

THE UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING Dept of Electrical & Electronic Engineering

EEE 3352: Electromechanics and Electrical Machines

ASSIGNMENT 2: ELECTROMAGNETIC FIELDS (*Due 18/10/2022*)

1.

A parallel plate capacitor has two plates each of area 0.02 m^2 and separated by a mica sheet of thickness 0.5 mm. If the relative permittivity of mica is 6, find the capacitance of the capacitor.

The capacitor is charged to a p.d. of 100 V between the plates and is then isolated from *the* supply. The sheet of mica is removed without altering the distance between the plates and without allowing any charge to leak away. What is the new value of p.d. between the plates?

2.

A toroid is wound with 300 turns on a plastic ring having a cross-sectional area of 400 mm^2 and a mean circumference of 350 mm. The plastic material has a relative permeability of 2. Calculate (a) the inductance of the coil

(b) the induced e.m.f. when the current is reduced at the rate of 200 A/s.

3.

What force can one pole of an electromagnet exert on a movable steel object if there is a uniform air gap of 5 mm between them, the area of the pole end face is 10^4 mm^2 , the magnetic flux density is 0.5 T? Assume that the flux path has negligible reluctance apart from the airgap. What is the stored energy in the magnetic field in the airgap?

If for the case above the airgap were increased to 8 mm and the flux remained the same, what force would be exerted?

4.

The plates in a paralel plate capacitor are free to press on the dielectric. If the plates are 5 cm square, the gap of 1 mm is completely filled with a slab of dielectric with ε_r =3 and 1 kV is applied, what is the total force on the plates?

Dr A Zulu 11/10/2022