

Coffeyville Community College

ENGR-210
COURSE SYLLABUS
FOR
ENGINEERING PHYSICS I

Ryan Willis
Instructor

COURSE NUMBER: ENGR-210 **COURSE TITLE:** Engineering Physics I
CREDIT HOURS: 5
INSTRUCTOR: Ryan Willis
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OFFICE HOURS: See schedule posted on office door
PREREQUISITE(S): Calculus with Analytical Geometry I or concurrently enrolled in Calculus with Analytical Geometry I.
REQUIRED TEXT AND MATERIALS: *Physics for Scientists and Engineers* 3rd ed. Douglas C. Giancoli Prentice Hall Publishing

COURSE DESCRIPTION:

A theory and lab course which covers vectors, mechanics, wave motion, simple harmonic motion, and the Laws of Thermodynamics including Kinetic Theory. Calculus is used in the problem solving.

EXPECTED LEARNER OUTCOMES:

1. Apply linear equations to Physics.
2. Apply quadratic equations to Physics.
3. Apply the Pythagorean Theorem to various physical concepts.
4. Apply the basic Trig functions to Physics problems.
5. Use the Law of Sines in problem solving.
6. Use the Law of Cosines in problem solving.
7. Construct appropriate graphs for physics applications.
8. Apply the major Trig Identity concepts to problem solving in Physics.
9. Apply basic integration and differentiation concepts to simple Physics problems.
10. Use the Metric System in solving Physics problems.
11. Apply vector concepts to various Physics problems.
12. Understand Error Analysis and how it relates to lab measurements in Physics.

13. Apply the conditions of equilibrium to mechanics problems in Physics.
14. Solve physics problems requiring the concept of Moments.
15. Solve motion problems involving distance, rate, and time.
16. Apply concepts of gravity to problem solving.
17. Apply Newton's 2nd Law of Motion to problem solving.
18. Use motion in a plane in solving Physics problems.
19. Apply basic concepts of Work to problem solving.
20. Solve Energy problems in Physics.
21. Solve Power problems in Physics.
22. Solve momentum-related problems in Physics.
23. Solve impulse-related problems in Physics.
24. Apply concepts of rotation to problem solving.
25. Apply concepts of Moment of Inertia to problem solving.
26. Solve elasticity problems in Physics.
27. Study the physics of gravity and its application.
28. Study simple concepts involving fluid.
29. Apply Simple Harmonic Motion (SHM) concepts to problem solving in Physics.
30. Gain an understanding of sound as a pressure and how its strength is measured.
31. Solve simple thermodynamics problems working with 1st and 2nd laws of thermodynamics.

**LEARNING TASKS
& ACTIVITIES:**

Cognitive: Unit Tests and Problems

Psychomotor: Lab Exercises

Metacognitive: Identification of least understood concepts

**ASSESSMENT OF
OUTCOMES:**

You will be evaluated according to quizzes, lab work, and test scores. Homework will be assigned, but will not be picked up. However, doing your homework will help you study for the weekly quizzes and the unit tests.

#	Description	Pts each	Ttl
5	Tests (lowest one dropped)	100	400
10	Quizzes (lowest one dropped)	15	135
13	Lab write ups (lowest dropped)	15	180
1	Comprehensive Final	150	150
1	Lab Final	50	50
Total			915

Grade Distribution:

