17. Alternating Currents

Definitions

r.m.s. of an AC current: r.m.s value of an alternating current is the value of the steady current which would deliver the same power to a given resistance as the alternating current.

Rectification: The conversion of AC to DC.

Diode: A device that conducts current predominantly in one direction. An ideal diode has infinite resistance in reverse bias and zero resistance in forward bias.

- Root mean square of current/voltage is peak current/voltage divided by square root of 2.
- Mean power supplied is half peak power.
- In a transformer, the iron core concentrates the magnetic flux within the core through both the primary and secondary coils.
- An ideal transformer has **no energy losses in the coil and core (resistance in coil and core is zero)** and **no flux leakage in** and hence at any instant the magnetic flux through each turn is the same in both primary and secondary coils.
- Voltage and number of turns are directly proportionate
- Current and voltage and inversely proportionate since the rate at which the a.c. source transfers energy to the primary equals the rate at which the primary transfer energy to the secondary since there is no energy lost in an ideal transformer.
- **Causes of power loss:**

1. Heating effect of current in copper windings
   ➢ Thick copper wire is used
2. Flux leakage
3. Hysteresis losses (magnetising and reversing this magnetisation)
   ➢ Core made of soft iron which has low hysteresis
4. Induction of eddy currents
   ➢ Insulating varnish confines the eddy currents to individual laminae, thus possible eddy-current paths are narrower and their heating effect are greatly reduced.

- If both primary and secondary windings are wound from top to bottom in the same direction, the output and input will be in antiphase and the top terminals will have the opposite polarities.
- If wound in opposite direction then output and input voltage are in phase and top terminals have the same polarity.

Questions

1. What is the purpose of the iron core?

Ans: To confine the magnetic field lines to ensure maximum magnetic flux linkage between the primary and secondary coils.

2. What is a disadvantage of using a diode? (for half wave rectification)

Ans: Half of the power supplied is not transferred to the resistor.