements of this project. Information on due dates, design criteria, and grading will be provided by the professor.

ADDITIONAL POLICIES

PARTICIPATION

Participation in my class is mandatory. I expect you to come to class prepared, ready to learn and to participate. You must bring with you to class your textbook, a notebook to take additional notes during class discussions, a scientific calculator, and a binder or folder to keep all your papers and handouts organized. I will keep track of your attendance, preparedness, and participation.

USE OF LISTENING, VIDEO, OR OTHER RECORDING DEVICES

I do not permit the use of any electronic listening or recording devices by anyone in my classroom. If you need to use a recording device as an authorized disability accommodation, then you must provide me with verification from ACCESS prior to the use of the device.

USE OF LAPTOP COMPUTERS

You may use laptop computers in the classroom only for note taking purposes. You may not surf the web, play games, or engage in any activity which I would consider disruptive to your learning process.

USE OF CELLPHONES

You may not use your cell phone during class, it must be turned off! Also, you may not use your cell phone in lieu of a scientific calculator.

STUDENT RESPONSIBILITY

You, as the student, are responsible for **all** material presented in class and in assignments. Make-up exams will be given **only** in case of verified illness or exceptional circumstances. You must contact me in a timely manner to schedule a make-up exam.

DISABILITIES ACCOMODATION

Appropriate accommodations will be made for students with disability related needs. Students with a disability, whether physical, learning, or psychological, who believe they will need accommodations in this class, are encouraged to contact ACCESS as soon as possible so accommodations can be set up in a timely fashion. Accommodations are based on eligibility and can only be provided if you have submitted verification from ACCESS in the form of a Confidential Memo. The ACCESS office can be reached at (805) 378-1461 and is newly located in the LMC.

ACADEMIC INTEGRITY

Academic integrity and honesty is of utmost importance. Cheating of any kind will not be tolerated in this course. Cheating includes turning in someone else's work as your own, copying from someone else's paper, using "cheat sheets", class notes, the textbook, unauthorized technology, programmable or graphing calculators, or sharing calculators during exams and in-class quizzes. Cheating will result in a letter grade of "F" equivalent to zero points for that particular assignment/quiz/test, and any previous assignments will be called into question. In addition, a report will be made to the Behavior Intervention Team.

NO SMOKING POLICY

In the interest of the health and welfare of students, employees, and the public, smoking is not permitted on the Moorpark College campus other than in the parking lot.

IMPORTANT DATES

August 30th: Last day to drop with full refund or credit (All students/Fall semester only)
September 6th: Last day to drop a semester-length class without a "W"
November 22nd: Last day to drop a semester-length class with a "W"

CLASS SCHEDULE

DATE	TEXT	TOPICS	QUIZ (DATES MAY CHANGE)	EXAM
8/20	Chapter 1 General Principles	Introduction Fundamental concepts; units of measurements; SI units; numerical calculations; analysis proc.		
8/22	Chapter 2 Force Vectors 2.1 – 2.6	Scalars and vectors; vector operations; vector addition; Cartesian vectors; addition of Cartesian vectors		
8/27	Chapter 2 Force Vectors 2.7 – 2.9	Position vectors; force vector; dot product	Q1 Take home Ch. 1 & Ch. 2	
8/29	Chapter 3 Force System Resultants 3.1 – 3.4	Moment of a force-scalar/vector; cross-product; principle of moments		
9/3	Chapter 3 Force System Resultants 3.5 – 3.8	Moment of a force about an axis; moment of a couple; simplification of a moment and couple system		
9/5	Chapter 4 Equilibrium of a Rigid Body 4.1 – 4.6	Conditions for equilibrium; FBD; equations of equilibrium 2-D and 3-D	Q2 In class Ch. 3	
9/10	Chapter 4 Equilibrium of a Rigid Body 4.7 – 4.10	Characteristics of dry friction; problems involving dry friction; frictional forces on flat belts and screws		
9/12	Chapter 4 Equilibrium of a Rigid Body	In-class problem solving	Q3 In class Ch. 4	
9/17	Chapter 5 Structural Analysis	Trusses; method of joints; zero-force members		
9/19	Chapter 5 Structural Analysis	Method of sections; frames and machines	Q4 Take home Ch. 5	

