1. (*20 Points*)

   (a) Write down Maxwell's equations in differential form.

   (b) Prove that the four Maxwell's equations are not totally independent.

2. (*15 Points*)

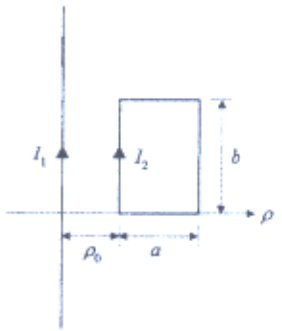
   A coaxial cable is formed by two concentric cylinders of radii 1 cm and 3 cm. With only air as the dielectric between the two conductors, the cable can withstand a potential difference of 600 V before breakdown. If the space between the two cylinders is partially filled with a dielectric cylinder of relative permittivity $\varepsilon_r = 10$ for 1 cm < r < 2 cm, what is the breakdown voltage of this cable?

3. (*15 Points*)

   A coaxial cable contains an insulating material of conductivity σ. If the radius of the central wire is a and that of the sheath is b, find the conductance G of the cable per unit length.

4. (*15 Points*)

   Find the mutual inductance between the rectangular loop and the infinite line current, as shown in the figure.



5. (*20 Points*)

   A distortionless line operating at 120 MHz has $R = 20\ \Omega$/m, $L = 0.3\ \mu$H/m, and $C = 63$ pF/m. (a) Determine the propagation constant γ, phase velocity v, and characteristic impedance Z_0. (b) How far will a voltage wave travel before it is reduced to 20% of its initial magnitude? (c) How far will it travel to suffer a 45° phase shift?

6. (*15 Points*)

   Design a single-stub network to match a $25-j50\Omega$ load to a 50Ω transmission line. What is the

(背面仍有題目,請繼續作答)

VSWR on each section of the transmission lines in your design? (Note: you may use the Smith chart below, *temporarily*. But don't forget to write down important procedures and results on your answer sheet. Otherwise they could not be graded.)