Reedley College

CREDIT COURSE OUTLINE

I. COVER PAGE

(1) ENGR 8	(2) STATICS	(3) 3
Number	Title	Units

(4)	Lecture / Lab Hours:			
	Total Course Hours			
		Total Lec hours:		54.00
		Total Lab hours:		0
		Total Contact hours:		54.00
	Lec will generate 0 hour(s) outside work.			
	Lab will generate 0 hour(s) outside work.			
(5)	Grading Basis:	Grading Scale Only		
		Pass/No Pass option		X
		Pass/No Pass only		
(6)	Advisories: Eligibility for English 126 Eligibility for English 125			
(7)	Pre-requisites(requires C grade or better): PHYS 4A			
	Corequisites: MATH 6			

(8)Classification:			
		Degree applicable:	X
		Non-degree applicable:	
		Basic skills:	
(9)RC	Fulfills AS/AA degree requirement: (area)		
	General education category:		
	Major:	ENGINEERING	
	Certificate of:		
	Certificate in:		
(10)CSU		Baccalaureate:	X
(11)Repeatable: (A course may be repeated three times)			0

(12) Catalog Description:
The study of rigid bodies in static equilibrium when acted upon by forces and couples in two- and three-dimensional space. Includes equilibrium of rigid bodies, trusses, frames and machines, as well as the calculation of centers of mass, centroids, friction, moments of inertia, and shear and bending moment diagrams.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

I. Solve mechanical equilibrium problems involving the equilibrium of particles and rigid bodies using both graphical and vector calculus techniques.
II. Solve mechanical equilibrium application problems for trusses, frames, and machines.
III. Calculate shear, normal forces, and bending moment for loaded beam problems and produce shear and bending moment diagrams.
IV. Solve friction application problems.
V. Determine centroid, center of mass, and center of gravity for various objects and geometric shapes.
VI. Determine moment of inertia and mass moment of inertia for various objects and geometric shapes.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

I. Understand the vector operations of addition, subtraction, dot product, and cross product and use them in applications.
II. Draw the free body diagram of an object subjected to external forces and couples.
III. Apply the principles of mechanical equilibrium to solve problems involving a force system acting on a point mass.
IV. Define and use the concepts of moment, couple, and resultant as they apply to static equilibrium problems.
V. Apply the principles of mechanical equilibrium to solve problems involving forces and couples acting on a theoretical rigid body.
VI. Learn the analytical techniques appropriate for objects subjected to distributed forces.
VII. Solve truss, frame, and machine application problems, using the principles of mechanical equilibrium.
VIII. Define and use the concepts of shear force, normal force, and bending moment in the solution of internal force problems.
IX. Generate shear and bending moment equations and draw shear and bending moment diagrams for a loaded beam.
X. Solve different classes of dry friction problems.

XI. Apply the theory of dry friction to application problems.
XII. Define and calculate centroid, center of mass, and center of gravity for various 1-D, 2-D, 3-D, and composite bodies.
XIII. Define and calculate moment of inertia and mass moment of inertia for various 1-D, 2-D, 3-D, and composite bodies.

IV. COURSE OUTLINE:

Lecture Content:

I. Introduction: Fundamental physical quantities and units of measure in engineering mechanics; Newton's Laws of Motion.
II. Force Vectors
    1. Scalar and vector quantities
    2. Vector addition and subtraction using graphical and Cartesian techniques
    3. Position vectors
    4. Dot product and applications
III. Equilibrium of a particle
    1. Conditions of equilibrium
    2. Free body diagrams
    3. Two-dimensional particle equilibrium problems
    4. Three-dimensional particle equilibrium problems
IV. Moments and Resultants
    1. Vector cross product
    2. Moment of a force about a point
    3. Principle of moments
    4. Moment of a force about an axis
    5. Couples
    6. Equivalent systems
    7. Resultant of a force-couple system
    8. Wrenches
    9. Distributed force loading
V. Equilibrium of a Rigid Body
    1. Conditions of equilibrium
    2. Types of supports
    3. Free Body Diagrams
    4. Two-dimensional rigid body equilibrium problems
    5. Three-dimensional rigid body equilibrium problems
VI. Trusses, Frames and Machines
    1. Two-dimensional trusses
    2. Method of joints
    3. Zero-force members
    4. Method of sections
    5. Space trusses
    6. Frames
    7. Machines
VII. Internal Forces
    1. Shear, bending moment, and normal force calculations
    2. Shear and bending moment equations and diagrams
    3. Relationship between distributed load, shear, and moment
VIII. Friction
    1. Dry friction
    2. Solving dry friction problems
    3. Application to wedges, screws, and bearings
IX. Centroid, Center of Mass, Center of Gravity
    1. Centroid, center of mass, center of gravity for two-dimensional bodies
    2. Centroid, center of mass, center of gravity for three-dimensional bodies
    3. Centroid, center of mass, center of gravity for one-dimensional bodies
    4. Centroid, center of mass, center of gravity for composite bodies
X. Moments of Inertia
    1. Moment of inertia for areas
    2. Parallel Axis Theorem
    3. Mass moment of inertia

