TUTORIAL QUESTIONS_ALTERNATING CURRENTS

Question 1

a.) What is eddy current? State one exmaple where eddy current is useful and one where they are disadvantage.

b.) In a transformer, the core on which the primary and secondary coils are wound is laminated, i.e. the core is made up of a large number of strips, rather than being solid. This reduces energy losses due to currents induced in the core. Explain

i.) how these currents arise in the core

ii.) why laminating the core reduces energy losses due to the currents.

Question 2

The primary coil of a transformer has 500 turns and the secondary coil 2000 turns. A 5 V alternating supply is connected to the primary. Calculate the voltage across the secondary.

Question 3

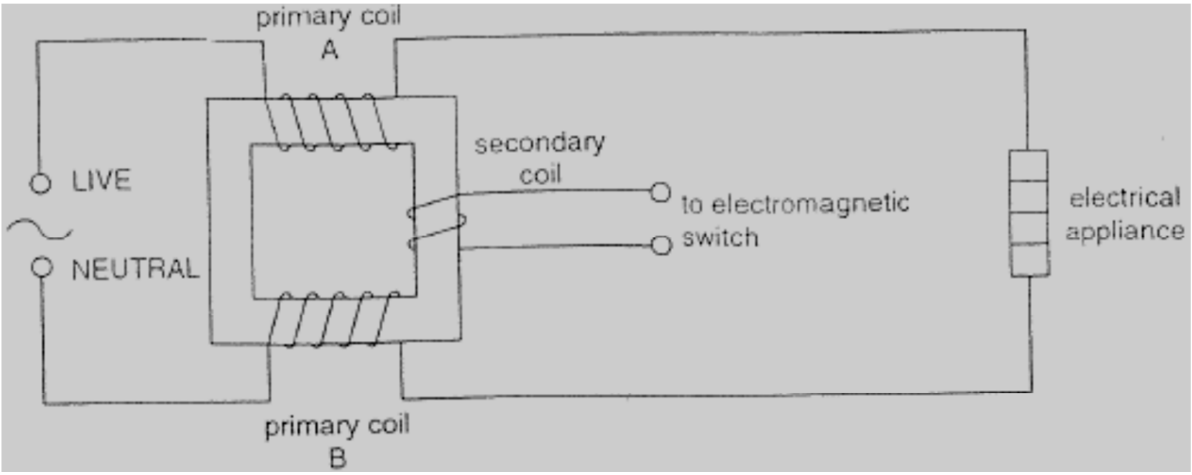
In order to light a 12 V lamp, a transformer with 2400 turns in the secondary coil is used to step-down the voltage of the a.c. mains (240 V). Calculate the number of turns in the primary coil.

Question 4

Calculate the power loss in transmitting 2 MW of electrical power through cables of total resistance 2 Ω, if the voltage is a.) 4000 V b.) 400 kV

Question 5

A protective device in a mains circuit consists of a transformer with two primary coils A and B and a secondary coil, as shown. The primary coils each have the same number of turns and are wound in opposite directions on the core.



The main supply is connected in series with the two primary coils and the electrical appliance. The secondary coil is connected to an electromagnetic switch. At one particular moment, the live lead is positive with respect to the neutral lead. On the diagram, mark arrows to indicate the directions of the magnetic field in the transformer core due to

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

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

c.) Hence explain why there is no emf induced in the secondary coil.

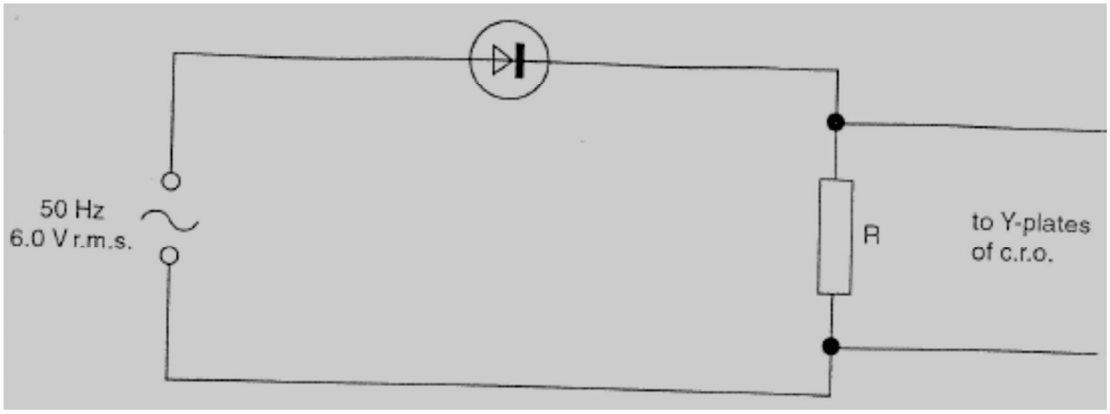
A fault develops in the electrical appliance such that there is a current to earth. As a result, the current in the primary coil A no longer equal to that in coil B. State and explain the effect of this fault on

e.) the magnitude of the flux in the core of the transformer.

