Q1 a) Why replacing winding in a shell type transformer is not an easy job? Explain briefly

Answer:

The shell type transformer is a simple rectangular form and the core surrounds the considerable portion of the windings which is shown in fig. Both the primary & secondary windings are placed in the one limb. And the coils are wound in from of multi-layer disc type. The different layers of the multi-layer disc are insulated from each other by paper.

Q1 b): Why the width of the central limb in a shell type transformer is double to the width of the outer limbs? Explain briefly.

Answer:

In shell type transform, the windings are put around the center limb and the flux path is completed through two side limbs. The centre limb carries the total magnetic flux while side limbs (cores) forms a part of the parallel magnetic circuit, carry half of the total flux. Consequently, the width hence cross-sectional area of the central limb is double that of each side of limb

Q2: In a transformer, when primary voltage is stepped up, primary current is stepped down. Moreover, the efficiency of distribution transformer is 60 to 70 % and not 100%. Justify these statements.

Answer:

Distribution transformer is designed for maximum efficiency at 60% to 70% load as it normally doesn't operate at full load all the time. Its load depends on distribution demand. Whereas power transformer is designed for maximum efficiency at 100% load as it always runs at 100% load being near to generating station.The main difference between power and distribution transformer is distribution transformer **is** designed for maximum efficiency at 60% to 70% load as normally doesn't operate at full load all the time. Its load depends on distribution demand. Whereas power transformer is designed for maximum efficiency at 100% load as it always runs at 100% load being near to generating station.

Q3: A single phase, 50Hz, transformer is built on an iron core having an effective cross sectional area of 120 cm^2. The voltage on the primary side is 3000V while on secondary side is 200V. The number of turns on the low voltage side are 50. Calculate:

a) The number of turns on the high voltage side.

b) The value of maximum flux density.

Solution:

Given data:

frequency (f) = 50 Hz

cross sectional Area = 120cm^2

voltage (Vp) = 3000 v

No of turns (Ns) = 50

Required data:

a) No of turns on the high voltage side (Np) =?
b) The value of maximum flux density

A: finding Np

We know that

Vp/Vs= Np/Ns

Or

vp×Ns/Vs= Np

Putting the values

3000×50/200= Np

Np=150000/200

Np=750 N (answer)

B: finding the value maximum flux density

Formula: V1=4.44×F×Ø×N1

First we find Ø

Ø=V1/4.44×F×N1

Ø=3000/4.44×50×750

Ø=3000/166500

Ø=0.0180 testa

Now

V2=4.44×f×Ø×N2

Ø=V2/4.44×f×N2

Ø=200/4.44×50×50

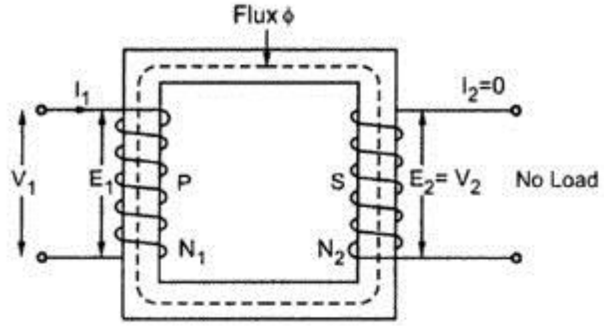
Ø=200/11100

Ø = 0.0180 testa

Q4 a) What will happen if the core of a transformer has infinite permeability? Explain briefly
Answer:

Core of transformer is made of highly permeable material so that with small magnetizing current in primary, a large magnetic flux is generated. Alternately, for same current, higher permeability will require less number of turns and save in winding cost. The core is a magnetic circuit. The current flowing in the turns in the primary try to produce a flux. The greater the magnetic conductance of the circuit the more flux you get from the same current and number of turns. The greater the flux in the secondary, the greater the EMF and current when the flux changes.

Q4 b) Why the magnetizing current (Iμ) lags behind input voltage (V_1) by 90° in an ideal transformer? Explain briefly
Answer:
Consider an ideal transformer on no load as shown in the figure. The supply voltage is V_1 and as it is an no load the secondary current $I_2 = 0$.



The primary draws a current I_1 which is just necessary to produce flux in the core. As it is magnetizing the core, it is called magnetizing current denoted as I_u. As the transformer is ideal, the winding reactance is zero and it is purely inductive in nature. The magnetizing current is very small and lags V_1 by 30° as the winding is purely inductive. This I_u produces an alternating flux Φ which is in phase with I_u.

The flux links with bith the winding producing the induced emf E1 and E2, in the primary and secondary windings respectively. According to Lenz's law, the induced emf opposes the cause producing it which is supply voltage V1. Hence E1 is in antiphase with V1 but equal in magnitude. The induced emf E2 also opposes V1 hence in antiphase with V1 but its magnitude depends on N2. Thus E1 and E2 are in phase

It can be seen that flux is reference. Iu produces flux hence in phase with phi. V1 leads Iu by 90 degree as winding is purely inductive so current has to lag voltage by 90 degree.

E1 and E2 are in phase and both opposing supply voltage V1.

The power input to the transformer is V1 I1 cos (Angle between V1 and I1) i.e. zero.

This is because on no load input power is zero and for ideal transformer there are no losses hence input power is also zero. Ideal no load power factor of transformer is zero lagging.

Q5 a) What will happen if pole shoes are not present in a DC machine? Explain briefly

Answer: the function of pole shoes in a dc machine to support field coil.Decrease reluctance.and Increase cross section area of magnetic circuit . if the pole shoes are not present in dc machine the function are not work.

Q5 b) What will happen if a commutator is not present in a DC generator? Explain briefly

Answer:

the function of commutator is to lead current from external stationary leads to the rotating coils of the armature winding in case of motor and to draw current from armature winding to external circuit in case of generator basically it act as a rectifier as it converts sinusodial(a.c.) signal into d.c signal. To convert energy from AC to DC or DC to AC we use inverter or converter circuit. The commutator is also called as mechanical rectifier which converts AC to DC in case of a generator whereas in the case of a motor it converts DC to AC. The commutator is also made up of copper segment as it collects currents and the insulation used to separate segments is mica. . Without commutator the ac current will not convert into the dc current.