※ 考生請注意：本試題 ☑可 □不可 使用計算機

1. A long, grounded conducting cylinder of radius a is placed along the z-axis in an initially uniform electric field $\mathbf{E}_0 = \mathbf{a}_x E_0$. Determine the potential distribution V and electric field intensity $\mathbf{E}$ outside the cylinder. (15%)

2. Three point charges are placed at the vertices of an equilateral triangle with the side of one meter. Each point charge carries +1 μC. Determine the force on each charge, the magnitude of the electric field at the center of the triangle, and the magnitude of the electric field at the mid-point of one side of the triangle. (15%)

3. Two large parallel plates of area A are separated with a distance d, and maintained at potentials 0 and V. A third similar plate, carrying a charge q, is isolated from the other two and placed at the midway between them. Determine the potential of this plate. (20%)

4. The dipole antenna is found to be very effective in sensing electromagnetic radiation. Determine a suitable length of dipole antenna that works for the FM band of 88 – 108 MHz. (20%)

5. An electron beam has a circular cross-section of radius R, and the charge density within the beam is $-\rho$. Determine the electric field within the beam and outside the beam. (15%)

6. An electronic circuit is designed to operate at 1 MHz. To minimize the electromagnetic interference with nearby systems, it is desirable to enclose the circuit in an aluminum box. If the radiation set by the circuit produces an electric field of 100 mV/m on the inner surface of the box and no more than 1 mV/m is permissible outside, determine the minimum thickness of aluminum required. (The conductivity of aluminum is assumed to be 3.54 x 10^{-7} S/m.) (15%)