3306 physics lectures, Spring 2026

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https://www.physics.smu.edu/saptaparnab/PH3306_Spring_2026/
Based on Simon Dalley's lectures delivered in spring 2025

WARM UP 14-16: Superconductivity (Halliday: 26.2 & 26.4), Electromagnetic waves (Halliday: 33.1 & 33.3), and Polarization & Reflection & Refraction (Halliday: 33.4 & 33.7)

Write your answers in the space following the warm-up question if you can. Write as if you are explaining to a fellow student. If you need more space, you are probably over-thinking things.

Define current and current density

Explain why superconductors do not display electrical resistance below the critical temperature.

Describe the behavior of the magnetic field $\vec{B}$ inside and outside a superconducting material below its critical temperature.

Can electromagnetic waves be transverse, longitudinal, or both?

Can you see electromagnetic waves of wavelength 5 x 10^{-5} m with your eyes? Explain why or why not.

Roughly what wavelength of electromagnetic waves does your phone emit/absorb?

What is the energy density of an electromagnetic wave in terms of the electric field magnitude $\vec{E}$?

Two radio dishes (shaped like bowls) are receiving signals from a radio station which is sending out radio waves in all directions with power P. Dish 2 is twice as far away as Dish 1, but has twice the diameter. Explain which dish receives more power on average.

Why does a plane electromagnetic wave travel at constant speed yet there is a force associated with it on an object placed in its path?

What defines the polarization direction of electromagnetic waves?

Explain why Snell's law breaks down above a certain angle of incidence.

Explain why blue light is refracted more than red light.

How many reflections from water droplets are necessary to make a secondary rainbow?

Explain what happens to the polarization of light when it is incident on an interface at the Brewster angle.