Q10 December 2019

A conductor with an effective length of 300 mm and a diameter of 9.5 mm carries a current of 25 A at right angles to a magnetic field. The force on the conductor is 18 N. Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux.

Q7 March 2018

(a) State the units of EACH of the following:

(i) flux; (ii) flux density; (iii) magnetomotive force; (iv) inductance. (4)

(b) The active length of a conductor carrying a current of 42A at right angles to a magnetic field is 800 mm. The force on the conductor is 21 N. Calculate the strength of the magnetic field. (4)

12. A conductor of 12.5 mm diameter has an effective length of 600 mm when carrying a current of 25 A at right angles to a magnetic field. The force on the conductor is 24 N. Calculate EACH of the following:

(a) the flux density; (3)

(b) the magnetic flux. (3)

11. (a) State Lenz's Law. (2)

(b) A conductor with an effective length of 500 mm creates a magnetic flux 280 μWb when carrying a current of 45 A. The force on the conductor is 40 N.

Calculate the diameter of the conductor. (6)

10. A conductor with an effective length of 300 mm and a diameter of 9.5 mm when carrying a current of 25 A at right angles to a magnetic field. The force on the conductor is 18 N.

Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux. (4)

12. A conductor of 7.5 mm diameter has an effective length of 400 mm and carries a current of 20 A. The force on the conductor is 20 N.

Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux. (4)

Q11 March 2019

An armature coil has 222 turns and rotates between the poles of an electromagnet at a speed of 10.25 m/s in a uniform magnetic field of flux density 24 mT. The axial length of the coil is 275 mm. Calculate the maximum e.m.f. generated in the coil. (6)

Q10 December 2019

A conductor with an effective length of 300 mm and a diameter of 9.5 mm carries a current of 25 A at right angles to a magnetic field. The force on the conductor is 18 N. Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux.

$F = BIL \sin\theta$

F = force = (N)

B = Flux density in Tesla (T)

I = Current (Amp)

0.3 = 300 mm = L = length

90 = θ = angle (90°)

sin 90 = 1

$18 = x \times 25 \times 0.3 \ (\sin 90)$

$\frac{18}{25 \times 0.3} = x = 2.4 \text{ T}$

b) $B = \frac{\phi}{A}$ ← magnetic Flux

Area

Tesla Flux density

Area = πr^2

$d = 9.5$ mm

$r = 4.25$ mm $= 0.00425$ m

Area $= \pi (0.00425)^2$

$= 5.674501731 \times 10^{-5}$ m^2

$$B = \frac{\phi}{A}$$

$$7.4 = \frac{\phi}{5.674501731 \times 10^{-5}}$$

ϕ = Wb Weber $= \frac{1 \text{ kg m}^2}{s^2 A^1}$

1.36×10^{-4} Wb

Q7 March 2018

(a) State the units of EACH of the following:

(i) flux; (ii) flux density; (iii) magnetomotive force; (iv) inductance. (4)

(b) The active length of a conductor carrying a current of 42A at right angles to a magnetic field is 800 mm. The force on the conductor is 21 N. Calculate the strength of the magnetic field. (4)

$B = \frac{\phi}{A}$

i) Flux - Watts

ii) Flux density = Tesla

iii) Magnetomotive Force = Ampere turns

iv) inductance = Henry

b) $F = BIL \sin\theta$

$\theta = 90$

$I = 42$

$L = 800\,mm = 0.8\,m$

$F = 21$

$B = x$

$H = \frac{NI}{L}$

$H = \frac{42}{0.8}$

$= 52.5\ At/m$

12. A conductor of 12.5 mm diameter has an effective length of 600 mm when carrying a current of 25 A at right angles to a magnetic field. The force on the conductor is 24 N.
Calculate EACH of the following:

(a) the flux density; (3)

(b) the magnetic flux. (3)

$F = BIL\sin\theta$

$F = 24$

$B = x$

$I = 25$

$L = 600\,mm = 0.6\,m$

$\sin(90) = 1$

$24 = x(25)(0.6)$

$x = 1.6$ Tesla

$B = \frac{\phi}{Area}$

Area = 12.5 mm diameter

$r = 6.25\,mm$

$0.00625\,m$

$A = \pi(0.00625)^2 = 1.22718 \times 10^{-4}\,m^2$

$B = \frac{\phi}{A}$

$1.6 \times 1.22718 \times 10^{-4} = 1.96 \times 10^{-4}$ (H)

11. (a) State Lenz's Law. (2)

(b) A conductor with an effective length of 500 mm creates a magnetic flux 280 μWb when carrying a current of 45 A. The force on the conductor is 40 N.

