BIOL 233 – MECHANICS – STATICS | 3 CREDITS

SYLLABUS

CATALOG DESCRIPTION

An introduction to basic engineering structural analysis of static (stationary) objects. Methods to examine external and inter forces on structural components are developed using vector methods.

Prerequisites: PHYS 215 and MATH 189

Semester Offered: Fall

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

Course Learning Outcomes

Upon successful completion of the course, the student will be able to…

1. Forces, moments, and couples.
2. Mechanical systems and equilibrium.
3. Center of gravity, centroid, and moments of inertia.

Special Learning Outcomes

Upon successful completion of the course, the student will be able to…

1.1 Represent forces, moments, and couples as vectors.
1.2 Manipulate 2 and 3-dimensional vectors graphically and algebraically.
1.3 Use position vectors and unit vectors to represent direction.
1.4 Perform dot product and cross product vector operations.
1.5 Verbally define the moment of a force, and of a couple.
1.6 Apply the rules of movement of forces, moments, and couples on a rigid body.
1.7 Reduce a complex system of forces to a single force and a moment at a specified point.
1.8 Further reduce a system of forces to a single force, acting around a specified axis.
1.9 Reduce distributed loads to a single force.

2.1 Know and apply the conditions for rigid-body equilibrium.
2.2 Draw simple free-body diagrams which represent actual mechanical systems.
2.3 Use free-body diagrams to write the equations of equilibrium in 2 and 3-dimensions.
2.4 Solve the resulting simultaneous equations using matrices and a scientific calculator.
2.5 Apply force and moment constraints to various mechanical supports.
2.6 Know and apply the assumptions made in the analysis of simple trusses.
2.7 Define a two-force member.
2.8 Apply engineering judgment to simple truss structures in order to determine whether the members are in compression or tension.
2.9 Draw free-body diagrams and analyze trusses using the methods of joints and sections.
2.10 Apply analysis methods to simple frames and machines.
2.11 Describe how external forces and moments on structural members translate into internal forces and moments.
2.12 Relate internal forces to the process of structural member design.
2.13 Calculate internal forces at specific structural locations.
2.14 Calculate frictional forces and apply them to structural analysis.

3.1 Define and calculate the center of gravity position for a system of particles.
3.2 Differentiate between the concepts of center of gravity and center of mass.
3.3 Explain the calculus-based derivation of center of gravity, center of mass, and centroid for a randomly shaped solid body.
3.4 Use calculus based arguments to calculate center of gravity, center of mass, and centroid for simple, symmetrical objects.
3.5 Verbally define the concepts of area and mass moments of inertia.
3.6 Explain the calculus-based derivation of moment of inertia.
3.7 Relate the relevance of moment of inertia to design of structural members.
3.8 Calculate moments of inertia for various single piece and composite physical cross sections.