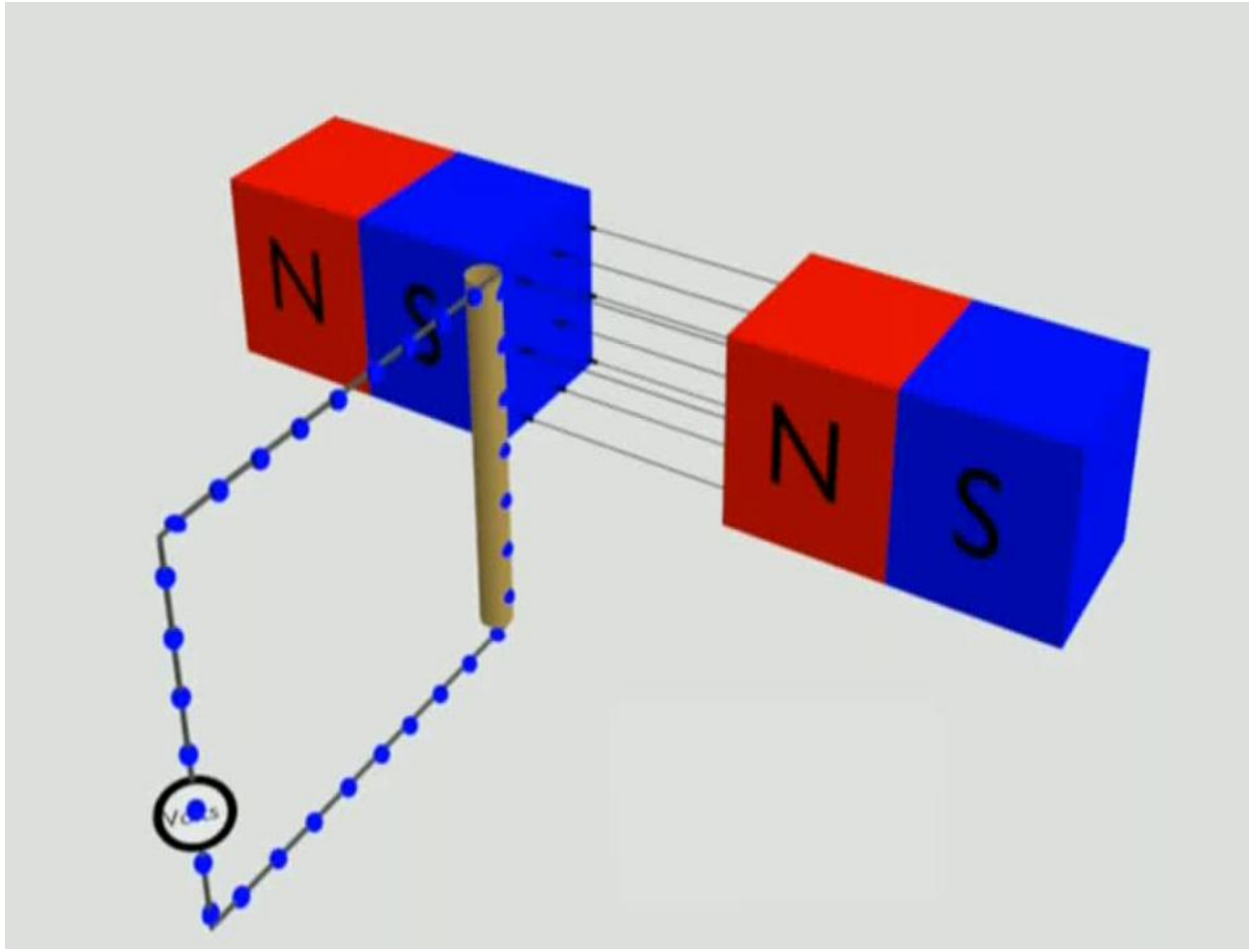
Practical No: 4

Aim: Understand the phenomenon of self-induction and mutual-induction.

Electromagnetic Induction

Electromagnetic Induction or Induction is a process in which a conductor is put in a particular position and magnetic field keeps varying or magnetic field is stationary and a conductor is moving. This produces a Voltage or EMF (Electromotive Force) across the electrical conductor.



