NS 545 Concepts in Physics VI: Electromagnetic Induction and Physical Optics
Course Schedule

N.B.: The schedule below has not yet been adapted to the blended schedule of online and in-class meetings. Course readings may vary between course offerings.

Session 1: Faraday’s Law

Sections from Cutnell & Johnson: 22.1 – 22.4, 22.10
Philosophy/History/Education Research: Faraday and his experiments.
Laboratory experiment: Investigating the interactions between a magnet and a coil connected to a galvanometer.

Reading assignment for Session 3:

Optional reading:

Session 2: Lenz’s Law.

Sections from Cutnell & Johnson: 22.2
Laboratory experiment: “Faraday’s Law”

Web assignment 1

Session 3: Motional emf and eddy currents.

Sections from Cutnell & Johnson: 22.5
Philosophy/History/Education Research: The mechanical view of electromagnetic phenomena.
Laboratory experiment: Eddy currents
Applications: Train brakes.

Reading assignment for Session 6:

Recommended reading:

Session 4: Transformers and Generators

Sections from Cutnell & Johnson: 22.7 – 22.8, 22.10
Demonstrations: A generator and a motor; a transformer.
Laboratory experiment: “Generating electricity”
Mathematics and Problem-Solving: Ideal transformers.
Applications: Power generation and transmission.

Web assignment 2

Session 5: Test 1; Electromagnetic Waves and Polarized light.
Sections from Cutnell & Johnson: Chapter 24.
Test 1: 1-hour test on sessions 1-4.
Applications: Radio and television; microwave ovens.
Laboratory experiment: “Polarized light”
Mathematics and Problem-Solving: Solving problems using Malus’ law.

Session 6: The interference of light.
Sections from Cutnell & Johnson: 27.1, 27.2, 27.10
Philosophy/History/Education Research: Huygens and he wave theory of light.
Laboratory experiment: “Interference and Diffraction”
Applications: Radar detectors; The Doppler shift as a tool in Astronomy.
Web assignment 3
Reading assignment for Session 7:

Session 7: Interference and Diffraction.
Sections from Cutnell & Johnson: 27.5 – 27.9
Laboratory Experiment: “Interference and Diffraction”
Mathematics and Problem-Solving: Solving problems involving single and double slits.
Reading assignment for Session 8:

Session 8: Thin-film interference.
Sections from Cutnell & Johnson: 27.3, 27.10
Philosophy/History/Education Research: Discussing Newton’s Opticks.
Demonstrations: Various thin films.
Applications: Soap bubbles; non-reflective coatings.
Web assignment 4
Reading assignment for Session 10:
  • Articles from Selections from Physics Education Research Literature as listed above in the bibliography.

Session 9: Test 2; Inductors and Inductance.
Sections from Cutnell & Johnson: 22.9
Test 2: 1-hour test on sessions 6 – 8.
Laboratory experiment: “RL Circuits”
Mathematics and Problem-Solving: Using exponentials.
Session 10: Introduction to AC Circuits.
Sections from Cutnell & Johnson: 23.1 – 23.4
Laboratory experiment: “Introduction to AC Circuits”
Mathematics and Problem-Solving: Understanding the impedance triangle.
Web assignment 5

Session 11: RLC Circuits and Resonance
Sections from Cutnell & Johnson: 23.5 – 23.7
Laboratory experiment: “RLC Circuits”
Mathematics and Problem-Solving: Applying the impedance triangle.

Session 12: Presentations
Philosophy/History/Education Research: Students’ presentations
Web assignment 6

Session 13: Test3; Course wrap-up.
Review of AC Circuit concepts and applications.
Take home exam.
Hand in journals.
Course evaluation.

Bibliography

Selections from primary sources


Selections from secondary sources


**Selections from Physics Education Research Literature**


