

**Answer on** Question #57893, Physics / Electromagnetism

An armature coil consists of 20 turns of wire, each of area  $A = 0.09\text{m}^2$  and total resistance 15.0 . It rotates in a magnetic field of 0.5T at a constant frequency of 150/3.14. Calculate the value of (i) maximum (ii) average induced emf produced in the coil

**Find:**  $\text{emf}_{\text{max}} - ?$   $\text{emf} - ?$

**Given:**

$$N=20$$

$$A=9\times 10^{-2}\text{ m}^2$$

$$B=0,5\text{ T}$$

$$\omega=150/3,14\text{ s}^{-1}$$

$$R=15\ \Omega$$

**Solution:**

Law of electromagnetic induction:

$$\text{emf} = -N \frac{\Delta\Phi}{\Delta t} \quad (1),$$

where  $N$  – number of turns of wire,

$\Delta\Phi$  – change of magnetic flux that passes through the area,

$\Delta t$  – time for which a change happens

$\frac{\Delta\Phi}{\Delta t}$  – derivative

Magnetic flux:

$$\Phi = BA \cos \omega t \quad (2).$$

$$(2) \text{ in } (1): \text{emf} = NBA\omega \sin \omega t \quad (3)$$

$$\text{The general expression: } \text{emf} = \text{emf}_{\text{max}} \sin \omega t \quad (4)$$

$$\text{Of } (3) \text{ and } (4) \Rightarrow \text{emf}_{\text{max}}=NBA\omega \quad (5)$$

$$\text{Of } (5) \Rightarrow \text{emf}_{\text{max}}= 43\text{ V}$$

The average value for the period of oscillations:  $\text{emf}=0\text{ V}$

**Answer:**

$$\text{emf}_{\text{max}}=43\text{ V}$$

$$\text{emf}=0\text{ V}$$