Self induced EMF

Stage 1

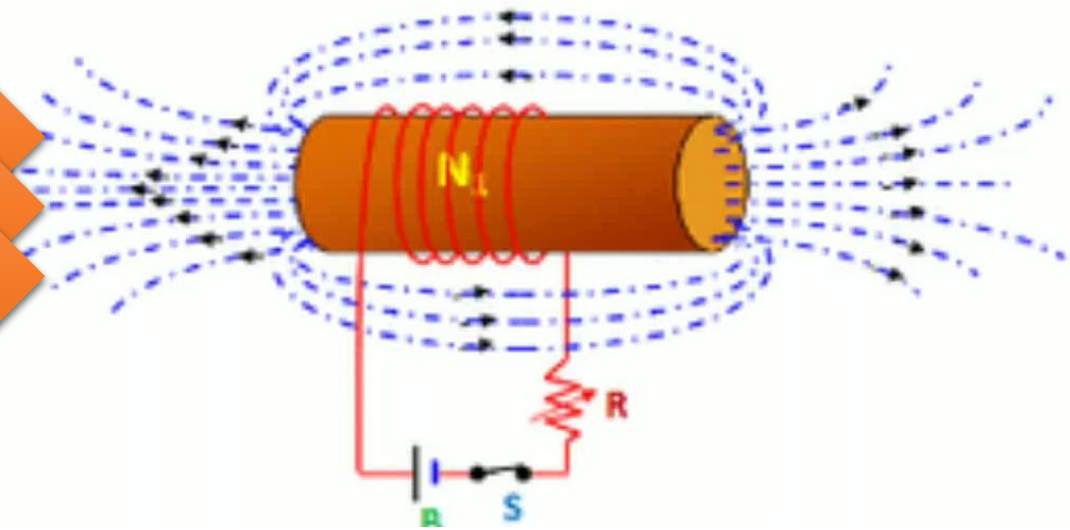
Current flowing through coil is changed.

Stage 2

Flux linking with its own winding changes

Stage 3

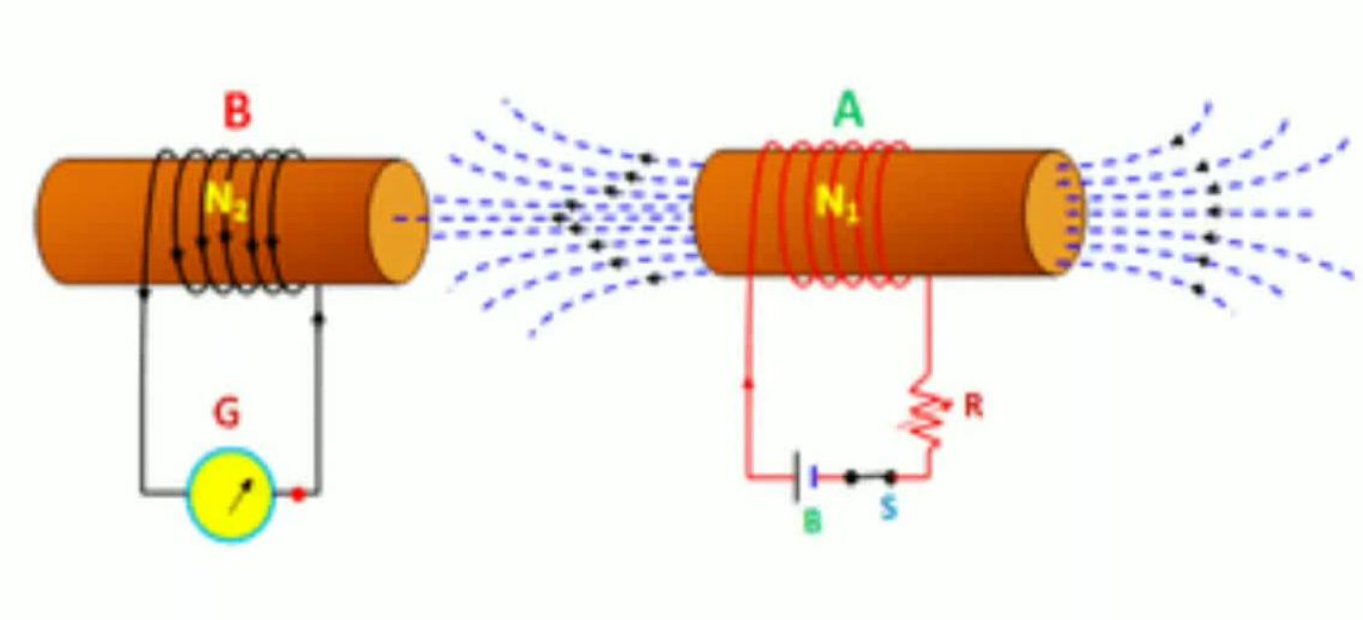
Due to change in linking flux, emf is induced.



