

UNIT I- WAVES

TEXT REFERENCES:

Chapters 13 and 14

UNIT OBJECTIVES:

1. Define the terms period, frequency, wavelength and amplitude.
2. Determine the period of a simple harmonic oscillator when given the physical parameters of the system.
3. Construct graphs of Displacement vs. Time for an oscillating system which is undamped, underdamped, critically damped, and/or overdamped.
4. Use the wave velocity equation ($v = \lambda f$) to determine the unknown variable when the other variables are given.
5. Describe by definition and example the difference between transverse and longitudinal waves.
6. State the perceptual variables which correspond to frequency, intensity and harmonics, and give the frequency range for human hearing.
7. Convert a sound intensity from W/m^2 to decibels.
8. Use the Doppler effect to calculate the apparent change in frequency for a source moving toward or away from the observer.
9. State the Superposition Principle and determine the harmonic wavelengths for standing waves on a string.
10. Define resonance and determine the harmonic frequencies for resonance of air columns in pipes.

UNIT II - ELECTRIC FIELDS

OBJECTIVES

1. Define electric charge, and list important properties of charge.
2. Use the Law of Conservation of Charge to describe the process of charging an electrically neutral body.
3. Describe the difference between electrical conductors and insulators, indicating examples and uses of each.
4. Use Coulomb's Law to calculate the electrostatic force between electric charges.
5. Draw lines of force to describe the electric field created by distributions of charge.
6. Define electric field strength, calculate its value at a specified point in an electric field, and determine the force on a given charge placed at that point.
7. Define electric potential difference, calculate its value between two specified points in an electric field, and determine the work done on a given charge moved between the two points.
8. Describe how a device which produces an EMF can be used to accelerate a charged object, and then define the electron volt (eV).
9. Define capacitance, describe the construction and use of capacitors, and calculate the capacitance of a capacitor.
10. Given capacitors of known values connected to specified potential differences, calculate the charge and energy stored.

TEXT REFERENCES

Chapter 15

Chapter 16

Chapter 17

UNIT III - D.C. ELECTRIC CIRCUITS

OBJECTIVES

1. Define current, and indicate biologically significant currents.
2. Use Ohm's Law to determine the current through and/or potential difference across known resistances.
3. Determine the resistance of various materials of known resistivity.
4. Calculate the current flowing through devices of known power rating.
5. Determine the cost of using electrical appliances when given information on the price of electric energy.
6. Use Ohm's Law to analyze simple series and parallel electric circuits.
7. Determine the equivalent resistance of a combination series/parallel circuit.
8. Apply Kirchhoff's Network Laws to analyze a multi-loop resistive circuit.
9. Describe the result of a "short" in a circuit, and state the function of fuses and circuit breakers.
10. Describe how a simple series RC circuit works, and sketch a quantitative capacitor charging curve.

TEXT REFERENCES

Chapter 17

Chapter 18

UNIT IV- ELECTROMAGNETISM

OBJECTIVES

1.
 - a. Describe the difference between magnetized and unmagnetized iron.
 - b. Describe one method of demagnetization.
 - c. Describe what happens when a bar magnet is cut in half.
2.
 - a. Sketch the magnetic field of a bar magnet.
 - b. Sketch the earth's magnetic field.
3. Use the right hand rule to determine the direction of the magnetic field around current-carrying conductors.
4. Determine the magnetic field strength near a current-carrying long straight wire, a circular loop, or a solenoid.
5. Determine the force acting on a moving charge or a current-carrying wire placed in a magnetic field.
6. Describe the operation of a galvanometer or electric motor based on magnetic torque effects.
7. Indicate the quantity being measured, the meter resistance, and the method of connection for ammeters and voltmeters.
8. State Faraday's Law, and describe practical examples of the law in use.
9. Use graphs to illustrate the difference between pure DC, pure AC, and rectified AC currents.
10. Use the transformer equations to determine transformer voltages, currents and windings.