90-100% A
80-90% B
70-80% C
60-70% D
<59% F

**COURSE
SCHEDULE:**

Chapter 1 Measurement
1.1-1.7

Chapter 2 Motion in One Dimension
2.1-2.8

Chapter 3 Vectors, Kinematics in 2-D
3.1-3.10

Chapter 4 Dynamics: Newton's Laws of Motion
4.1-4.9

Chapter 5 Further Applications of Newton's Laws
5.1-5.3

Chapter 6 Gravitation
6.1-6.9

Chapter 7 Kinetic Energy and Work
7.1-7.5

Chapter 8 Potential Energy and Conservation of Energy
8.1-8.9

Chapter 9 Linear Momentum and Collisions
9.1-9.10

Chapter 10 Rotation about a Fixed Axis
10.1-10.11

Chapter 11 General Rotation
11.1-11.10

Chapter 12 Equilibrium and Elasticity
12.1-12.8

Chapter 13 Fluids
13.1-13.9

Chapter 14 Oscillations
14.1-14.8

Chapter 15 Wave Motion
15.1-15.11

Chapter 16 Sound
16.1-16.9

Chapter 17 Temperature and Thermal Expansion
17.1-17.9

Chapter 18 Kinetic Theory
18.1-18.7

Chapter 19 Heat and the First Law of Thermodynamics
19.1-19.10

Chapter 20 Second Law of Thermodynamics; Heat Engines
20.1-20.10

**ATTENDANCE
POLICY:**

Attendance in a physics course is essential for any degree of success in that course. When it is determined that lack of attendance is jeopardizing the success of the student, counseling will be in order to conclude whether the student should remain enrolled in the class. The student should not miss class periods for a course of this type. In each class period new ideas are presented which build upon the ideas of the previous class period. These ideas, in turn, lay the foundation for what will be discussed at the next class period. When a student is absent all information should be obtained from a fellow student concerning the assignment covered and to be covered. Absence is no excuse for being unaware of the progress and activities of the class. Attendance is expected for success in the class, but **attendance will not be taken.**

NOTICE:

Out of respect for your classmates, when you enter the classroom please turn off your cell phone. Remember that your time in the class should be spent listening; not taking calls. Thank you.

COMPETENCIES:

TOPIC 1 PREREQUISITE MATH

APPLY LINEAR EQUATIONS TO PHYSICS

1. Solve for one of two variables.
2. Solve for a numerical value of a variable.

APPLY QUADRATIC EQUATIONS TO PHYSICS

1. Identify the four ways of solving a quadratic equation.
2. Solve a quadratic equation by means of factoring and using the quadratic formula.

APPLY THE PYTHAGOREAN THEOREM TO VARIOUS PHYSICAL CONCEPTS

1. Solve for one side of a right triangle when given the other two sides.

APPLY THE BASIC TRIG FUNCTIONS TO PHYSICS PROBLEMS

1. Know the three fundamental trig functions: sin, cos, tan
2. Identify the three basic functions of a labeled triangle.
3. State the three sin, cos, tan of a 0, a 30, a 45, a 60, a 90, and a 180.

USE THE LAW OF SINES IN PROBLEM SOLVING

1. State the law of Sines.
2. Apply the law of Sines to solve for side or an angle of an obtuse or scalene triangle.

USE THE LAW OF COSINES IN PROBLEM SOLVING

1. State the law of Cosines.
2. Apply the law of Cosines to solve for a side or an angle of an obtuse or a scalene triangle.

CONSTRUCT APPROPRIATE GRAPHS OF PHYSICS APPLICATIONS

1. Identify the five major components of a graph.
2. When given a set of data, plot a graph of the data in a satisfactory manner.
3. When given data to be graphed, identify and explain which variable is the independent and which the dependent is.

APPLY THE MAJOR TRIG IDENTITY CONCEPTS TO PROBLEM SOLVING IN PHYSICS

1. State the six basic trig functions and their inverses.
2. State the SIN and COS of (2)
3. State the various forms of $\sin^2 + \cos^2 = 1$

APPLY BASIC INTEGRATION AND DIFFERENTIATION CONCEPTS TO SIMPLE PHYSICS PROBLEMS

1. Solve problems requiring differentiation of simple algebraic expressions.
2. Solve problems requiring differentiation of simple trig functions and expressions.
3. Solve problems requiring integration of simple algebraic expressions.
4. Solve problems requiring integration of simple trig functions and expressions.

