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Magnetic Field due to Current Formulas

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List of 15 Magnetic Field due to Current Formulas

Magnetic Field due to Current

1) Angle of Dip

Open Calculator

fx $$\delta = \arccos\left(\frac{B_H}{B_{net}}\right)$$

ex $$60° = \arccos\left(\frac{0.00002\mathrm{Wb/m^2}}{0.00004\mathrm{Wb/m^2}}\right)$$

2) Current in Moving Coil Galvanometer

Open Calculator

fx $$i = \frac{K_{spring} \cdot \theta_G}{n \cdot A \cdot B}$$

ex $$0.009226\mathrm{A} = \frac{51\mathrm{N/m} \cdot 32°}{95 \cdot 13\mathrm{m^2} \cdot 2.5\mathrm{Wb/m^2}}$$

3) Electric Current for Tangent Galvanometer

Open Calculator

fx $$i = K \cdot \tan(\theta_G)$$

ex $$0.124974\mathrm{A} = 0.2\mathrm{A} \cdot \tan(32°)$$

4) Field Inside Solenoid

Open Calculator

$$B = \frac{[\text{Permeability-vacuum}] \cdot i \cdot N}{L}$$

$$9.2E\hat{}\text{-}5\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A} \cdot 100}{3000\text{mm}}$$

5) Field of Bar Magnet at Axial position

Open Calculator

$$B_{axial} = \frac{2 \cdot [\text{Permeability-vacuum}] \cdot M}{4 \cdot \pi \cdot a^3}$$

$$4.080759\text{Wb/m}^2 = \frac{2 \cdot [\text{Permeability-vacuum}] \cdot 90\text{Wb/m}^2}{4 \cdot \pi \cdot (16.4\text{mm})^3}$$

6) Field of Bar Magnet at Equatorial position

Open Calculator

$$B_{equitorial} = \frac{[\text{Permeability-vacuum}] \cdot M}{4 \cdot \pi \cdot a^3}$$

$$2.04038\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 90\text{Wb/m}^2}{4 \cdot \pi \cdot (16.4\text{mm})^3}$$

7) Force between Parallel Wires

Open Calculator

$$F_l = \frac{[\text{Permeability-vacuum}] \cdot I_1 \cdot I_2}{2 \cdot \pi \cdot d}$$

$$2.8E\hat{}\text{-}5\text{N/m} = \frac{[\text{Permeability-vacuum}] \cdot 1.1\text{A} \cdot 4\text{A}}{2 \cdot \pi \cdot 31\text{mm}}$$

8) Magnetic Field at Center of Arc

Open Calculator

$$M_{arc} = \frac{[\text{Permeability-vacuum}] \cdot i \cdot \theta}{4 \cdot \pi \cdot r_{ring}}$$

ex
$$3.2\text{E}\hat{\ }\text{-}7\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A} \cdot 0.5^\circ}{4 \cdot \pi \cdot 6\text{mm}}$$

9) Magnetic Field at Center of Ring

Open Calculator

$$M_{ring} = \frac{[\text{Permeability-vacuum}] \cdot i}{2 \cdot r_{ring}}$$

ex
$$2.3\text{E}\hat{\ }\text{-}6\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A}}{2 \cdot 6\text{mm}}$$

10) Magnetic Field Due to Infinite Straight Wire

Open Calculator

$$B = \frac{[\text{Permeability-vacuum}] \cdot i}{2 \cdot \pi \cdot d}$$

ex
$$1.4\text{E}\hat{\ }\text{-}5\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A}}{2 \cdot \pi \cdot 31\text{mm}}$$

11) Magnetic Field due to Straight Conductor

Open Calculator

fx
$$B = \frac{[\text{Permeability-vacuum}] \cdot i}{4 \cdot \pi \cdot d} \cdot (\cos(\theta_1) - \cos(\theta_2))$$

ex
$$1.5E\hat{}\text{-}6\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A}}{4 \cdot \pi \cdot 31\text{mm}} \cdot (\cos(45^\circ) - \cos(60^\circ))$$

12) Magnetic Field for Tangent Galvanometer

Open Calculator

fx
$$B_H = \frac{[\text{Permeability-vacuum}] \cdot n \cdot i}{2 \cdot r_{ring} \cdot \tan(\theta_G)}$$

ex
$$0.035026\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 95 \cdot 2.2\text{A}}{2 \cdot 6\text{mm} \cdot \tan(32^\circ)}$$

