

Far Western University
Faculty of Engineering
Bachelor's Degree in Architecture
Course of Study 2075

Course Title: Applied Mechanics	Credit: 3
Course Code: CE 123	Number of lecture/week: 3
Nature of the Course: Theory	Tutorial/week: 2
Year/Semester: First/Second	Total hours: 45

1. Course Introduction:

The course provides a basic knowledge to the students to understand the basics of engineering mechanics. It enables the students to be acquainted with the basic concepts and principles of forces, centroid and Moment of Inertia, along with fundamental analysis of structures. The course deals with the statics and dynamics of particles as well as rigid bodies.

2. Course Objectives:

At the end of this course the student will be able to:

- Understand basic principles of particle and rigid bodies at rest and motion.
- Apply the knowledge base for developing development of architectural configuration.
- Introduce the concepts of engineering mechanics in various branches of engineering problems.

3. Specific objectives and Concepts:

Specific Objectives	Contents
• Realize the concept and scope of mechanics • Learn about the particles, rigid and deformable bodies. • Learn to draw free body diagram for establishing equations of equilibrium. • Learn about different systems of unit used in engineering mechanics.	Unit I: Introduction (6 Hours) Definition and scope of Engineering Mechanics, concepts of particles, rigid, deformable and fluid bodies. Fundamental concepts and principles of mechanics. Concepts of Particles and Free Body Diagram, Physical meaning of Equilibrium and its essence in structural application. Equations of static equilibrium, systems of units.
• Understand the characteristics of force. • Learn the composition and resolution of forces. • Understand the moment and couple of forces and their resolution.	Unit II Forces (6 hours) Definition and principle of forces, types of forces, principle of transmissibility & its limitations, resolution & composition of forces, moment of forces about a point and axes, theory of couples, resolution of forces into forces & couple & vice versa, composition and resolution of system of forces.
• Distinguish between CG and Centroid. • Compute centroid of different plane figures • Compute moment of inertia of plane figures and composite figures. • Determine moments of inertia of compound figures using parallel axis	Unit III : Center of gravity, centroid and moments of inertia (6 hours) Definition & derivation of center gravity, Centroid of lines areas and volumes. First and second moments of area, radius of gyration, moments of inertia of common figures, parallel and perpendicular axis theorems, moments of

theorem.	inertia of built-up sections. Determination of moments of inertia by direct integration.
- Understand development of friction - Learn characteristics of friction - Apply this knowledge to analyze practical problems.	Unit IV : Friction (2 hours) Introduction: definition, types, causes & effects, Laws of dry friction, static and dynamic coefficient of friction, angle of friction, condition of sliding or tipping, application of friction in static problems.
- Understand the principle and functions of a beam as a structure. - Understand statically and kinematic determinacy. - Learn internally developed forces of different kinds developed in beams. - Analyze member forces in beam with sketch	Unit V: Analysis of Beams and Frames (9hours) Definition and types of Beams, supports – roller, hinged and fixed supports. Reactions and degrees of freedom of the supports, external and internal forces in beams. Statically indeterminacy, kinematic indeterminacy. Definition and sign convention of axial force, shear force and bending moment, relation between load, shear force and bending moment. Axial force, shear force and bending moment diagrams of beams and frames.
- Understand Truss as a structural member. - Determine stability and determinacy of trusses. - Analyze plane trusses by the method of joints and sections.	Unit VI : Analysis of Plane Trusses (4 hours) Definition of a Truss, types of trusses, geometrical stability of trusses, determinacy and stability, analysis of trusses by the method of joints, analysis of trusses by the methods of sections.
- Understand the concept of dynamics as applied to particle. - Determine the motion of particle and rigid body. - Develop equation of motion for different cases.	Unit VII: Kinematics of particles and rigid bodies (4 hours) Introduction to dynamics, rectilinear motion of particles, position, velocity and acceleration of a particle and rigid body, determination of motion of particle and rigid body, uniform rectilinear motion of particles, uniformly accelerated rectilinear motion of particles. General plane motion of rigid body.
- Define motion of particle along a curved path. - Resolve velocity and acceleration. - Derive equation of motion for n-t and r- θ coordinate	Unit VIII : Curvilinear Motion (3 hours) Curvilinear motion of a particle, position, velocity and acceleration of a particle, rectangular components of velocity and acceleration, introduction of tangential and normal components, radial and transverse components.
- Define Newton's law as applied to particle. - Derive momentum equations and apply work energy principle. - Explain impulsive impact and apply principle of impulse and momentum to solve collision problems.	Unit IX : Kinetics of particles and rigid body (5 hours) Newton's Second Law of motion and momentum, equation of motion and dynamic equilibrium, Linear and angular momentum : rate of change and conservation, Kinetic energy of particles, Principle of work & energy application, impulsive motion and impact, central impact (direct and oblique)

References:

1. "Vector Mechanics for Engineers- Sstatics and Dynamics", F.P. Beer and E.R. Jonsion, Jr. 6e, McGraw-Hill Book Co., New York, USA, 1987
2. "Engineering Mechanics-Statics and Dynamics", Shame, I.H. 3rd ed., New Delhi, Prentice Hall of India, 1990.
3. "Engineering Mechanics-Statics and Dynamics", R.C. Hibbeler, Ashok Gupta. 11thedition., New Delhi, Pearson, 2009.