TOPIC 2 METRICS, VECTORS & ERRORS

USE THE METRIC SYSTEM IN SOLVING PHYSICS PROBLEMS

1. Know the metric prefixes: kilo, milli, centi.
2. Identify the basic metric unit of mass, time, length, volume, and force.
3. Differentiate between fundamental and derived physical units.

APPLY VECTOR CONCEPTS TO VARIOUS PHYSICS PROBLEMS

1. Differentiate between a vector and a scalar.
2. Find the sum (Resultant) of two or more vectors.
3. Find the difference between two vectors.
4. When given a vector find its x and y components.

UNDERSTAND ERROR ANALYSIS AND HOW IT RELATES TO LAB MEASUREMENTS IN PHYSICS

1. Describe the two types of errors commonly found in lab experiments.
2. Identify when given a set of data, the mean, median, and mode.
3. When given the experimental result and the acceptable result, determine the percent of error.

TOPIC 3 NEWTON'S THREE LAWS APPLIED TO STATICS

APPLY THE CONCEPTS OF STATICS TO MECHANICS PROBLEMS IN PHYSICS

1. Determine the x, y components of a given force.
2. Find the resultant of two or more given force vectors. (Concurrent and Coplanar)
3. State the first Law of Equilibrium.
4. Find tension in ropes of a hanging body.

5. Find force exerted by friction on a block on a horizontal surface.
6. Find force exerted by friction on a block on an inclined plane.
7. Determine forces/tension in members of a truss/boom poised at an angle from the horizontal. (Requiring 1st Law of Equil.)
8. State Newton's 1st, 2nd, & 3rd Laws of Motion.

TOPIC 4 MOMENTS

SOLVE PHYSICS PROBLEMS REQUIRING THE CONCEPT OF MOMENTS

1. Calculate the moment of a given force about a body.
2. Calculate the torque exerted by a pair of forces (couple) acting on a body.
3. Determine forces/tension in members of a truss/boom poised at an angle from the horizontal. (Requiring 2nd Law of Equil.)
4. State the 2nd Law of Equilibrium.
5. Solve "plank/ladder" problems.
6. Solve bridge problems.
7. Solve "suspended bar" problems.

TOPIC 5 KINEMATICS

SOLVE MOTION PROBLEMS INVOLVING DISTANCE, RATE, AND TIME.

1. Solve for the missing variables when given the others.
2. Define the terms speed, velocity, and acceleration.
3. Know the six basic equations of linear motion (Kinematics).
4. State the relationship between instantaneous velocity, average velocity, initial velocity, and final velocity.
5. Solve simple "free fall" problems.
6. Solve simple vertical, one-dimensional motion problems.

TOPIC 6 GRAVITY, NEWTON'S 2ND LAW, & MOTION IN A PLANE

APPLY CONCEPTS OF GRAVITY TO PROBLEM SOLVING
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1. Describe the mathematical law of gravity.
2. Describe the relationship between mass, inertia and weight.
3. Describe the "effects" of free-fall on a mass.
4. State Newton's 2nd Law of Motion.

GRAVITATION

1. Define Newton's Law of Gravitation.
2. Introduce the Principle of Superposition
3. Study and Define Kepler's Laws

APPLY NEWTON'S 2ND LAW OF MOTION TO PROBLEM SOLVING

1. Solve problems relating mass, force and acceleration using Newton's 2nd Law of Motion.
2. Solve "elevator/tension" problems.
3. Solve "motion-down-a-ramp" problems.
4. Solve "Atwood" type problems.

USE MOTION IN A PLANE IDEAS IN SOLVING PHYSICS PROBLEMS

1. State the principle of Independent Velocities.
2. Solve simple projectile motion problems.
3. State the equation used to describe centripetal force.
4. State the relationship between centrifugal force and centripetal force.
5. Solve simple centripetal force problems.
6. Solve simple satellite problems.