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

I. Sample Text Title:
    1. Recommended - Hibbeler *Engineering Mechanics, Statics,* ed. 12 Prentice Hall, 2010,

II. Other Readings

___ Global or international materials or concepts are appropriately included in this course
___ Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing Check either 1 or 2 below			
X	***1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.***		
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.		
	a) essay exam(s)		d) written homework
	b) term or other paper(s)		e) reading reports
	c) laboratory report(s)	X	f) other (specify)

Required assignments may include but are not limited to the following:
Formal report describing the design, analysis, and testing of a structure.

B. Problem Solving Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)		d) laboratory reports
	b) quizzes		e) field work
X	c) homework problems	X	f) other (specify):

Required assignments may include but are not limited to the following:
1. Computational problems are assigned throughout the course. Occasionally, design problems are also assigned.
2. Exams are computational and problem solving in nature.

C. Skill demonstrations, including:			
X	a) class performance(s)		c) performance exams(s)
	b) field work		d) other (specify)

Required assignments may include but are not limited to the following:
Demonstration of design project performance

D. Objective examinations including:			
	a) multiple choice		d) completion
	b) true/false		e) other (specify):
	c) matching items		

COURSE GRADE DETERMINATION:
Description/Explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.
80% Exams 10% Homework 10% Project

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met YES	NO
Textbook	X	
Reference materials		X
Instructor-prepared materials		X
Audio-visual materials		X

Indicate Method of evaluation:
Used readability formulae (grade level 10 or higher) ____

Text is used in a college-level course	X	
Used grading provided by publisher		
Other: (please explain; relate to Skills Levels)		

Computation Level (Eligible for MATH 101 level or higher where applicable)	X	
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course	X	
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.	X	
Requires independent thought and study	X	
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	X	

List of Reading/Educational Materials
Recommended - Hibbeler *Engineering Mechanics, Statics,* ed. 12 Prentice Hall, 2010,

Comments:

_____ This course requires special or additional library materials (list attached).
_____ This course requires special facilities:

Attached Files:

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

(eligibility for English 126) (as outcomes for English 262) __X__ Using phonetic, structural, contextual, and dictionary skills to attack and understand words. __X__ Applying word analysis skills to reading in context. __X__ Using adequate basic functional vocabulary skills. __X__ Using textbook study skills and outlining skills. __X__ Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.	1. Reading textbook descriptions of statics topics. 2. Reading descriptions of engineering problems and relating these to the topics and methods of the course. 3. Reading instructor-provided course notes.
(eligibility for English 125) (as outcomes for English 252) __X__ Writing complete English sentences and avoiding errors most of the time. __X__ Using the conventions of English writing: capitalization, punctuation, spelling, etc. __X__ Using verbs correctly in present, past, future, and present perfect tenses, and using the correct forms of common irregular verbs. __X__ Expanding and developing basic sentence structure with appropriate modification. __X__ Combining sentences using coordination, subordination, and phrases. __X__ Expressing the writer's ideas in short personal papers	1. Writing a description of the design process used in a design project. 2. Writing a summary of the calculations on a design project. 3. Writing a summary of the test results from a design project. 4. Writing a critical review of the success of a design project.

utilizing the writing process in their development.	

