22.105 Curriculum

1. **Electrostatics**
    - **A. Theory**
        - **a. Coulomb's law**
        - **b. Gauss's law**
        - **c. Potentials**
        - **d. Laplace and Poisson equations**
        - **e. Forces and energy**
        - **f. Solving electrostatic problems**
    - **B. Applications**
        - **a. Capacitors and resistors**
        - **b. Field concentration around corners'**
        - **c. Child-Langmuir law**
2. **Magnetostatics**
    - **A. Theory**
        - **a. Ampere's law**
        - **b. Vector potential**
        - **c. Biot-Savart law**
        - **d. Forces and energy**
        - **e. Solving magnetostatic problems**
    - **B. Applications**
        - **a. Magnets**
        - **b. Inductors**
        - **c. Superconducting magnets**
3. **Single Particle Motion**
    - **A. Theory**
        - **a. Lorentz force**
        - **b. Conservation laws**

B. Applications

a. Motion in a DC magnetic field

b. Spectrometers

c. Electrostatic accelerators

d. Magnetostatic accelerators

e. Density limit in a charged particle beam

4. Quasi-statics

A. Theory

a. Faraday's law

b. Low frequency Maxwell equations

B. Applications

a. Transformers

b. Ignition coil

c. Pulsed power supply

d. Magnetic diffusion

5. Electromagnetic waves

A. Theory

a. Displacement current

b. Full Maxwell equations

c. Forces and energy

B. Applications

a. Plane waves

b. Reflection, refraction, absorption, transmission

c. Transmission lines

d. Waveguides

e. Klystrons, gyrotrons

6. Electromagnetic Radiation

A. Theory

a. Coulomb and Lorentz gauge

b. Lienard-Wiechert potentials

c. Radiation by an accelerating charge

B. Applications

a. Radiation from a dipole antenna

b. Thomson scattering

c. Compton scattering, photoelectric effect

d. Synchrotron radiation

e. Bremsstrahlung radiation

f. Cerenkov radiation