## *OPERATING INSTRUCTIONS*

# B-H CURVE SETUP

SIBA
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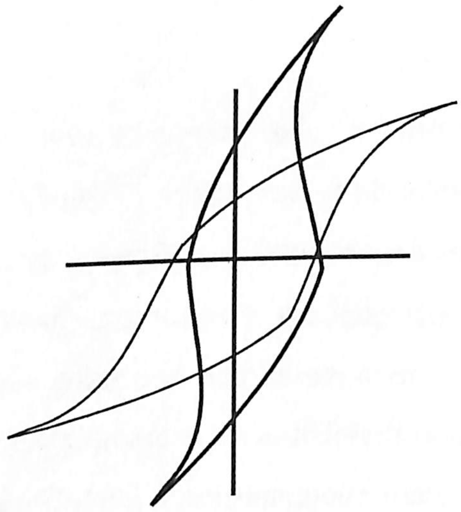
Objective:- Knowledge of (i) Hysteresis loop (ii) Coerecivity, (iii) Retentivity and Magnetic induction field.

Activity:- To Trace B-H curve for different magnetic materials using C.R.O. & find out the magnetic parameters from these.

Introduction

The term magnetic materials is used to represent the substances which possess spontan-eous magnetisation below a critical temperature. The characterisation which are usually used to define the quality of these materials are coercive field, remanent induction or polarisation, magnetic induction field or magnetic polarisation at saturation, permeability & hysteresis loss, information about these properties can be obtained from magnetisation hysteresis loop, which is (visual) curve showing the lag of magnetic induction field (B) or magnetic polarisation(J) behind the magnetising field(H).A typical magnetic polarisation or B-H curve for a ferromagnetic material is shown in fig.1.

To obtain the B-H curve the circuit of fig.2 is used. The step-down transformer with different output voltage is used to adjust the magnetising current in the circuit. This current is measured with an AC ammeter and the voltage developed by it across a small resistance r is applied to the X-plates of the C.R.O. This is used as measure of (H).The output of the pick-up coil, Eq. is applied to an integrating circuit consisting of a resistance R and capacitance C of suitable time constant RC. The integrating signal is then applied to the Y-plates to give a signal representing B. The resulting trace on the C.R.O. is B-H curve of the specimen.



## Experimental Details

Apparatus:-Step-down transformer of 4V to 12V/1.2A.Solenoid with known length and winding, different magnetic materials, small resistance(1ohm),known large resistance(100,200,300&500 Kohm),known capacitance(1&2uF).

Recommended App.:- AC ammeter 2.5A,C.R.O. is preferably with both X &Y scales calibrated in volts.

(i) Note down the length, diameter & number of windings of the solenoid, and the no. of windings &area of cross-section of the pick-up coil. Make the connections as shown in fig.2.

(ii) Switch on the mains & adjust the transformer voltage so as to give a current nearly 0.5A. Adjust the X & Y amplifier gains of C.R.O. to give a B-H curve of suitable size on the screen. Adjust the values of R & C to have proper shape of the curve.

(iii) Bring Y-input of C.R.O. to 0-mark on the panel so as to have a horizontal trace at the center. Find its total length in terms of volts. This is peak topeak value of $e_x$,$(e_x)_{pp}$.Shift Y-input to AC ,without changing another knoband make the B-H curve symmetrical w.r.t. the origin oftheC.R.O.screen.Record voltages correspondingto points of coercivefield$(a_x)_c$,remanent induction $(e_y)_r$ & saturation magnetic induction(ey)s on the B-H curve. Trace the curve. It may be found convenient to record $2(e_x)_c$, $2(e_y)_r$ & $2(e_y)_s$.

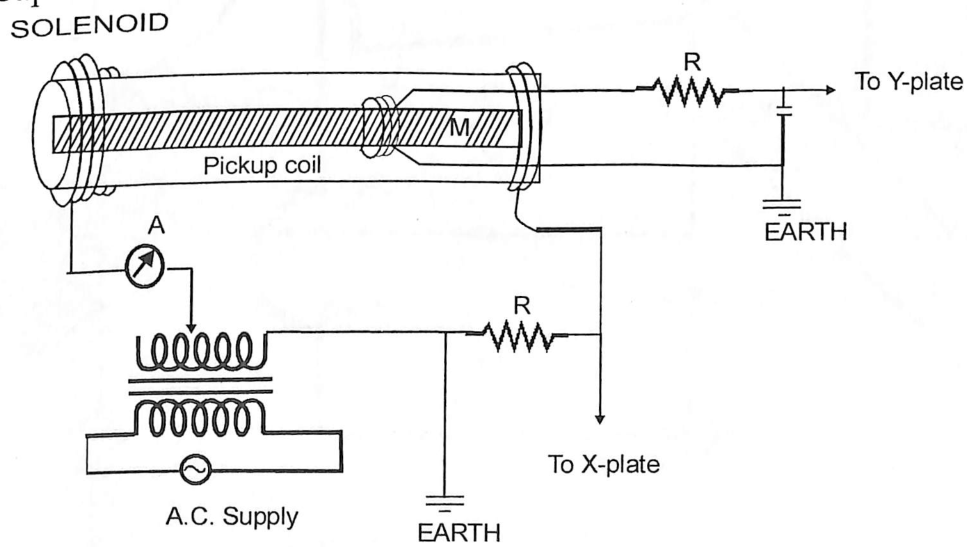
(iv) Change the value of current and take above observations for two, three values of current. Note that the amplitudes of signals fed to the C.R.O. donot drive its amplifiers to saturation a stage when loop will be ditorted.