9/24	Chapter 6 Center of Gravity, Centroid, and Moment of Inertia 6.1-6.2	Center of gravity, center of mass, centroid; composite bodies		
9/26	No lecture Only exam day			**Exam I** Ch. 1,2,3,4,5
10/1	Chapter 6 Center of Gravity, Centroid, and Moment of Inertia 6.3-6.6	Resultant of distributed loading; moments of inertia for areas; parallel-axis theorem; moments of inertia for composite areas	Q5 Take home Ch. 6	
10/3	Chapter 7 Stress and Strain 7.1 – 7.4	Internal resultant loadings; stress; average normal stress		
10/8	Chapter 7 Stress and Strain 7.5 – 7.9	Average shear stress; allowable stress; design of simple connections; deformations; strain	Q6 Take home Ch. 7	
10/10	Chapter 8 Mechanical Properties of Materials 8.1 – 8.4	Tension and compression test; stress-strain diagram; stress-strain behavior of ductile and brittle materials; Hooke's law		
10/15	Chapter 8 Mechanical Properties of Materials 8.5 – 8.7	Strain energy; Poisson's ratio; shear stress-strain diagram	Q7 Take home Ch. 8	
10/17	Chapter 14 Stress and Strain Transformation 14.1 – 14.4	Plane-stress transformation and equations; principal stresses and maximum in-plane shear stress; Mohr's circle plane stress		
10/22	Chapter 14 Stress and Strain Transformation 14.5 – 14.10	Absolute maximum shear stress; plane strain; equations of plane strain; strain rosettes; material-property relationships	Q8 Take home Ch. 14	
10/24	Chapter 9 Axial Load 9.1 – 9.2	Saint-Venant's Principle; elastic deformation of an axially loaded member		
10/29	No lecture Only exam day			**Exam II** Ch. 6,7,8,14

10/31	Chapter 9 Axial Load 9.3 – 9.6	Principal of superposition; statically indeterminate axially loaded member; the force method of analysis; thermal stress		
11/5	Chapter 10 Torsion 10.1 – 10.4	Torsional deformation of a circular shaft; torsion formula; power transmission; angle of twist	Q9 In class Ch. 9	
11/7	Chapter 11 Bending 11.1 – 11.2	Shear and moment diagrams and graphical methods		
11/12	Chapter 11 Bending 11.3 – 11.4	bending deformation of a straight member; flexure formula	Q10 Take home Ch. 11	
11/14	Chapter 12 Transverse Shear 12.1 – 12.3	Shear in straight members; shear formula; shear flow in built-up members		
11/19	Chapter 13 Combined Loadings 13.1 – 13.2	Thin-walled pressure vessels; state of stress caused by combined loadings	Q11 In class Ch. 12	
11/21	Chapter 15 Design of Beams and Shafts 15.1 – 15.2	Basis for beam design; prismatic beam design; In-class problem solving		
11/26	No lecture Only exam day			**Exam III** Ch.9,10, 11,12,13
11/28	**Thanksgiving Holiday – No Class**			
12/3	Chapter 16 Deflection of Beams and Shafts 16.1 – 16.2	The elastic curve; slope and displacement by integration	Q12 In-class Ch.15	
12/5	Chapter 16 Deflection of Beams and Shafts 16.4 – 16.5	Method of superposition; statically indeterminate beams and shafts- method of superposition		
12/10	Chapter 17 Buckling of Columns 17.1 – 17.3	Critical load; ideal column with pin supports; columns having various types of supports	Q13 Take home Ch.16&17	Bridge is Due
12/17 T	**Final Exam – Cumulative Selected topics from the entire book 8:00 – 10:00 AM**			

The instructor reserves the right to change class policies and class schedule if necessary.