

# PHYSICS DEPARTMENT

## COURSE OUTLINE

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### PHYS 154 TECHNICAL PHYSICS 3

A Physics course with applications relevant to Electronics Technology. Topics include measurement, vectors, kinematics, dynamics, uniform circular motion, rotary motion, vibrations, waves, sound and light.

OFFERED:	Q1
CREDIT:	4
IN-CLASS WORKLOAD:	4 lecture, 2 lab (alt. weeks), 1 seminar
PRE-REQUISITES:	Physics 151 or Physics 11 and Math 172 or Math 11 or Applications of Math 12

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#### REQUIRED MATERIALS:

Textbook: "Physics", 6<sup>th</sup> edition, Cutnell, J.D. and Johnson, K.W.

Physics 154 lab manual

Bound laboratory notebook

Graph paper (millimeter/centimeter ruled graph paper is preferred)

Calculator

#### DEPARTMENT POLICIES REGARDING TESTING:

1. Students must write quizzes, tests, midterm tests, etc., on the date and time assigned by the instructor. Missed exams normally receive a zero grade. In exceptional circumstances such as medical issues or a documented illness, a make-up exam may be given or the test may be waived at the discretion of the instructor. The instructor should be notified prior to the exam.
2. The final exam will cover the entire course and will be 3 hours long. As stated in the current college calendar (p. 39) "students are expected to write tests and final exams at the scheduled time and place." Exceptions will only be considered for emergency circumstances as outlined in the calendar. Holidays or scheduled travel flights are not accepted.
3. Midterm tests may be discounted from the grading mark distribution (see below) if all term work, including term tests, labs, and assignments, has been completed with a grade of 60% or higher. In this case, the final grade for the course may be based on a combination of the final exam and the lab mark.

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## DEPARTMENT POLICIES REGARDING LABS:

1. All assigned laboratory exercises and reports must be completed with an overall grade of 60% in order to obtain credit for this course. A lab may be made up at a later time only in the case of documented illness or other extenuating circumstances.
2. At the discretion of the instructor, a student who is repeating this Physics course may not be required to complete the laboratory exercises a second time if an average lab grade of 70% or better was obtained.

## STUDY TIME

It is recommended that between 5 and 10 hours per week (or more for students with a weak background) be spent studying for this course outside of class time.

## GRADING

The standard mark distribution for this course is as follows:

Final Exam	50%
Midterms and other work	40%
<u>Lab Reports</u>	<u>10%</u>
	100%

## COURSE OUTLINE

### TUTORIAL TOPICS:

#### 1. **Measurement & Units – The International System**

- 1.1 Systeme Internationale (SI)
  - 1.1.1 Base units
  - 1.1.2 Prefixes
  - 1.1.3 Derived units
- 1.2 British Engineering and US Customary systems and conversions
- 1.3 Dimensional algebra

#### 2. **Kinematics**

- 2.1 Linear kinematics - Review

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**OUTLINE:****1. Vectors**

- 1.1 Components of vectors
- 1.2 Vector addition and subtraction
- 1.3 Kinematic examples
  - 1.3.1 Displacement, velocity, acceleration
  - 1.3.2 Relative motion
- 1.4 Vector multiplication
  - 1.4.1 Scalar product and work
  - 1.4.2 Vector product and torque

**2. Dynamics – Newton’s Laws**

- 2.1 Newton’s second law
  - 2.1.1 Forces – tension, springs, friction, gravity
  - 2.1.2 Free-body diagrams
  - 2.1.3 Two-dimensional problems

**3. Equilibrium**

- 3.1 Concurrent coplanar forces – algebraic 2-D problems
- 3.2 Non-concurrent forces

**4. Work and Energy**

- 4.1 Concept of work
- 4.2 Mechanical energy
  - 4.2.1 Kinetic energy
  - 4.2.2 Potential energy – gravitational and elastic
- 4.3 Conservation of energy
- 4.4 Power

**5. Uniform Circular Motion**

- 5.1 Centripetal acceleration
- 5.2 Centripetal force

**6. Rotary Motion**

- 6.1 Equations of uniform rotary motion
- 6.2 Torque
- 6.3 Moment of inertia
- 6.4 Rotational dynamics
- 6.5 Rotational energy
- 6.6 Rotational power

**7. Vibrations**

- 7.1 Periodic motion
  - 7.1.1 Period, frequency and amplitude
- 7.2 Simple harmonic motion
  - 7.2.1 Definition
  - 7.2.2 Circular motion and SHM
  - 7.2.3 Angular velocity and frequency
  - 7.2.4 Acceleration
- 7.3 Vibratory energy

## 8. **Waves**

- 8.1 Wave types
- 8.2 Wave characteristics
  - 8.2.1 Speed, wavelength, frequency, phase
- 8.3 Transmission between media
- 8.4 Wave equation
  - 8.4.1 Phase difference
- 8.5 Wave energy
  - 8.5.1 Intensity, intensity ratio, inverse square law
- 8.6 Interference
  - 8.6.1 Superposition theorem
  - 8.6.2 Beats
- 8.7 Standing waves and resonance
  - 8.7.1 Vibrating strings,
  - 8.7.2 Vibrating air columns
  - 8.7.3 Vibrating rods
- 8.8 Speed of sound
  - 8.8.1 Temperature effects
- 8.9 *Doppler effect – Optional material*

## 9. **Light**

- 9.1 Reflection
- 9.2 Refraction
- 9.3 Total internal reflection
- 9.4 Optical fibers
  - 9.4.1 Modes of propagation and dispersion
  - 9.4.2 *FOTS – Optional material*