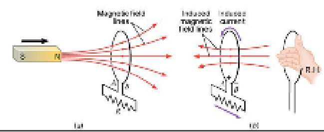
Calculate the diameter of the conductor. (6)

the direction of the induced magnetiuc field will be in the opposite direction to the induced flux ?

Faraday's Law: $\mathcal{E} = -N\frac{d\Phi_B}{dt}$

The minus sign in the Faraday's law of induction is due to the fact that the induced emf will always oppose the change. It is also known as the Lenz's law and it is stated as follows:

The current from the induced emf will produce a magnetic field, which will always oppose the original change in the magnetic flux.



b) $F = BIL\sin\theta$

$F = 40\ N$

$B = x$

$I = 45\ Amps$

$\theta = 90$

$L = 500mm = 0.5\ m$

$40 = x(45)(0.5)(\sin 90)$

$x = \frac{40}{(45)(0.5)} = 1.7777$

$B = 1.777778$ Tesla

Flux density

$B = \frac{\phi}{A}$ — Flux, Area

$\phi = 280\ \mu Wb = 280 \times 10^{-6}\ Wb$

$1.77778 = \frac{280 \times 10^{-6}}{A} = \frac{2.8 \times 10^{-4}}{A}$

$A = \frac{280 \times 10^{-6}}{1.777778}$

$A = 1.575 \times 10^{-4}\ m^2$

$\pi r^2 = 1.575 \times 10^{-4}$

$r = 7.0805 \times 10^{-3}\ m$

$d = 0.014161\ m$

10. A conductor with an effective length of 300 mm and a diameter of 9.5 mm when carrying a current of 25 A at right angles to a magnetic field. The force on the conductor is 18 N.

Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux. (4)

Density → B

$F = BIL\sin\theta$

Flux density → B

$B = \frac{\phi}{A}$ ← Flux, ← Area

$F = 18$

$B = x$

$I = 25$

$L = 300mm = 0.3$

$\theta = 90$

$18 = x\ 25\ 0.3$

$x = 2.4$ Tesla

diameter = 9.5 mm

$r = 4.75$ mm $= 0.00475$ m

Area $= \pi(0.00475)^2$

$\phi = 2.4 \times \pi(0.00425)^2$

$\phi = 1.7 \times 10^{-4}$ wb

12. A conductor of 7.5 mm diameter has an effective length of 400 mm and carries a current of 20 A. The force on the conductor is 20 N.

Calculate EACH of the following:

(a) the flux density; (4)

(b) the magnetic flux. (4)

Flux density

a) $F = BIL \sin\theta$

Flux Density (Tesla)

$B = \frac{\phi}{A}$ ← Flux (wb)

$F = 20$

$B = x$

$I = 20$

$L = 400 = 0.4m$

$\theta = 90$

$20 = x \times 20 \times 0.4$

$\frac{20}{20 \times 0.4} = x = 2.5$ Tesla

Area $= \pi r^2$

$r = 3.75 \times 10^{-3}$

$\pi(3.75 \times 10^{-3})^2 =$

$\phi = 1.10466 \times 10^{-4}$ (Wb)

Q11 March 2019

An armature coil has 222 turns and rotates between the poles of an electromagnet at a speed of 10.25 m/s in a uniform magnetic field of flux density 24 mT. The axial length of the coil is 275 mm. Calculate the maximum e.m.f. generated in the coil. (6)

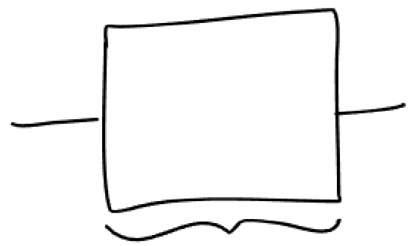
V = velocity = 10.25 m/s

$B = 24\ mT = 24 \times 10^{-3}\ T$

$F = BIL \sin\theta$

$E = BVL \sin\theta$

$E = 24 \times 10^{-3} \times 10.25 \times 61.05$



275 mm × 222

61050 mm effective length

$L = 61.05\ m$

$E = 15.0183$ volts