Check the appropriate spaces.
_____ Eligibility for Math 101 is advisory for the target course.
__X__ Eligibility for English 126 is advisory for the target course.
__X__ Eligibility for English 125 is advisory for the target course.
If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

CONTENT REVIEW	
PHYS 4A PHYSICS FOR SCIENTISTS AND ENGINEERS	
Newton's Laws	Newton's Laws of Motion are integral to statics problems
Gravity	Gravitational force is a significant force in many statics problems
Apply dimensional analysis to determine the units for an unknown quantity or to check the validity of equations.	The units of a statics solution must be arrived at by dimensional analysis.
MATH 6 MATH ANALYSIS III	
Use vector methods to solve problems in three dimensional analytic geometry.	Vector cross product is used in moment calculations. Vector dot product is used in determining force components.
Determine the extreme value(s) of a multi-dimensional function, the tangent plane to a three dimensional function, the directional derivative and gradient of a function by using partial derivatives.	Some statics problems involve maximizing or minimizing functions.
Use double and triple integrals to determine the areas and volumes bounded by curves and surfaces, determine the surface area and center of mass of a solid. Use polar, cylindrical and spherical coordinates for solving these types of problems.	Double and triple integrals can be used in determining center of mass problems.

REQUISITES	
Corequisite -- MATH 6 MATH ANALYSIS III	
• Use vector methods to solve problems in three dimensional analytic geometry. • Use double and triple integrals to determine the areas and volumes bounded by curves and surfaces, determine the surface area and center of mass of a solid. Use polar, cylindrical and spherical coordinates for solving these types of problems.	• Understand the vector operations of addition, subtraction, dot product, and cross product and use them in applications. • Draw the free body diagram of an object subjected to external forces and couples. • Apply the principles of mechanical equilibrium to solve problems involving a force system acting on a point mass. • Define and use the concepts of moment, couple, and resultant as they apply to static equilibrium problems. • Apply the principles of mechanical equilibrium to solve problems involving forces and couples acting on a theoretical rigid body. • Learn the analytical techniques appropriate for objects subjected to distributed forces. • Solve truss, frame, and machine application problems, using the principles of mechanical equilibrium. • Define and use the concepts of shear force, normal force, and bending moment in the solution of internal force problems. • Generate shear and bending moment equations and draw shear and bending moment diagrams for a loaded beam. • Solve different classes of dry friction problems. • Apply the theory of dry friction to application problems. • Define and calculate centroid, center of mass, and center of gravity for various 1-D, 2-D, 3-D, and composite bodies. • Define and calculate moment of inertia and mass moment of inertia for various 1-D, 2-D, 3-D, and composite bodies.
Subject Prerequisite -- PHYS 4A PHYSICS FOR SCIENTISTS AND ENGINEERS	

• Apply algebra, trigonometry, and first-year calculus to solve physical problems such as: • Vector quantities • Newton's Laws • Gravity • Apply dimensional analysis to determine the units for an unknown quantity or to check the validity of equations. • Correctly report the units of an observable when it is measured or calculated. • Distinguish between important physical observables, such as mass and weight or speed and velocity.	• Understand the vector operations of addition, subtraction, dot product, and cross product and use them in applications. • Draw the free body diagram of an object subjected to external forces and couples. • Apply the principles of mechanical equilibrium to solve problems involving a force system acting on a point mass. • Define and use the concepts of moment, couple, and resultant as they apply to static equilibrium problems. • Apply the principles of mechanical equilibrium to solve problems involving forces and couples acting on a theoretical rigid body. • Learn the analytical techniques appropriate for objects subjected to distributed forces. • Solve truss, frame, and machine application problems, using the principles of mechanical equilibrium. • Define and use the concepts of shear force, normal force, and bending moment in the solution of internal force problems. • Generate shear and bending moment equations and draw shear and bending moment diagrams for a loaded beam. • Solve different classes of dry friction problems. • Apply the theory of dry friction to application problems. • Define and calculate centroid, center of mass, and center of gravity for various 1-D, 2-D, 3-D, and composite bodies. • Define and calculate moment of inertia and mass moment of inertia for various 1-D, 2-D, 3-D, and composite bodies.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

1. _____ The prerequisite/corequisite is required by law or government regulations.
   Explain or cite regulation numbers:
2. _____ The health or safety of the students in this course requires the prerequisite.
   Justification: Indicate how this is so.
3. _____ The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.
   Justification: Indicate how this is so.
4. _____ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.
   Justification: Indicate how this is so.
5. _____ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.
   Justification: Cite the statistical evidence from the research.
6. _____ The prerequisite course is part of a sequence of courses within or across a discipline.
7. __X__ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:
   CSUF Math 77 (prev. or conc.)and Phys 4A UCD Math 21D (prev. or conc.) and Phy 9A Cal Poly Math 241 (prev. or conc.) and Phys 131