February 12, 2021 Student name (Block capitals):

Theory	Task1	Task2	Task3	AddOns	Result

1. Coulomb's law.

2. Ohm's law – both [integral and differential] notations

3. Four [main] Maxwell equations.

4. Dynamic definition of self- and mutual inductance(s).

5. Boundary conditions for E, D – interface between two dielectrics – tangential components
6. Boundary conditions for B, H – interface between two magnetics – normal components

7. Biot-Savart's law

8. Wave equation for E

9. Wave impedance as a function of frequency and material properties

10. Poynting vector – definition

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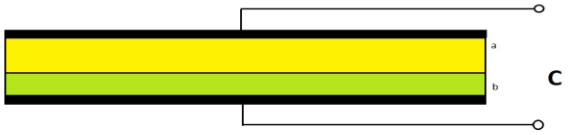
TASK 1:



A capacitor dielectric consists of two plain sheets of dielectric materials a and b, see Fig. <<<.

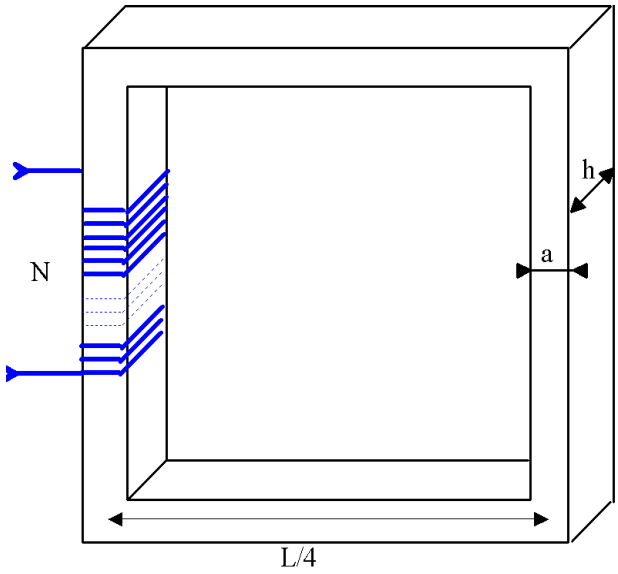
Thickness t_a = 5 mm, t_b = 2 mm, material properties: ε_{ra} = 4, ε_{rb} = 6, E_{ma} = 3 MV/m, E_{mb} = 5 MV/m. Sheet dimensions are 2m x 2m x t_a, 2m x 2m x t_b.

Find out:

a) Capacitance **C** of the capacitor (5p)

b) Breakdown voltage of the capacitor (5b)

TASK 2:



A ferromagnetic core (see Fig. <<<) has the following properties: Average fluxline length L = 0.2 m, relative permeability μ_r = 950, h = 2a = 10 mm. The core ic completed by N turns of a wire, forming an inductor.

Specify:

a) The number of turns N resulting in inductance of 1 H. (5p)

b) Current fed into the inductor resulting in core flux density B=1T. (5p)

TASK 3:

A coaxial cable has air dielectric and the following dimensions : r_a = 2 mm, r_b = 4 mm.

Specify:

a) The characteristic impedance of the cable (5p)
b) Breakdown voltage of the cable (E_m = 3 MV/m) (3p)
c) Maxima of RF power delivered through the cable to a load (time average value) (2p)