TUTORIAL QUESTIONS_ALTERNATING CURRENTS

Question 1

a.) An eddy current is an induced current flowing in a mass of metal, such as the core of a transformer or metal disc.

Eddy currents are used in electromagnetic braking system, for example, in trains where energy for the eddy currents comes from the kinetic energy of the trains and the eddy current themselves provide the braking force.

Eddy current are a disadvantage in the cores of transformers where energy is wasted in raising the internal energy of the core. (energy is lost as heat).

b.) i.) When there is a change of flux linkage, there will be induced emf. Since the core is a conductor, the induced emf creates current in the core itself. These currents are known as eddy currents. They flow in a circular fashion inside the core.

ii.) By laminating the core, the thin sheets of iron in the core are separated by a non-conductor so eddy currents cannot flow from one sheet to another. This reduces eddy currents and heat that they create in the core.

Question 2

$V_S / 5 = 2000 / 500$

$V_S = 20$ v

Question 3

$12/ 240 = 2400 / N_p$

$N_P = 48\,000$ TURNS

Question 4

a.) $P_{gen} = VI = 2 \times 10^6$

$I = 2 \times 10^6 / 4000 = 500$ A

$P_{loss} = 500^2 \times 2 = 5 \times 10^5$ W

b.) $P_{gen} = VI = 2 \times 10^6$

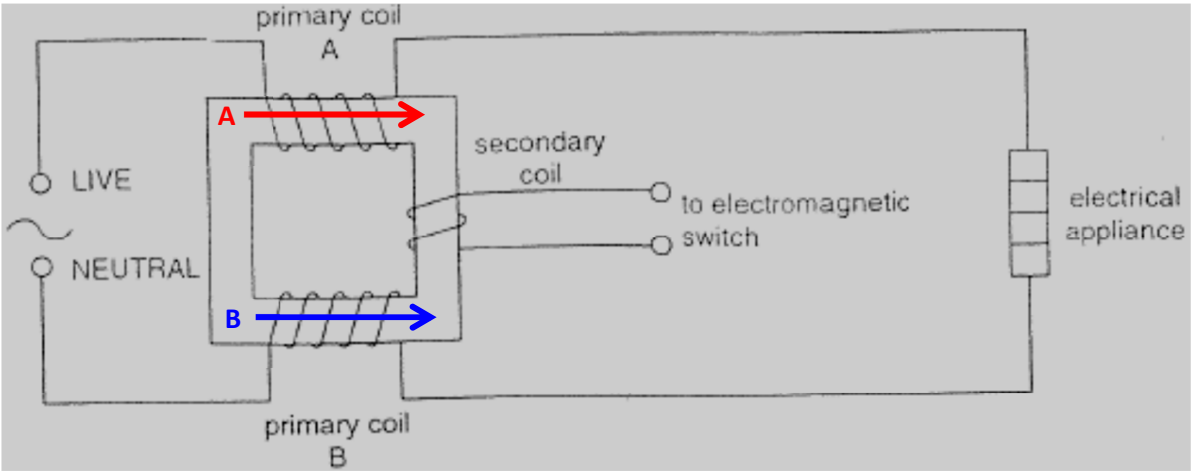
$I = 2 \times 10^6 / 4 \times 10^5 = 5$ A

$P_{loss} = 5^2 \times 2 = 50$ W

Question 5

a.) the primary coil A alone (label this arrow A),

b.) the primary coil B alone (label this arrow B),



c.) For an induced emf, there must be a change in flux linkage. Since there is no resultant flux in the secondary coil as flux from primary coil A and B cancels out each other, thus there is no change of flux, and therefore no induced emf.

A fault develops in the electrical appliance such that there is a current to earth. As a result, the current in the primary coil A no longer equal to that in coil B. State and explain the effect of this fault on

e.) Flux is no longer zero because flux due to A is not cancel by flux due to B.

f.) an emf is induced because the resultant flux will be changing due to the alternating current.

Question 6

a.) $V_0 = \sqrt{2} \times 6.0 = 8.5$ V

sensitivity = 8.5 / 1.7 OR sensitivity = 8.5 / 1.6

= 5.0 V cm^{-1} **= 5.3 V cm^{-1}**

b.) Negative peaks with same peak value (magnitude) occur at second half of the cycle. Period is the same.

Question 7

a.) $P_{gen} = VI = 4400$ kW

I (rms) = 4400 k / 11 k = **400 A**

b.)

i.) the ratio N_s/N_p required for transformer T = **25**

ii.) the ratio N_s/N_p required for transformer U = **0.04**

iii.) the current in the supply cables = 400 / 25 = **16 A**

c.) With current of 400 A travelling the whole distance of the cables, the heating effect in the cables will be very large. This will give low efficiency as power loss as heat is large.

d.) Peak value is the maximum value of an a.c.

Rms value is the steady value which delivers the same average power as the a.c. to a resistive load.

e.) $I_{peak} = 400 \times \sqrt{2} =$ **566 A**

Question 8

Refer to notes.

Question 9

a.) Less pronounced ripple.

b.) Less pronounced ripple.