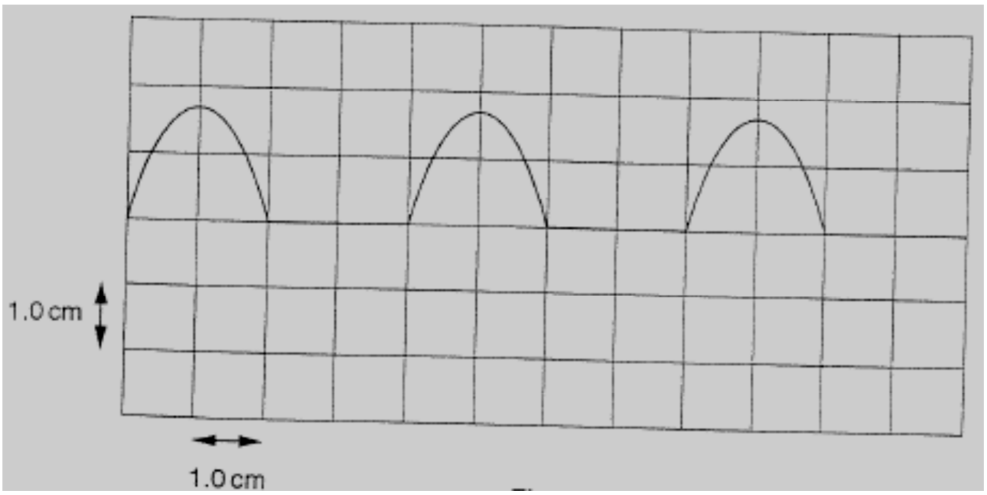
f.) the emf induced in the secondary coil.

Question 6

Figure shows a circuit diagram for a half-wave rectifier. The supply to the rectifier is rated as 50 Hz, 6.0 V rms.



A cathode ray oscilloscope (c.r.o) has its Y-plates connected across the load resistor R and the trace is seen below.

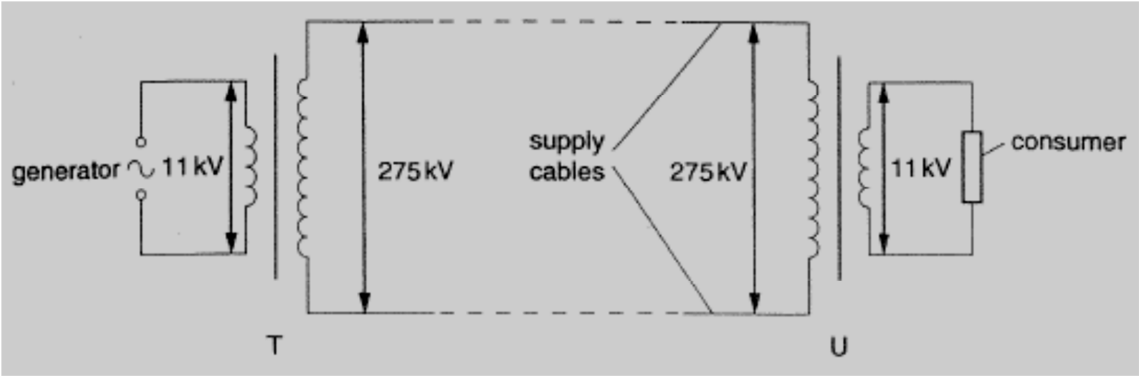


a.) Calculate the Y-plate sensitivity of the c.r.o. (unit in Vcm^{-1})

b.) On the diagram, draw a line to represent the trace seen when the connection to the diode is reversed.

Question 7

Electric power of 4400 kW is supplied to an industrial consumer at a considerable distance from a generating station. This is represented in figure below.



In order to do this, the electricity supply company makes use of a circuit containing two transformers, T and U. The transformers can be considered to be ideal and the supply cables to have negligible resistance.

a.) The power is generated at 11 kV r.m.s, and is supplied to the consumer at 11 kV r.m.s. Calculate the r.m.s current supplied to the consumer.

b.) There is a potential difference of 275 kV r.m.s. between the supply cables. Calculate

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

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

iii.) the current in the supply cables. (unit in A r.m.s)

c.) Explain why, when the resistance of the supply cables cannot be neglected, this arrangement is preferable to a system which generates and transmits the power at the same voltage of 11 kV r.m.s.

d.) Explain the distinction between the r.m.s value and the peak value of an alternating current.

e.) Find the peak value of the current.

Question 8

Sketch the following voltage patterns:

a.) A sinusoidal voltage graph

b.) The same voltage as (a), but half-wave rectified.

c.) The same voltage as (b), but smoothed.

d.) The same voltage as (a), but full-wave rectified.

e.) The same voltage as (d), but smoothed.

Question 9

A bridge rectifier circuit is used to rectify an alternating current through a resistor R. A smoothing capacitor C is connected across R. Figure below shows how the current varies. Use sketches to show the changes you would expect:

a.) if R was increased.

b.) if C was increased.