1. Write and explain the **Maxwell's equations** in differential form. (10%)

2. What is the *characteristic impedance* of a parallel-plate transmission line with perfectly conducting plates. (10%)

3. Classify the magnetic behaviors of the *Diamagnetic, Paramagnetic,* and *Ferromagnetic* materials. (10%)

4. When a capacitor is immersed in a medium having conductivity σ, a resistance R is measured between the terminals. Show that, regardless of the geometry of the capacitor, $RC = \varepsilon/\sigma$, where ε is the dielectric constant of the medium and C is the capacitance in the medium. (20%)

5. Obtain the electric field intensity along the axis of a uniform line charge of length L. The uniform line-charge density is ρ. (20%)

6. A plane electromagnetic wave is normally incident from vacuum on a plane surface film of uniform thickness d covering a semi-infinite dielectric substrate. Assume that $\mu = 1$ for both media, and the film and substrate have indices of refraction n_1 and n_2. Find an expression for the wave reflected into the vacuum in terms of n_1, n_2, and the vacuum wavelength λ. Under what conditions will the reflected wave vanish? (30%)