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Answer all the following questions

1)General:-

Q1(10D): Write the Maxwell's Equations of electromagnetic fields. Then drive the general form of Laplace's Equations in terms of:

1- The electric voltage potential. 2- The magnetic scalar potential.

Q2(10D): What is meant by boundary conditions? Determine the relation between the components of magnetic fields (B&H) between two different ferromagnetic materials. Also the similar equations of electric fields(D&E).

2)Electrostatic fields:-

Q2(20D): a) Drive the capacitance equation of cylindrical capacitor with two dielectric layers.

b) If the radii of the two cylindrical capacitor are 1500 mm, 1000 mm respectively and the insulator material has $\epsilon_r = 7$, calculate:

1- the capacitor capacitance.

2- the charge of each cylinder if the potential difference between the conducting surfaces is 1000v.

3- the capacitor stored energy.

Q3(20D): Figure 1 shows a cross section, el-vision view, of an electrostatic cell. The area of two parallel plates are equal and each has 1.0 m^2, a = 100 mm. If V_H=1500Kv, V_L=0.0v and $\epsilon_1 = 5\epsilon_2 = 7$, using 2DFEM as a numerical method, calculate:

1- the electric flux density in each element between the two plats.

2- the electric stored energy in each material.

3- the cell capacitance.

3) Magnetostatic fields:-

Q4(20D): Figure 2 shows a cross section, el-vision view, of two magneto-static cells, a=10mm. Both have the same dimensions and air gap and used to produce 0.6 T, flux density in the air gap. Fig.2-(a) shows a soft iron core with. dc exciting coil has 1000 turns, while Fig.2-(b) shows a permanent magnet cell. Calculate:1- the exciting current for (a).

2- the permanent magnet length and volume for (b).

Q5(20D): If a composite sheet is put into the air gap of any cell, as shown in Fig.2-(c). Using 2DFEM to calculate:

1- the magnetic flux density in each element.

2- the inductance of the air gap.

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