(v) Note the change produced in the loop when the magnetic material is replaced by similar one with lesser area of cross-section.

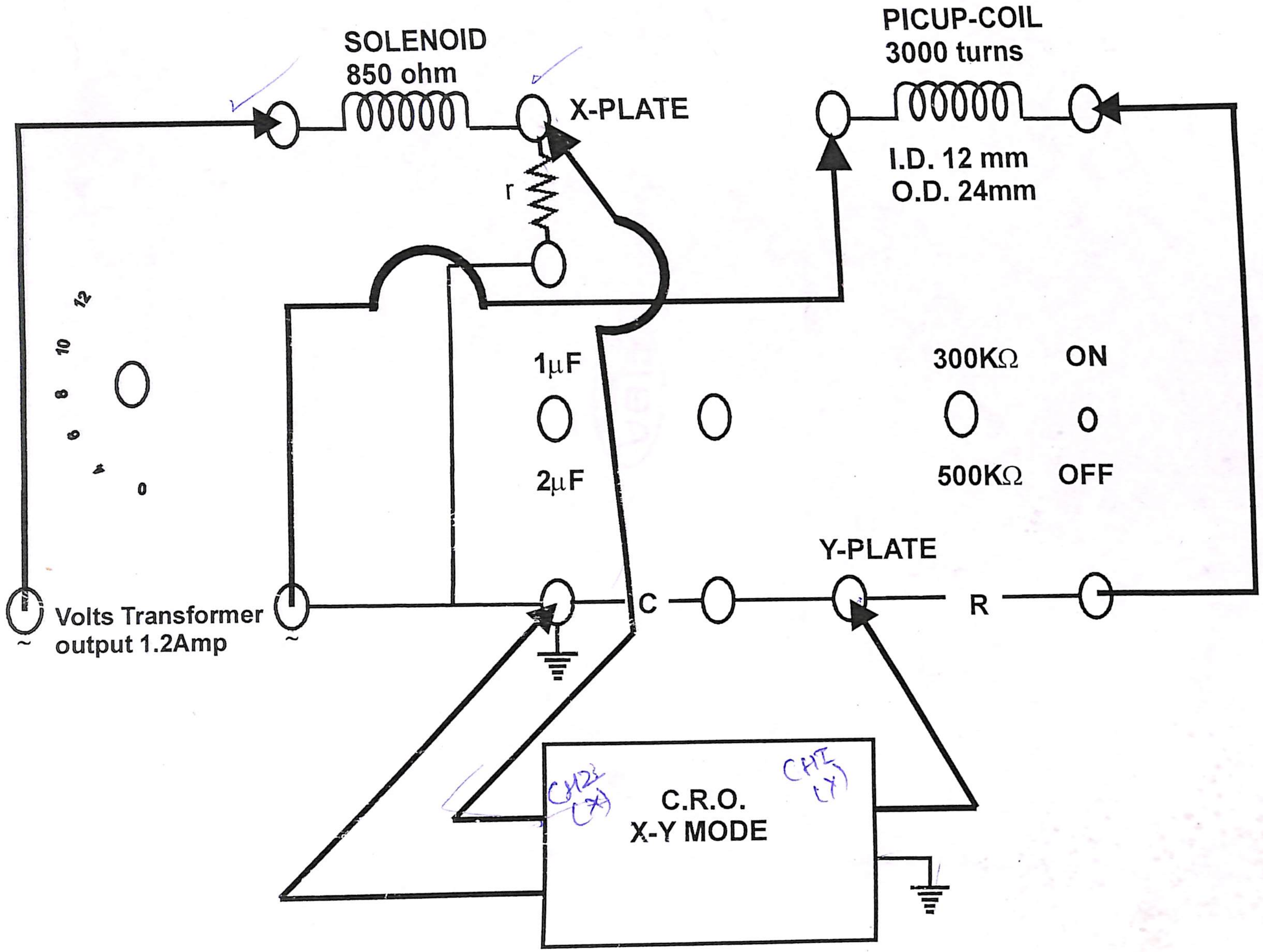
(vi) Repeat the experiment with a different magnetic material. Also note the effect of introducing a non-magnetic material in the pick-up coil.

(vii) Record the data as under;

| | | | |
|---|---|---|---|
| No. of turns in the solenoid coil | N | = | |
| Length of the solenoid | L | = | |
| Total no. of turns in the pick-up coil | n | = | |
| Area of cross-section of the pick-up coil | A | = | |
| Resistance in integrator circuit | R | = | |
| Capacitance in integrator circuit | C | = | |




| S.No. | Current i(A) | $(e_x)_{pp}$ (V) | $2(e_x)_c$ (V) | $2(e_y)_r$ (V) | $2(e_y)_s$ (V) |
|---|---|---|---|---|---|
| | | | | | |


SOLENOID
850 ohm
X-PLATE
PICUP-COIL
3000 turns
I.D. 12 mm
O.D. 24mm
r
12
10
8
6
4
0
1μF
2μF
300KΩ
500KΩ
ON
OFF
Y-PLATE
C
R
Volts Transformer
output 1.2Amp
C.R.O.
X-Y MODE