Examination like tasks workshop 6 (Lecture 11 and 12)

A/

Inductive sensors normally measure rotation but also to some extent distance. A small short coil (= the sensor) is placed in the field from a large but short coil. How does the mutual inductance depend on the distance between the two coils? How does it depend on rotation angle of gthe small coil?

The small coil is always on the symmetry axis of the large.

B/

Credit card readers are in principle made from a small coil reading the field of the cards permanent magnetization. The coil is connected to measurement device that can measure either voltage or energy (see it as voltage x current x time).

One is often directed to pull the carder fast through the reader.

How does doubling the speed affect the voltage and the energy?

C/

Buying a permanent magnet often mean that you have to read something like: “This magnet can give a magnetic field of 120 mT”. What can that mean? (It can mean two different things)

D/

An electromagnet made from the material whose hysteresis curve is given in the hand out has a μr= 240 before permanent magnetization has set in. Plot the field as function of airgap if the magnet is in the form an and horseshoe and it lifts an object with the same cross section as the magnet. The object has μr = 300. NI = 2000 A.

D’/

Same situation but the magnet is now permanent (NI=0)

E/

The wave equation is mostly derived under the condition of j = 0.

If we allow small current densities $j = \sigma E$ (σ=conductivity = 1/ resistivity) the solution will of coursa change .

Investigate how by doing the following:

1/ Assume we have a plane wave in the z –direction

2/ Assume the wave is stationary i e the only time dependence is the phase

3/ How are the solutions affected by σ ?