According to Lenz's law, an induced emf acts to oppose the change that produces it; a self induced emf is always in such a direction as to oppose the change of current in the coil in which it is induced.

Mutually induced EMF

- Whenever current in coil A changes, the flux linking with coil B changes and emf induced in coil B, this emf is known as mutually induced emf.



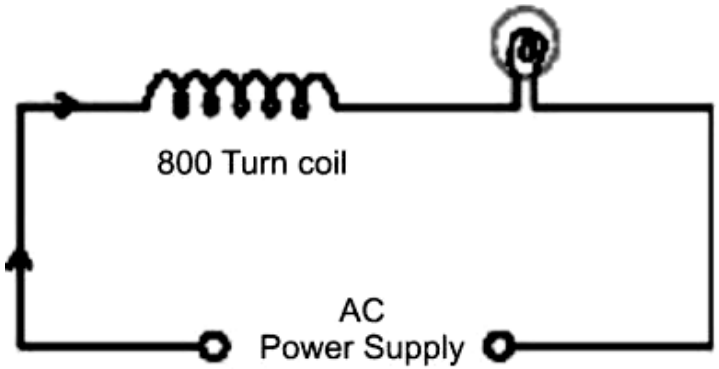
APPARATUS:

(1) A.C. Supply
(2) Coil or Inductor
(3) Bulb
(4) D.C Supply
(5) Coil
(6) Switch
(7) Galvanometer

PROCEDURE:

(Self-Induction)

1) Connect the circuit as shown in diagram.



a. Connect AC power supply with a one end of coil (800 turn) and other end to a light bulb.
b. Connect other end of light bulb to other end of AC power supply.

1) Now as you switch “On” the trainer board, you can observe that light bulb is glowing with good intensity.
2) Take I-core and insert in the coil, result will be the light of decreased intensity.
3) The glow of the bulb will decrease because, as the iron rod is inserted in the coil its inductance increases so inductive reactance increase. This result in an increase in impedance of the circuit. Consequently, the current in the circuit decreases and hence the glow of the bulb decreases.

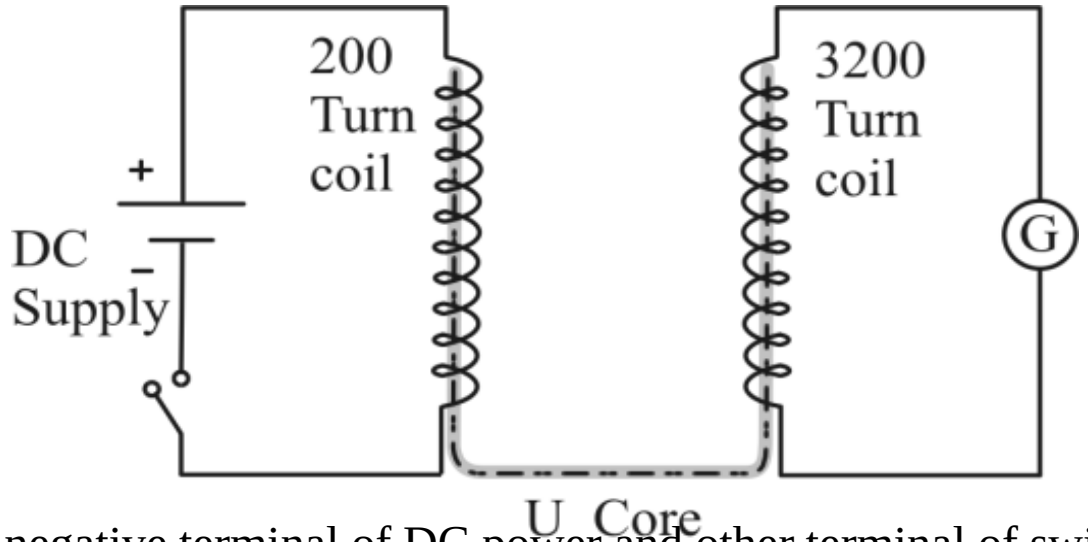
(Mutual-Induction)

If a varying current is flowing in the coil than an induced emf is produced in the neighboring coil. It means it is the property of two coils due to which each opposes any change in current flowing in the other by developing an induced emf.

PROCEDURE:

1) Take 200 turn, 3200 turn coil and a U-core from the given accessories.
2) Fit the U-core on the bracket given on trainer board.
3) Place the 200 turn coil in U–core as primary & 3200 turn coil as secondary winding.

4) Now connect the one end of 200 turn coil to positive terminal of DC power supply and other end to a terminal of switch, as shown in following figure.



