ENGR R130: ENGINEERING STATICS

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
R130

Course Title (CB02)
Engineering Statics

Banner/Short Title
Engineering Statics

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
Engineering Statics applies the principles of mechanics to rigid bodies in two and three dimensional equilibrium systems. Analytical and graphical solutions using force vectors and equivalent force systems to solve problems pertaining to friction, centroids, center of gravity, and moments of inertia for areas is the focus of this course.

Taxonomy of Programs (TOP) Code (CB03)
0901.00 - Engineering, General (requires Calculus) (Transfer)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
52.5
Maximum Contact/In-Class Lecture Hours
52.5

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
105
Maximum Outside-of-Class Hours
105

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
PHYS R131 and MATH R121

Requisite Justification

Requisite Type
Prerequisite

Requisite
PHYS R131

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Prerequisite

Requisite
MATH R121

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Solve for resultant force and moment vectors using 2Dand 3D position and unit vector analysis.
2	Analyze the external and internal force systems acting on rigid bodies in equilibrium.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Explain different systems of units pertaining to statics problems.
2	Generate free body diagrams for particles and rigid bodies.
3	Generate equivalent equilibrium systems that include forces and couple moments.
4	Utilize the dot product to determine the angle between two vectors and the projection of one vector onto another.
5	Calculate the moment of a force about a specified axis.
6	Reduce a simple distributed loading to a resultant force having a specified location.
7	Reduce a simple distributed loading to a resultant force having a specified location.
8	Analyze the equilibrium of rigid bodies subjected to dry friction forces.
9	Determine the centroid and moment of inertia for cross-sectionalareas of rigid bodies.
10	Communicate legible problem solutions to be understood by engineers in and out of their specific discipline.
11	Determine the forces that act on rigid bodies including external forces, weight, normal,distributed loads, friction and reactions at supports.
12	Calculate internal forces in members and create shear and bending moment diagrams for beams.
13	Perform vector analysis methods addressing forces acting on rigid bodies, trusses, frames, and machines.
14	Analyze two and three dimensionalforce systems on rigid bodies in static equilibrium.

Course Content

Lecture/Course Content

A. Vector Operations
1. Scalars and Vectors
2. Vector Operations
3. Vector Addition of Forces
4. Addition of a System of Coplanar Forces
5. Cartesian Vectors
6. Addition of Cartesian Vectors
7. Position Vectors
8. Force Vector Directed Along a Line
9. Dot Product
10. Concurrent two and three dimensional force systems

B. Equilibrium of a Particle
1. Condition for the Equilibrium of a Particle
2. The FreeBody Diagram
3. Coplanar Force Systems
4. Three-Dimensional Force Systems

C. Force System Resultants
1. Moments and Couples
2. Cross Product
3. Principle of Moments
4. Moment of a Force about a Specified Axis
5. Equivalent Force Systems
6. Distributed Force Systems

D. Equilibrium of Rigid Bodies (two and three dimensional)
1. Conditions for Rigid Body Equilibrium

2. FreeBody Diagrams
3. Equations of Equilibrium
4. Two and Three Force Members
5. FreeBody Diagrams
6. Equations of Equilibrium
7. Constraints and Determinacy

E. Structural Analysis
1. Simple Trusses
2. The Method of Joints
3. Zero Force Members
4. The Method of Sections
5. Space Trusses
6. Frames and Machines

F. Internal Forces
1. Beams
2. Internal Loadings Developed in Structural Members
3. Shear and Moment Equations and Diagrams
4. Relations between Distributed Load, Shear, and Moment

G. Friction
1. Characteristics of Dry Friction
2. Problems Involving Dry Friction
3. Friction in Machines

H. Center of Gravity and Centroid
1. Center of Gravity, Center of Mass, and the Centroid of a Body
2. Composite Bodies
3. Resultant of a General Distributed Loading
4. Centroid of Areas and Volumes

I. Area and Mass Moments of Inertia
1. Definition of Moments of Inertia for Areas
2. Parallel Axis Theorem for an Area
3. Radius of Gyration of an Area
4. Moments of Inertia for Composite Areas
5. Product of Inertia for an Area

Laboratory or Activity Content

None

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Group projects
Objective exams
Oral presentations
Other (specify)
Problem-Solving Assignments
Problem-solving exams
Quizzes

Other

Essays

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Distance Education
Demonstrations
Instructor-guided interpretation and analysis
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

1. Computer aided presentation: The instructor may employ the computer to aid in the presentation of course materials which would include simulations of specific phenomena such as the distribution of forces across the area of an object and computerized graphical representations of aspects of a system such as the variance of internal structural forces with respect to the location of an applied force.
2. Demonstrations: The instructor will demonstrate physical engineering principals by employing equipment and other items such as fulcrum. For instance; when studying static equilibrium of an object in the presence of external torques, a fulcrum, meter stick, and masses can be used to show the balancing effects required.
3. Distance Education (Lecture): When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meetings will be used to allow students to ask questions regarding the course and its material.
4. Instructor guided analysis: The instructor will work through engineering problems during lecture that investigate a given system in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic and methods employed to come to certain conclusions regarding said problem/system.
5. Lecture: The instructor will deliver the course subject matter via in person lectures to the students. For example, a lecture on static equilibrium.
6. Small group activities: These may be employed in the form of group quizzes where students work together in small groups to solve some engineering problems regarding current material.

Representative Course Assignments

Writing Assignments

1. Answers to short explanatory (conceptual) questions from the textbook, often assigned from among those at the end of each chapter or posed by the instructor, generally assigned weekly; a typical question might be “Regarding the diagrams shown, analyze and explain why each given system is, or is not, in static equilibrium.

Critical Thinking Assignments

Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given physical system or circumstance in order to come to the correct conclusion and/or answer regarding the question and/or desired outcome. For instance; Given a structural diagram of an object along with the forces that it is subject to, determine the range of force applied at the given location that will result in the object remaining in static equilibrium.

Reading Assignments

1. Regular textbook readings that reinforce the concepts discussed or demonstrated during the class meetings; these readings generally include theory and principles, descriptions of the important engineering feats, data tables, definitions, problem-solving examples, and practical applications of engineering in everyday life and in specialized environments.

Skills Demonstrations

None

Other assignments (if applicable)

None

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook typically amounting to 1 chapter a week. This will amount to 1.5 hours per week of reading.
2. Assigned conceptual and problem solving based homework that further investigates and explores the notions and theories discussed throughout the course. Typically, homework sets will require 4.5 hours to fully complete and will be due on a weekly basis.
3. Studying and preparing for quizzes and exams.

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type

Textbook

Description

Beer, F., & Johnston, R.E., & Mazurek, D. (2019). *Vector Mechanics for Engineers: Statics* (12th). New York McGraw-Hill Education.

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%—50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	The Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

Hybrid (51%—99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	The Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
09/04/2020

Dean
09/04/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

Curriculum Committee
11/25/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000599711

DOE/accreditation approval date
MM/DD/YYYY