TEXT REFERENCES

Chapter 18, Section 4
Chapter 19
Chapter 20, Sections 1,2,3

UNIT V - ELECTROMAGNETIC RADIATION

OBJECTIVES

1. Explain why an accelerated electric charge is necessary for transmission of signals through a vacuum.
2. Sketch a diagram of an electromagnetic wave showing the E, B and v vectors or the relative orientation between them.
Indicate whether electromagnetic waves are longitudinal or transverse.
3. Explain how an outgoing electromagnetic wave produced by a transmitter/antenna is detected by a receiver.
4. Compare and contrast mechanical and electromagnetic waves.
5. List in order of frequency or wavelength seven regions of the electromagnetic spectrum, and give a practical use for each.
6. Indicate the range of wavelengths for visible light in meters, nanometers, and Angstroms.
7. Solve problems using the wave equation $c = \lambda f$.
8. Apply appropriate algebraic rules to solve quantitative problems involving interference of waves.
9. Apply appropriate algebraic rules to solve quantitative problems involving diffraction of waves.
10. Define polarization, explain how a simple polarizer (filter) functions, and list two other methods of polarizing light.

TEXT REFERENCES

Chapter 20, Section 4
Chapter 24, Sections 1-4

UNIT VI - LIGHT

OBJECTIVES

1. Explain the propagation of light in terms of rays, and illustrate your explanation with a neat sketch.
2. Define index of refraction, state Snell's Law, and use Snell's Law to determine the angle of refraction at a surface.
3. Determine the critical angle and/or the index of refraction for total internal reflection.
4. Use the thin lens equations to determine the position and size of images formed by converging and diverging lenses.
5. Determine if the image of an object formed by a lens is real or virtual, upright or inverted, and enlarged or reduced.
6. Draw a schematic diagram of a compound microscope or a modern astronomical telescope showing the various parts, light paths, images formed, and the types of lenses used.
7. Explain why a spectrum of color results when white light is passed through a prism, illustrating your answer with a neat sketch.
8. Identify on a sketch the parts of the human eye which are responsible for forming an image.
9. State the function of rods and cones, and explain how they differ.
10. Explain the basic ideas of color vision.

TEXT REFERENCES

Chapter 22, Section 1-4
Chapter 23, Section 1,3,5
Chapter 25, Section 1,2,3,5

UNIT VII - QUANTUM MECHANICS

OBJECTIVES

1. State the problem with blackbody radiation as encountered by classical physics, and describe Planck's solution to the dilemma.
2. State the essential features of the photoelectric effect and Einstein's explanation for the phenomenon.
3. Apply Einstein's equations to analyze photoelectric effect phenomena.
4. Describe Bohr's model of atomic structure, and explain how it accounts for the emission of discrete wavelengths of electromagnetic radiation (line spectra).
5. Determine energy levels using Bohr's equations as applied to the hydrogen atom.
6. Explain why most objects do not demonstrate de Broglie's matter waves, illustrating your answer by calculating particle wavelengths.
7. Resolve the apparent wave-particle duality conflict for quantum entities in terms of experimental designs.
8. Describe the essential features of Schroedinger's Wave Theory.
9. Apply Heisenberg's Uncertainty Principle to determine the uncertainty in a particle's position, velocity or momentum.
10. State the Pauli Exclusion Principle, and indicate possible sets of quantum numbers for a given atomic electron state.

TEXT REFERENCES

Chapter 27, Section 1-4
Chapter 28, Section 1-4

UNIT VIII - NUCLEAR ENERGY AND RADIATION

OBJECTIVES

1. Define and/or identify the following terms:

Radioactivity	Alpha Ray
Proton	Beta Ray
Neutron	Gamma Ray
Isotope	Half-life
Nucleon	Binding Energy

2. Given the atomic number and mass number of a parent atom, apply the Nuclear Conservation Laws to determine the atomic number and mass number of a daughter atom after radioactive decay, or perform the converse operation.
3. Given the amount or activity of a radioactive sample and its half-life, determine the remaining amount or activity after a given period of time, or perform the converse operation.
4. Define in one or two sentences:
 - a. Nuclear fission
 - b. Chain reaction
 - c. Nuclear fusion
5. Sketch the nuclear binding energy curve, and use it to explain why both fission and fusion processes release energy.
6. Describe what happens when α , β , and γ rays strike and interact with matter, as well as how and why this occurs.
7. Define the curie and the rad, and then determine the activity of a radioactive source.
8. List and describe five industrial uses of radiation.
9. Determine the absorbed dose in rads and rems for radiation exposures.
10. Describe in a paragraph somatic and genetic effects of human exposure to radiation.
11. Describe medical diagnostic and treatment techniques which use ionizing radiation.

TEXT REFERENCES

Chapter 29
Chapter 30, Section 1-4