5) Make common to the negative terminal of DC power and other terminal of switch.

6) Connect one terminal of secondary coil to the galvanometer and other terminal to second terminal of galvanometer.

7) Now switch „On“ the trainer board and toggle switch, in the circuit. As the switch is ON the pointer of galvanometer will gives a sudden kick in one direction, say to the left.

8) Now when the toggle switch is turned off the galvanometer will give deflection to the right.

1) We have observed that when switch is ON the current in the primary being to increase from zero to maximum. During the growth of current the magnetic flux linked with the primary beings to increase & since secondary is vary near to primary coil so its linked magnetic flux is also increases. Hence current is induced in secondary.
2) Now according to Lenz's law the direction of current in secondary is such as to oppose the growth of power supply current in the primary, so the deflection of galvanometer is because of secondary induced current. When the switch is turned "Off" the current in the primary coil beings to decrease towards zero. So the magnetic flux linked with primary & as well as secondary also decreases. Because of that an induced current flows in secondary. According to Lenz's law the direction of current should be such as to oppose the decrease of current in the primary and this is possible only if the induced current flows in same direction as the power supply current in the primary. That is why the galvanometer gives deflection to the right direction at the time of break of circuit.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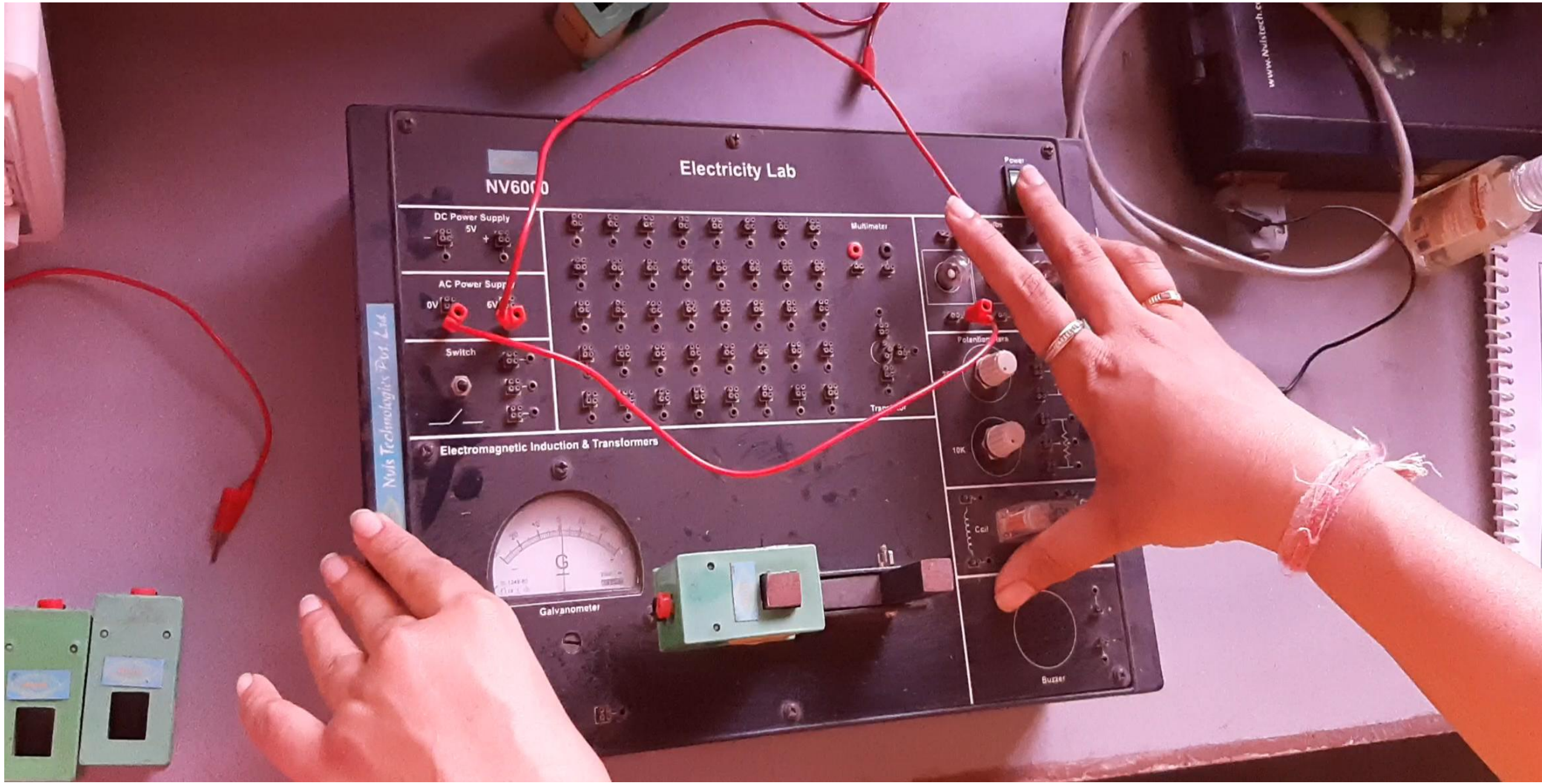
800Turn
3200Turn
200Turn
400Turn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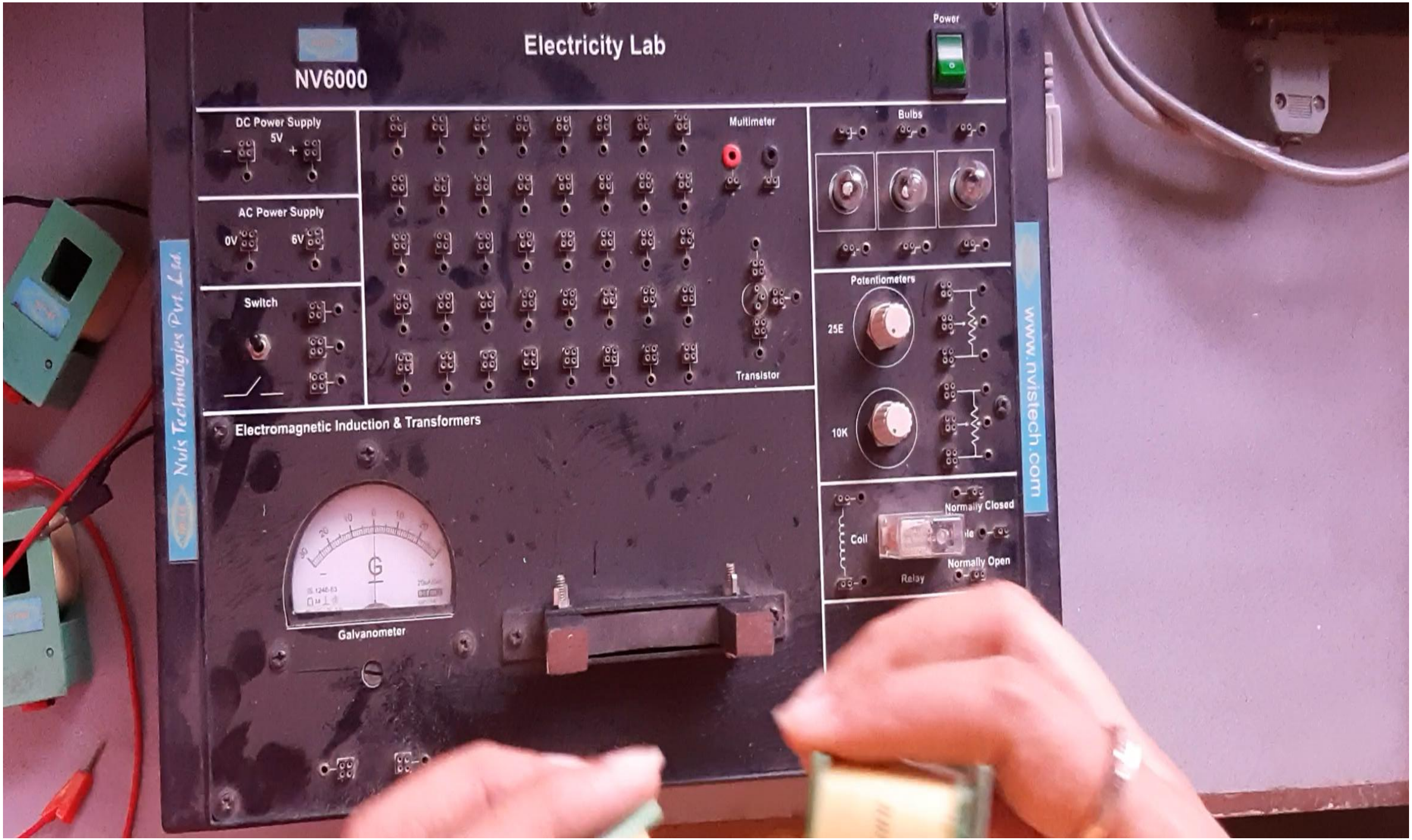
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Conclusion: