Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: James Bae **Date:** 11/12/2020

Department	Subject	Course Number	Title
Engineering: Technologies	Engineering: Technologies ENGR	181	Statics

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Total Units
3.00	3.00
Lecture Contact Hours	**Total Contact Hours**
48.00 - 54.00	48.00 - 54.00
Lecture Homework Hours	
96.00 - 108.00	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

-none-

General Education Justification:

Maximum Enrollment: 40

Maximum Enrollment Justification: Justification:

Grading Method: Letter Grade or P/NP

TOP code: 0901.00

Can be Taken 1 **time(s) for credit** (max 4)

- [ ] - Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- [ ] - Intercollegiate athletics course
- [ ] - Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

This course lays the foundation of Newtonian mechanics and serves as the building block for further courses in analysis and design. A study of two- and three-dimensional equilibrium of particles and rigid bodies; concentrated and distributed force systems; shear and bending moment stresses in beams; analysis of frames, machine and trusses; force resultant using vectors in tow and three dimension; non-coplanar force system, friction forces; center of gravity and moment of inertia.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

The students will learn about forces, free-body diagrams, moments of inertia, friction, equilibrium, and analytical and graphical problem-solving and their application to engineering.

Need for the course:

This course contributes to the A.S. Engineering: Drafting Technology award as an elective. It also is a foundational course for further study of engineering and pathways to a 4-year degree in Civil Engineering, Mechanical Engineering, Aerospace Engineering and other fields.

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- PHY 201 with a Grade of C or better. and
- MATH 212 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)
Upon the completion of the course the student will be able to do the following:

1. Formulate, solve and communicate engineering problem solutions using standards and practices used in all engineering disciplines.
2. Determine the forces that act on rigid bodies including external forces, weight, normal, distributed loads, friction and

reactions at supports.
3. Analyze and simplify a system of forces and movements to equivalent systems.
4. Analyze two- and three-dimensional force systems on rigid bodies in static equilibrium.
5. Design complete free-body diagrams, write appropriate equilibrium equations form the free-body diagram, and obtain solutions.
6. Perform vector analysis methods addressing forces acting on rigid bodies, trusses, frames, and machines.
7. Calculate internal forces in members and create shear and bending moment diagrams for beams.
8. Calculate centers of gravity and centroids and moment of inertia.
9. Analyze systems that include frictional forces.
10. Evaluate and measure the behavior of mechanical systems and examine the stability of systems in equilibrium by methods of virtual world.

Course Content:

(please number the outline of main topics and subtopics)

1. **Introduction**
    1. Fundamental concepts and principles
    2. System of Units
2. **Statics of particles**
    1. Vector Analysis
    2. Equilibrium of particles in planes and space
3. **Equivalent systems of forces on rigid bodies**
    1. Vector and Scalar product of vectors, mixed triple product of vectors
    2. Moment of a force and a couple
    3. Resolution of a system of forces to one force and one couple
4. **Equilibrium of rigid bodies**
    1. Free body diagram
    2. Equilibrium in two an three dimensions
5. **Distributed forces, cetroids and centers of gravity of:**
    1. Areas of lines
        1. Composite plates and wires
        2. Distributed loads on beams
        3. Forces on submerged surfaces
    2. Volumes
        1. Three dimensional bodies
        2. Composite bodies
6. **Analysis of Structures**
    1. Internal forces, Newton’s third law of motion
    2. Trusses
    3. Frames and machines
7. **Forces in beams**
    1. Internal forces in beams
    2. Shear and bending moment in beam
    3. Shear and bending movement diagram – Relationship between load, shear and bending moments
8. **Friction**
    1. Laws of dry friction and coefficient of friction
    2. Angles of friction
    3. Wedges
    4. Friction in Machines
9. **Distributed forces; moment of inertia**
    1. Moments of inertia of areas
    2. Moment of inertia of masses
10. **Methods of virtual work**
    1. Methods of virtual work

2. Stability and equilibrium

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Lecture
  Integration: Lectures will demonstrate the identification, application and calculation of virtual work, forces, friction, structures, centroids, center of gravity and statics.
- **Method:** Class and/or small group discussion
  Integration: Class and small group discussions of the relationship between load, shear and bending moments.
- **Method:** Multimedia presentations
  Integration: Multimedia presentations and videos cover demonstrations and applications of inertia, friction and methods of virtual works.
- **Method:** Computer-based demonstration
  Integration: Computer-based demonstrations to illustrate equilibrium in 2 and 3 dimensions and the application of software to engineering problems.
- **Method:** Readings
  Integration: Critical evaluation of texts, newspapers, journal articles, and other printed research. Assigned reading, analysis and discussion of professional articles on the topics of application of statics calculations methods and analysis of real-world applications.
- **Method:** Classroom demonstrations
  Integration: Classroom demonstrations cover forces, centers of gravity, structures, friction and inertia.
- **Method:** Field trip
  Integration: Field trips to professional laboratories (e.g. Riverside County Transportation Department) to observe the application of statics calculations of force and volume in the real world and expose students to an engineering workplace.
- **Method:** Guest Speakers
  Integration: Guest speakers will discuss application of statics calculations in their occupation. Speakers will present on structures, forces, and how they effect real world projects.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Portfolios
  Integration: Students will collect and submit their free body drawings and analysis of structures to be assessed on understanding of course content, accuracy, and communication of concepts.
- **Method:** Projects
  Integration: Projects will include drawing free body diagrams and analysis of structures, evaluated on the use of engineering standards on drawings, proper use of calculations and data, and clarity of communication.
- **Method:** Written papers and/or reports
  Integration: Written papers and/or reports on assigned 2 and 3 dimensional structures. Papers will assess students' knowledge, comprehension, and clarity of communication of statics calculations and application to problem situation.
- **Method:** Presentations on projects
  Integration: Presentations on projects performed for load, shear and bending moments. Will assess students' overall comprehension and implementation of material being taught.
- **Method:** Comprehensive examinations
  Integration: assessing the students' knowledge of vectors, forces, systems, and Statics. Assesses students knowledge and mastery of course material
- **Method:** Classroom participation
  Integration: participation will assess students' knowledge of vectors, forces, movement, statics, frames, trusses, equilibrium, and structures.
- **Method:** Homework

Integration: Homework will assess students learning in the areas of vectors, movement, systems, forces, statics, diagrams, equations, equilibrium, frames, machines, structures, gravity, and behaviors.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

- Read the chapter on system isolation and the construction of free-body diagram. Discuss how to isolate a body and model supports in a free-body diagram.
- In a coherent paragraph, describe the differences between the fundamental units in the US Customary System and the SI System.
- Write a one-page paper that describes and defines the static and kinetic frictional considerations of the model apparatus built in laboratory. On a separate page, include your model diagram of the system and the label the relevant forces.
- A 10-meter long beam I simply supported by a pin on left end and a roller on right end. It is loaded with uniformly distributed load of 100kN/m. Find the reactions at each support and draw a shear and bending moment diagram for the beam.
- Determine by integration, the centroid of one quarter of a circle with radius equal to 5 inches.

Textbooks:

- Hibbeler, R. C. (2016). *Statics and Mechanics of Materials 5th Edition* Pearson. ISBN: 9780134382593
- Beer, F., E. Johnston, D. Mazurek (2018). *Vector Mechanics for Engineers: Statics 12th Edition* McGraw Hill Education. ISBN: 1259977269
- Hibbeler, R. C. (2021). *Engineering Mechanics: Statics* Pearson. ISBN: 9780134814971

Other Resources:

Minimum Qualification

- Engineering (Masters Required)