

D-I(H), Paper-II

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Magnetism

Q:- Define magnetic induction field \vec{B} , intensity of magnetisation \vec{M} or \vec{P}_m and magnetising field \vec{H} .

Ans:- Intensity of ~~mag~~ magnetisation: \vec{M} is known as intensity of magnetisation, magnetic polarisation or simply magnetisation. It is defined as magnetic dipole moment per unit volume of the magnetised material. It is also denoted by \vec{P}_m .

The field due to magnetisation
 $= \mu_0 \vec{P}_m$

Magnetising field \vec{H} :- This field is due to the free (or conduction) currents i_{free} and is equal to the field \vec{B} in vacuum produced by the same current. The field \vec{H} is responsible for magnetising the specimen and is, therefore, known as magnetising field.

$$\vec{H} = \frac{\vec{B}}{\mu_0} - \vec{P}_m$$

Magnetic induction field \vec{B} :- Magnetic induction field \vec{B} is the total magnetic field within the magnetic material. It is the sum of the magnetising field $\mu_0 \vec{H}$ due to the free (conduction) current and the field $\mu_0 \vec{P}_m$ due to the magnetisation of the material having dipole magnetic moment per unit volume \vec{P}_m .

$$\therefore \vec{B} = \mu_0 \vec{H} + \mu_0 \vec{P}_m = \mu_0 (\vec{H} + \vec{P}_m)$$

Thus \vec{B} consists of two parts.

Units :- The magnetic induction \vec{B} and magnetic field \vec{H} are different fields. They are therefore measured in different units.

The units of \vec{B} is a Tesla.

$$1 \text{ Tesla} = 1 \text{ Wb/m}^2$$

As $\vec{B} = \mu_0 (\vec{H} + \vec{P}_m)$, the unit of \vec{H} and \vec{P}_m is the same as that of \vec{B} . The unit of \vec{P}_m is Ampere turns per meter. The unit of \vec{H} is Ampere turns per meter.