COURSE OUTLINE : ENGR 152
D Credit – Degree Applicable
COURSE ID 010184
Cyclical Review: February 2020

COURSE DISCIPLINE : ENGR

COURSE NUMBER : 152

COURSE TITLE (FULL) : Engineering Mechanics - Statics

COURSE TITLE (SHORT) : Engineering Mechanics-Statics

CALIFORNIA STATE UNIVERSITY SYSTEM C-ID : ENGR 130 - Statics

CATALOG DESCRIPTION

ENGR 152 is a first course in engineering mechanics usually required for civil, mechanical, environmental, chemical and biomedical engineering majors. Topics covered include the composition and resolution of co-planar and non-planar force systems, equilibrium of rigid bodies, distributed forces, forces in trusses, frames and cables, shear and bending moments in beams, and moments of inertia of areas and bodies. Engineering Mechanics - Statics helps students to develop effective engineering problem solving methods and skills.

Total Lecture Units: 3.00

Total Laboratory Units: 0.00

Total Course Units: 3.00

Total Lecture Hours: 54.00

Total Laboratory Hours: 0.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 54.00

Total Out-of-Class Hours: 108.00

Prerequisite: PHY 101 and MATH 104E or equivalent.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1				Prerequisite	Yes
2	MATH	104E	Calculus and Analytic Geometry	determine the volumes of solids of revolution using the disk method, the cylindrical shell method, and the cross-section method;	Yes
3	MATH	104E	Calculus and Analytic Geometry	determine work done in applications involving liquids and springs;	Yes
4	MATH	104E	Calculus and Analytic Geometry	evaluate improper integrals;	Yes
5	MATH	104E	Calculus and Analytic Geometry	find approximations to definite integrals using midpoint, trapezoidal and Simpson techniques;	Yes
6	PHY	101	Physics for Scientists and Engineers: A	calculate the work performed by forces;	Yes
7	PHY	101	Physics for Scientists and Engineers: A	calculate forces necessary for the static equilibrium of physical objects;	Yes
8	PHY	101	Physics for Scientists and Engineers: A	use computers to perform calculations and to make graphs.	Yes

EXIT STANDARDS

1 apply the principles of mechanics - statics to practical engineering problems in the following areas: composition and resolution of co-planar and non-planar force systems, equilibrium of rigid bodies, distributed forces, forces in trusses, frames and cables, shear and bending moments in beams, moments of inertia of areas and bodies;
2 calculate external and internal forces in structural members such as in trusses;
3 determine the forces that act on rigid bodies which may include externally applied forces, weight, normal forces, distributed loads, friction and reactions at structural supports;
4 analyze and resolve vectors that represent forces acting on trusses, frames, machines;
5 analyze two dimensional and three dimensional forces that act on rigid bodies in static equilibrium;
6 create force, shear and bending moment diagrams to determine the location and magnitude of the largest forces and moments;
7 use position and unit vectors to solve force equations;

STUDENT LEARNING OUTCOMES

1 formulate and solve engineering problems using organized and systematic methods such as stating assumptions, creating free body diagrams, deriving and utilizing applicable equations and performing calculations;
2 use load (force), shear, and moment diagrams to evaluate the magnitude and location of the largest forces and moments on a static rigid body as a method of designing static structures;

3 effectively communicate engineering mechanics – statics problem solutions to a varied audience.

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	Vector Mathematical Operations • Addition and subtraction • Dot-product and cross-product • Mixed triple product	3	0	3
2	The Principle of Static Equilibrium • Newton's First Law of Motion • Decomposition of force vectors into Cartesian components • Unit vectors	4	0	4
3	Statics of Particles in Two or Three Dimensions • Two and three dimensional force systems • Space (dimensional) diagram • Free body diagrams	4	0	4
4	Equivalent System of Forces • Moment of a force about a point or axis • Moment of a force-couple • Equivalent force systems: forces only, moments, and forces • Varignon's Theorem	4	0	4
5	Statics of Rigid Bodies • Constructing free-body diagrams • Line-of-action and the principle of transmissibility • Equilibrium of two-force and three-force rigid bodies • Force reactions at supports and connections in two and three dimensions • Determinate and indeterminate reaction systems • Support-reaction types; ball, rough surface roller, ball-and-socket, universal joint, fixed support, hinge and bearing, pin and bracket	6	0	6

6	Centroids, Center of Mass, and Center of Gravity • Centroids of areas and volumes • First moment of areas and lines • Theorem of Pappus-Guldinus	6	0	6
7	Distributed Loads • uniform loads • non-uniform loads Forces on Submerged Surfaces (optional) • Hydrostatic-pressure versus fluid-depth • Free body diagrams for submerged bodies • Center of pressure location using the first moment of areas • Resultant of hydrostatic forces	2	0	2
8	Analysis of Structures • Trusses: internal forces in members: method of joints, method of sections • Frames and machines: transmission and transformation of forces	6	0	6
9	Forces in Beams and Cables • Shear and bending-moment diagrams for point-loaded and distributed-loaded beams • Cables with concentrated and distributed force-loads	6	0	6
10	Friction • Laws of dry friction • Coefficient of sliding and static friction • Angle of friction • Friction forces • Free-body diagrams that include friction forces • Belt friction forces and the angle of wrap • Wedges • Friction in machines	6	0	6

11	Moments of Inertia • Second moment • Radius of gyration • Product of inertia • Parallel-axis theorem • Moments of inertia for composite areas/masses Mohr's Circle (optional) Virtual Work (optional)	7	0	7
				54

OUT OF CLASS ASSIGNMENTS

1 homework (e.g. calculation of the external and internal forces of a simple truss);
2 individual projects (e.g. design and build a small popsicle stick bridge which includes a short written report or technical calculation memo);
3 group projects (e.g. estimate and measure the mechanical advantage of a simple pulley system).

METHODS OF EVALUATION

1 quizzes;
2 project presentation (e.g. PowerPoint presentation of group project stressing effective communication);
3 midterm examinations;
4 final examination;

METHODS OF INSTRUCTION

- [x] Lecture
- [ ] Laboratory
- [ ] Studio
- [ ] Discussion
- [x] Multimedia
- [ ] Tutorial
- [ ] Independent Study
- [x] Collaboratory Learning
- [x] Demonstration
- [ ] Field Activities (Trips)
- [ ] Guest Speakers
- [x] Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Engineering Mechanics: Statics	Required	Prentice Hall	14	Mastering Edition	Hibbeler, R. C.	9780135681985	2020