Unit 12

Section one : Reading comprehension

Single-Phase Circuits & Direct-current machine

Alternating current in a circuit possessing resistance only

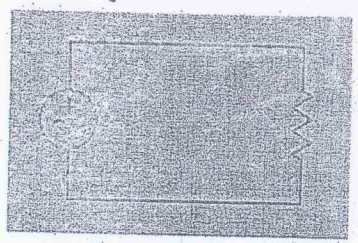

Figure - a

Consider a circuit having a resistance R ohms connected across the terminals of an a.c. generator A, as in Figure - a, suppose the alternating voltage to be represented by the sinf wave of fig- b . If the value of

the voltage at any instant v volts, the value of the current at that instant is given by :

$i = v/R$ amperes.

When the voltage is zero, the current is also zero; and since the current is proportional to the voltage, the waveform of the current is exactly the same as that of the voltage. Also the two quantities are in phase with each other; that is, they pass through their zero values at the same instant and their maximum values in a given direction at the same instant. Hence the current wave is as shown dotted in fig- b .

If V_m and I_m be the maximum values of the voltage and current respectively, it follows that:

$Im = Vm/R$ (12-1)

But the r.m.s. value of a sine wave is 0.707 times the maximum value, so that:

r.m.s. value of voltage = $V = .707\ V_m$

and r.m.s. value of current $= I = 0.707\ I_m$.

Substituting for I_m and V_m in (12-1)we have:

$I = V/R$

Hence Ohm's Law can be applied without any modification to an a.c. circuit possessing resistance only.

If the instantaneous value of the applied voltage is represented

by : $v = Vm \sin\theta$

The phasors representing the voltage and current in a

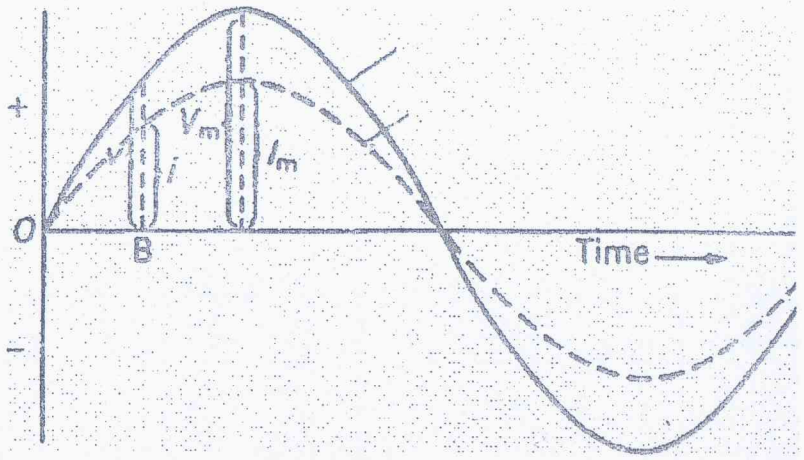

Figure- b

resistive circuit are in phase. The two phasors are actually coincident, but are drawn slightly apart so that the identity of each may be clearly recognized.

Direct-current machine

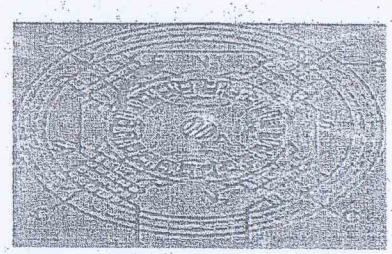

Figure - c

Fig. c shows the general arrangement of a four-pole d.c generator or motor. The fixed part consists of four steel

cores C, referred to as pole cores, attached to a steel ring R, call] the yoke. The pole cores are usually made of steel plates riveted together and bolted to the yoke, which may be of cast steel or fabricated rolled steel. Each pole core has pole tips partly to support the field winding and partly to increase the cross-sectional area and thus reduce the reluctance of the airgap. Each pole core carries a winding F so connected as to excite the poles alternately N and S.

The armature core A consists of steel laminations, about 0.4-0.6 mm thick, insulated from one another and assembled on the shaft in the case of small machines and on a cast-steel spider in the case of large machines. The purpose of laminating the core is to reduce the eddy-current loss.

Slots are stamped on the periphery of the laminations, partly to accommodate and provide mechanical security to the armature winding and partly to give a shorter airgap for the magnetic flux to cross between the pole face and the armature 'teeth'. In fig.c, each slot has two circular conductors, insulated from each other.

Comprehension Exercises

A. Answer the following questions orally .

1) What is the relation between current and voltage in a resistive circuit ?

2) What does being in phase with each other mean ?

3) What are the different parts of a generator ?

4) Define the yoke .

5) What are the different parts of an armature core ?

B . Put "T" for true and " F " for false statements.

..... 1) In a resistive circuit the waveform of the current is exactly the same as that of the voltage .

..... 2) Ohms law needs to be modified in an AC circuit possessing resistance .

..... 3) The phasors representing the voltage and current in a resistive circuit are coincident .

..... 4) The pole cores are usually made of steel plates riveted together .

..... 5) The purpose of laminating the core is to reduce the eddy – current loss .

C . Multiple choice questions

1) In a resitive circuit the voltage and current .....

a) arenot in phase and differ 180°

b) arenot in phase and differ 90°

c) arenot in phase and differ 60°

d) are in phase with each other

2) The r.m.s value of a sine wave is ..... times the

maximum value .

a) 0/707 b) $\frac{1}{2}$ c) 0/606 d) $\frac{1}{4}$

3) The steel ring of the fixed part of a DC generator is called .....

a) yoke b) pole c) core d) armature

4) The core of an armature consists of .....

a) a shaft b) a cast steel spider

c) steel lamination d) All of them

5) The purpose of laminating the core is to .....

a) control the eddy – current loss

b) increase the eddy – current loss

c) reduce the eddy – current loss

d) None of them

D : Fill in the blanks with the following words.

Quantity Lamination Pole cores
Instantaneous Generator Air gap Phasors

1) ..... quantities of voltage and current in a circuit can be measured by an oscilloscope .

2) A circuit which converts mechanical energy into electrical energy is termed .....

3) Generator and motor coils are on .....

4) In designing DC machines efforts are made to shorten the ..... for the magnetic flow to pass .

5) Voltage and current ..... are coincident in a resistive circuit .

Section Two : Traslation Activities

A: Translate the following passage into Persian .

Inductor

An inductor is a passive electrical component that includ a series of conductive windings or coils which cooperate define the magnetic field in a specified region when electric current is established in the turns. Inductors oft comprise a magnetic core composed of an iron or ferr material that is wound with a conductive coil. Consequent inductors are often referred to as wire-wound coil devic An inductor is divided into a wire wound type and a stack type, each having different application fields and fabricati methods. In a wire wound type inductor, a coil is wound a base body such as a magnetic material, etc. In this case, the number of windings increases in order to get a hi inductance, the high frequency characteristic deteriorat based on the increased number of windings, because a str capacitance is present between the wound coils. Inducto can be wound around cores having a variety of shap