1. (10%) Does $\mathbf{A} \cdot \mathbf{B} = \mathbf{A} \cdot \mathbb{C}$ imply $\mathbf{B} = \mathbf{C}$? Explain.

2. (10%) State the divergence and Stokes's theorems in words.

3. (10%) Sketch the electric field lines of an electric dipole and the magnetic flux lines of a magnetic dipole respectively.

4. (10%) Determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in the opposite direction. The wires are separated by a distance d.

5. (10%) In a time-varying situation how do we define a good conductor? A lossy dielectric?

6. (10%) The electric field intensity of a plane wave in free space is
   $$\mathbf{E} = \mathbf{a_x} E_0 \cos(\omega t - kz).$$
   Determine the magnetic field intensity $\mathbf{H}$ in phasor expression.

7. (10%) The polarization vector in a dielectric sphere of radius R_0 is $\mathbf{P} = \mathbf{a_R}P_0.$ Determine
   a) the equivalent polarization surface and volume charge densities, and
   b) the total equivalent charge on the surface and inside the sphere.

8. (10%). Explain why a single-conductor waveguide can not support TEM waves.

9. (10%) Assume that the standard for personal safety in a microwave environment is that the power density be less than 10 mW/cm^2. A cell-phone emits EM-wave at 1.8 GHz with 200 V/m in amplitude of electric field intensity. Determine weather the cell-phone is allowed to be used under the standard. You have to show your calculation.

10. (10%) A quarter-wave transformer is used to match a 75 Ω transmission line with a 120 Ω load. Find the characteristic impedance of the quarter-wave transformer.