13) Magnetic Field on Axis of Ring

Open Calculator

fx
$$B = \frac{[\text{Permeability-vacuum}] \cdot i \cdot r_{ring}^2}{2 \cdot \left(r_{ring}^2 + d^2\right)^{\frac{3}{2}}}$$

ex
$$1.6E\hat{}\text{-}6\text{Wb/m}^2 = \frac{[\text{Permeability-vacuum}] \cdot 2.2\text{A} \cdot (6\text{mm})^2}{2 \cdot \left((6\text{mm})^2 + (31\text{mm})^2\right)^{\frac{3}{2}}}$$

14) Magnetic Permeability

Open Calculator

$$\mu = \frac{B}{H}$$

$$5.555556 \mathrm{H/m} = \frac{2.5 \mathrm{Wb/m^2}}{0.45 \mathrm{A/m}}$$

15) Time Period of Magnetometer

Open Calculator

$$T = 2 \cdot \pi \cdot \sqrt{\frac{I}{M \cdot B_H}}$$

$$157.0796 \mathrm{s} = 2 \cdot \pi \cdot \sqrt{\frac{1.125 \mathrm{kg \cdot m^2}}{90 \mathrm{Wb/m^2} \cdot 0.00002 \mathrm{Wb/m^2}}}$$

Variables Used

- **a** Distance from Center to Point *(Millimeter)*
- **A** Cross-Sectional Area *(Square Meter)*
- **B** Magnetic Field *(Weber per Square Meter)*
- B_{axial} Field at Axial Position of Bar Magnet *(Weber per Square Meter)*
- $B_{equitorial}$ Field at Equitorial Position of Bar Magnet *(Weber per Square Meter)*
- B_H Horizontal Component of Earth's Magnetic Field *(Weber per Square Meter)*
- B_{net} Net Earth's Magnetic Field *(Weber per Square Meter)*
- **d** Perpendicular Distance *(Millimeter)*
- F_l Magnetic Force per Unit Length *(Newton per Meter)*
- **H** Magnetic Field Intensity *(Ampere per Meter)*
- **i** Electric Current *(Ampere)*
- **I** Moment of Inertia *(Kilogram Square Meter)*
- I_1 Electric Current in Conductor 1 *(Ampere)*
- I_2 Electric Current in Conductor 2 *(Ampere)*
- **K** Reduction Factor of Tangent Galvanometer *(Ampere)*
- K_{spring} Spring Constant *(Newton per Meter)*
- **L** Length of Solonoid *(Millimeter)*
- **M** Magnetic Moment *(Weber per Square Meter)*
- M_{arc} Field at Center of Arc *(Weber per Square Meter)*
- M_{ring} Field at Center of Ring *(Weber per Square Meter)*
- **n** Number of Turns of Coil

- **N** Number of Turns
- **r_{ring}** Radius of Ring *(Millimeter)*
- **T** Time Period of Magnetometer *(Second)*
- **δ** Angle of Dip *(Degree)*
- **θ** Angle Obtained by Arc at Center *(Degree)*
- **θ_1** Theta 1 *(Degree)*
- **θ_2** Theta 2 *(Degree)*
- **θ_G** Angle of Deflection of Galvanometer *(Degree)*
- **μ** Magnetic Permeability of Medium *(Henry per Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[Permeability-vacuum]**, 4 * Pi * 1E-7 Henry / Meter
  Permeability of vacuum
- Function: **arccos**, arccos(Number)
  Inverse trigonometric cosine function
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Magnetic Field Strength** in Ampere per Meter (A/m)
  Magnetic Field Strength Unit Conversion
- Measurement: **Magnetic Field** in Weber per Square Meter (Wb/m^2)
  Magnetic Field Unit Conversion

- Measurement: **Surface Tension** in Newton per Meter (N/m)
  Surface Tension Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Meter ($kg \cdot m^2$)
  Moment of Inertia Unit Conversion
- Measurement: **Magnetic Permeability** in Henry per Meter (H/m)
  Magnetic Permeability Unit Conversion
- Measurement: **Stiffness Constant** in Newton per Meter (N/m)
  Stiffness Constant Unit Conversion

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- Capacitor Formulas
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