1. Describe the following terminologies.(25%)
   (a) Doppler effect, (b) Skin depth, (c) Bio-Savart law, (d) Hall effect,
   (e) Coulomb's law.

2. A conducting material of uniformly circular cross section and conductivity s has the shape of a half of the toroid, with inner radius a and and outer radius b, as shown in Figure 1. Determine the resistance between the end faces.(15%)

3. Write the set of four differential form of Maxwell's equations as eight scalar equations in Cartesian, cylindrical, and spherical coordinates, respectively.(15%)

4. Show that a plane wave with an instantaneous expression for electric field
$$E(z,t)= a_x E_{10} \sin(wt-kz)+a_y E_{20}\sin(wt-kz+f)$$
is elliptically polarized. Find the polarization ellipse.(15%)

5. A cylindrical bar magnet of radius a and length L has a uniform magnetization $M=a_z M_0$ along its axis as shown in Figure 2. Find the magnetic flux density at an arbitrary distant point p(x,y,z).(15%)

6. In measuring the low voltage of biopotentials from our body, what steps do you suggest to take for increasing the signal-to-noise ratio? Describe them based upon the principles of electromagnetism.(15%)
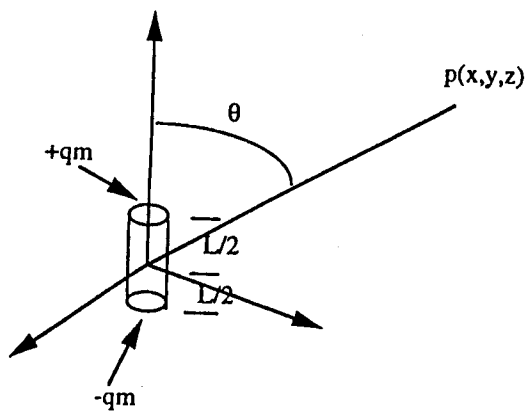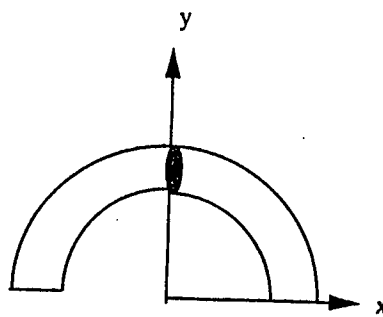
Figure 2

Figure 1