

PHYS103-MECHANICS (4 Cr.)

Pre-requisite: PHYS100 OR Intermediate/A Level Physics OR equivalent

Instructor: Dr. Khalid Javed (kjaved@fccollege.edu.pk)

Office: S001

Lecture days/time: 09:30 –10:45 (T & R) S007 & **Lab:** 10:00 – 11:50 (F) S-029

Office hours: (M, W, F) 10:00 -11:00 & (T, R) 11:00 -12:00

Learning Objectives:

Student will learn the fundamental physics of Mechanics and its applications in everyday life. Evaluations and exams will be based on analytical and conceptual problems. Students shall be made to solve question and exercises at the end of each chapter.

Learning Outcomes:

By the end of this course the students will be able to

1. Understand and appreciate that natural phenomena can be explained using fundamental laws of mechanics/physics.
2. Express these laws in mathematical terms.
3. Develop understanding of the material by solving problems.
4. Become familiar with physics principles applicable in other fields of science.

Recommended books:

1. **Fundamentals of Physics by Halliday/Resnick/Walker.**
2. University Physics (Models and Applications) by de William P. Crummett.
3. The Feynman Lectures on Physics Volume I

Course Outlines/Topics (Textbook of Halliday/Resnick/Walker):

Topic -1: Measurements

Physical quantities, SI units, Changing units, Length, Time, Mass, Accuracy, Precision, Practice problems.

Topic -2: Vectors

Vector and Scalars, adding vectors geometrically, Components of vectors, Unit vectors, adding vectors by components, Multiplying vectors, Practice problems.

Topic -3: Motion along a straight line

Description of motion, Position and displacement, Average velocity and average speed, Instantaneous velocity and speed, Acceleration, Constant acceleration (a special case), Free fall acceleration, Practice problems.

Topic -4: Motion in 2-D & 3-D

Motion in two or three dimensions, Position and displacement, Average velocity and instantaneous velocity, Average acceleration and instantaneous acceleration, Projectile motion, Uniform circular motion, practice problems.

Topic -5: Force and Motion

Newton's first law, Force, Mass, Newton's second law, Newton's 3rd law, Applying Newton's laws, Friction, The drag force and terminal speed, Uniform circular motion, practice problems.

Topic -6: Work and Energy

Energy, work, Work-KE theorem, Work done by a gravitational force, Work done by a spring force, Work done by a general variable force, Power, Potential energy, Path independence of conservative forces, Conservation of mechanical energy and total energy, practice problems.

Topic -7: Systems of Particles

Center of mass, Newton's 2nd law for a system of particles, Linear momentum and its conservation, Elastic and inelastic collisions in one dimension, practice problems.

Topic -8: Rotation

Rotational variables, Are angular quantities vectors, Rotation with constant angular acceleration, Relating the linear and angular variables, Kinetic energy of rotation, Rotational inertia, Torque, Newton's 2nd law for rotation, Work and rotational KE, Angular momentum & its conservation, practice problems.

Topic -9: Oscillations

Oscillations, Simple harmonic motion, Velocity, acceleration and energy in SHM, The force law of SHM, SHM and Uniform circular motion, Damped SHM, Forced oscillations and resonance, practice problems.

Topic -10: Gravitation

Newton's Gravitational Law, Gravitation near Earth's surface, Gravitation inside Earth, Gravitational PE, Escape speed, Planets and satellites: Kepler's laws, Einstein and gravitation, Gravitation in terms of curvature of space time, practice problems.

Course evaluation:

Mid-term exam (25%), Final exam (25%), Quizzes (25%), Lab (15%).
Homework/assignments (10%).

Attendance and Grading Scale policy:

Students must attend all the lectures. If attendance of any student falls below 70%, he/she will not be allowed to sit in the final exam. FCCU grading scale policy will be followed to calculate grades and quality points.