TOPIC 7 WORK/ENERGY/POWER

APPLY BASIC CONCEPTS OF WORK TO PROBLEM SOLVING

1. State the definition of work and energy and how they are related.
2. State the metric and English units used in work and energy discussions.
3. State the conservation of Energy Law.
4. Solve simple work related problems.

SOLVE ENERGY PROBLEMS IN PHYSICS

1. State the definition of Kinetic energy and Potential energy and how they are related.
2. Solve simple transformation problems of potential energy into kinetic.

SOLVE POWER PROBLEMS IN PHYSICS

1. List the standard units of power in the English and the metric systems.
2. State how Power is computed.
3. Solve simple Power problems.

TOPIC 8 MOMENTUM & IMPULSE

SOLVE MOMENTUM-RELATED PROBLEMS IN PHYSICS

1. State the law of conservation of momentum.
2. Write the equation for momentum.
3. Write the equation for momentum = impulse.
4. Solve simple problems dealing with perfectly elastic collisions (1-D).
5. Solve simple problems dealing with inelastic collisions (1-D).
6. Solve simple 2-D problems involving colliding bodies.

SOLVE IMPULSE-RELATED PROBLEMS IN PHYSICS

1. Solve simple impulse type problems.

TOPIC 9 ROTATION & MOMENT OF INERTIA

APPLY CONCEPTS OF ROTATION TO PROBLEM SOLVING

1. Translate the six basic linear kinematic equations into their “rotary” counterpart.
2. Solve simple problems involving angular velocity, speed, distance and acceleration.

APPLY CONCEPTS OF MOMENT OF INERTIA TO PROBLEM SOLVING

1. State the definition of moments of inertia.
2. Write a general equation defining moment of inertia.
3. Calculate the center of mass of a given body.
4. Calculate the moment of inertia of a given mass.

TOPIC 10 ELASTICITY, WAVE MOTION & SHM

SOLVE ELASTICITY PROBLEMS IN PHYSICS

1. Define the terms stress and strain mathematically.
2. Calculate stress, strain and Young’s modulus for a given set of data.
3. State Hooke’s law.
4. Solve elasticity problems requiring use of Hooke’s law.

APPLY SIMPLE HARMONIC MOTION (SHM) CONCEPTS TO PROBLEM SOLVING IN PHYSICS.

1. Define the term “simple harmonic motion.”
2. Solve for the velocity, acceleration, and position of a body oscillating on a spring.
3. Solve for the energy of a vibrating body.
4. State the equation for finding the period of a simple pendulum.
5. Solve simple pendulum problems.

THE STUDENT WILL GAIN AN UNDERSTANDING OF SOUND AS A PRESSURE AND HOW ITS STRENGTH IS MEASURED

1. Solve sound problems dealing with intensity and beats.
2. Solve problems in sound using the unit of decibels.
3. Describe the Doppler effect as it relates to understanding the propagation of sound waves.
4. Describe the human response to sound both in loudness and frequency.

TOPIC 11 FLUIDS

FLUIDS

1. Define what a fluid is.
2. Define density and pressure.
3. Define Pascal's Principle.
4. Define Archimedes' Principle.
5. Define the Continuity Equation.
6. Define Bernoulli's Equation.

TOPIC 12 TEMPERATURE, THERMODYNAMICS, KINETIC THEORY, ENTROPY

TEMPERATURE, HEAT, AND THE LAW'S OF THERMODYNAMICS

1. Define temperature using the zeroth law of thermodynamics.
2. Study the absorption of heat by solids.
3. Introduce the First Law of Thermodynamics
4. Study heat transfer mechanisms

KINETIC THEORY, ENTROPY AND APPLICATIONS OF THE 2ND LAW OF THERMODYNAMICS

1. Study the ideal gas equation.
2. Define entropy
3. Define the 2nd Law of Thermodynamics.
4. Application of Entropy to Engines and Refrigerators

This syllabus is subject to revision with prior notification to the student by the instructor.