## Electromagnetic Engineering-2022

### Final Exam (75 minutes)-Open Book

### Q1 (3.5 point)

The object consists of the semi-cylinder with charge density $\sigma_1 \sim \sin\varphi$ in cylindrical coordinate and the rectangular ground with surface charge density $\sigma_2 = k - $ constant as in Fig. 1. Find the electric field at the point P far from the object.
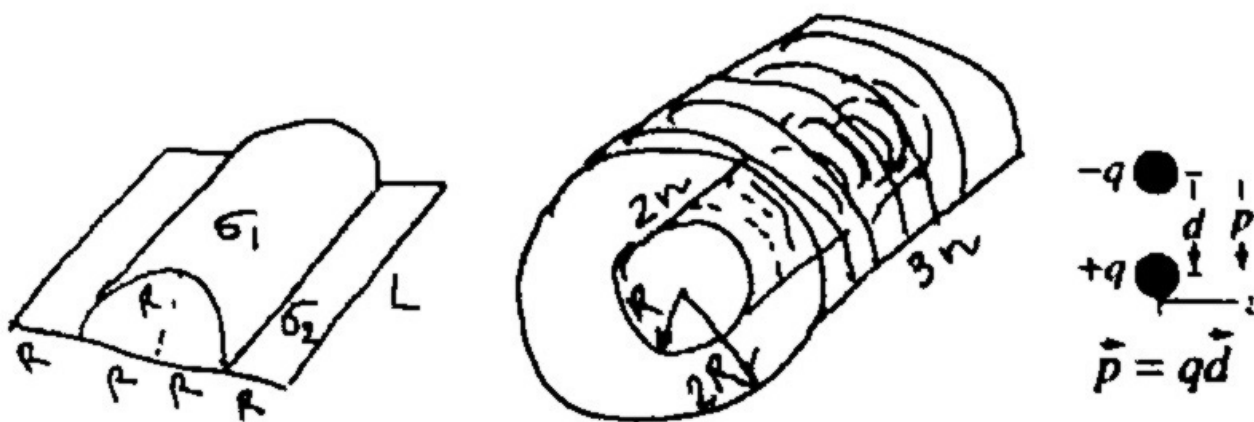


Fig.1 Semi-cylinder and its ground Fig.2 Two solenoids    Fig.3 Electric dipole

### Q2 (4 points).

There are two solenoids with their radii R and 2R and with their number of loops per unit of length are 2n and 3n respectively as in Fig.2 . This two solenoids are coincide. Given a particle with mass $m$ and flying with a constant velocity $v$ in the magnetic field of the two solenoids in circular orbit. Find the radius of the orbit of the particle.

### Q3 (2.5 points)

A electric dipole (Fig. 3) with its moment vector $p$ rotates with the angular velocity $\omega$, around an axis which is perpendicular to the vector $p$. The rotating axis is coincide to the vector $\mathbf{B}$, the uniform magnetic field. Find the drift velocity of the electric dipole in the magnetic field if the mass of the dipole is $m$ and constant angular velocity.