

# CAMOSUN COLLEGE

## PHYSICS DEPARTMENT

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### **PHYS 195 PHYSICS for CIVIL ENGINEERING BRIDGE**

A physics course for students in the Civil and Mining Engineering Bridge program. Topics will be reviewed and expanded beyond those covered in technology programs including thermal energy, mechanical waves, sound, physical optics, geometric optics, elementary electricity and magnetism, simple AC and DC circuits.

OFFERED:	Q3
CREDIT:	4
IN-CLASS WORKLOAD:	4 Lec, 2 Lab
OUT-OF-CLASS WORKLOAD:	6
PREREQUISITES:	Restricted to students in the Civil and Mining Engineering Bridge Program or departmental permission

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### **OUTLINE**

#### **1. Thermal Energy**

- 1.1 Review of Temperature
  - 1.1.1 Temperature Scales
  - 1.1.2 Thermal Equilibrium
  
- 1.2 Thermal Expansion
  - 1.2.1 Mechanical model of materials
  - 1.2.2 Linear expansion
  - 1.2.3 Volume expansion
  - 1.2.4 Capacity problems
  
- 1.3 Heat
  - 1.3.1 Heat and thermal energy
  - 1.3.2 heat and mechanical work
  - 1.3.3 heat and temperature change
  - 1.3.4 Specific heat capacity
  - 1.3.5 Change of Phase
  - 1.3.6 Latent heat of fusion and vaporization
  - 1.3.7 Calorimetry

## 2. **Mechanical Waves**

- 2.1 Periodic Waves
  - 2.1.1 Wave velocity, frequency, period, wavelength
  - 2.1.2 Transverse and longitudinal waves
  - 2.1.3 Travelling waves in space and time
- 2.2 Wave velocity in an elastic medium
- 2.3 Energy in waves
- 2.4 Interference of waves
  - 2.4.1 Constructive and destructive interference
  - 2.4.2 Effect of frequency, amplitude and direction
  - 2.4.3 Standing waves
  - 2.4.4 Standing waves in a string
  - 2.4.5 Standing waves in air columns
  - 2.4.6 Beats
- 2.5. Sound
  - 2.5.1 Nature of pressure waves
  - 2.5.2 Decibel scale
  - 2.5.3 Doppler effect
  - 2.5.4 Shock waves

## 3. **Physical Optics**

- 3.1 Conditions for stable interference of light waves
  - 3.1.1 Coherence
  - 3.1.2 Monochromaticity
- 3.2 Young's double slit experiment
  - 3.2.1 Conditions for interference
  - 3.2.2 Interference pattern
  - 3.2.3 Intensity distribution
  - 3.2.4 Effect of initial phase
- 3.3 Thin films
  - 3.3.1 Phase on reflection
  - 3.3.2 wedge films
- 3.4 Diffraction
  - 3.4.1 Single slit diffraction
  - 3.4.2 Resolution
  - 3.4.3 Diffraction grating

## 4. **Geometric Optics**

- 4.1 Light at an interface
  - 4.1.1 Laws of reflection
  - 4.1.2 Laws of refraction
  - 4.1.3 Index of refraction
  - 4.1.4 Prisms
  - 4.1.5 Dispersion
  - 4.1.6 Total internal reflection
  - 4.1.7 Optical fibers

## 5. **Images in mirrors**

- 5.1 Plane mirror images
- 5.2 Concave and convex surfaces
  - 5.2.1 Images in Concave and convex surfaces
  - 5.2.2 Mirror equation
  - 5.2.3 Magnification
  - 5.2.4 Spherical aberration
  - 5.2.5 Parabolic mirrors
- 5.3 Images by refraction
  - 5.3.1 Refraction at a plane surface
  - 5.3.2 Refraction at a curved surface
  - 5.3.3 Refraction in thin lens
  - 5.3.4 Lens equation
  - 5.3.5 Magnification
  - 5.3.6 Aberrations
  - 5.3.7 Apparent depth
- 5.4 Optical Systems
  - 5.4.1 The simple magnifier
  - 5.4.2 The compound microscope
  - 5.4.3 The telescope

## 6. **Electrostatics**

- 6.1 Electric Charges
  - 6.1.1 Types of charges
  - 6.1.2 First law of electrostatics
  - 6.1.3 Conductors and insulators
  - 6.1.4 Coulomb's law
- 6.2 Electric field
  - 6.2.1 Concept

6.2.2 Due to point charges

6.2.3 Electric field lines

6.3 Electric potential

6.3.1 Electric potential energy

6.3.2 Potential difference

6.3.3 Equipotential surface

6.3.4 Potential in a uniform field

6.3.5 Potential near a point charge

## 7. **Electric circuits**

7.1 Parts of a circuit

7.1.1 Types of sources

7.1.2 Types of loads

7.1.3 Electric Current

7.2 Resistance

7.2.1 Ohm's law

7.2.2 Factors affecting resistance

7.2.3 Temperature dependence

7.2.4 Internal resistance of sources

7.2.5 Superconductors

7.3 Series circuits

7.3.1 Description

7.3.2 Characteristics

7.4 Parallel circuits

7.4.1 Description

7.4.2 Characteristics

7.5 Series-parallel circuits

7.6 Kirchhoff's Rules

7.6.1 Junction (current) rule

7.6.2 Loop (voltage) rule

## 8. **Magnetic fields**

8.1 Description

8.2 Force on a charge

8.2.1 Characteristics

8.2.2 Magnetic flux density

8.2.3 Generator principle

- 8.3 Magnetic force on a conductor
  - 8.3.1 In a uniform field
  - 8.3.2 Torque on a loop
  - 8.3.3 Motor principle

9. **Alternating Current**

TEXTS AND REFERENCES

Physics for Engineers and Scientists- Serway