Middle East Technical University
Electrical and Electronics Eng. Dept.

EE 361 Homework 1 due 22 Oct. 2010

Question 1

Mohamed E. El-Hawary, Principles of Electric Machines with Power Electronics Applications, A Reston Book, Prentice-Hall.

Example 1.5 In the magnetic system shown in Fig. 1.32, employ the magnetization curves of Fig. 1.7 to determine:

a) The coil current required to produce total flux $\phi = 0.25 \times 10^{-3}$ Wb.

b) The reluctance of the entire flux path.

c) Relative permeability μ_r for each material under these conditions.

d) The reluctance of each part, cast iron and cast steel, of the magnetic system.

Leakage flux may be neglected.

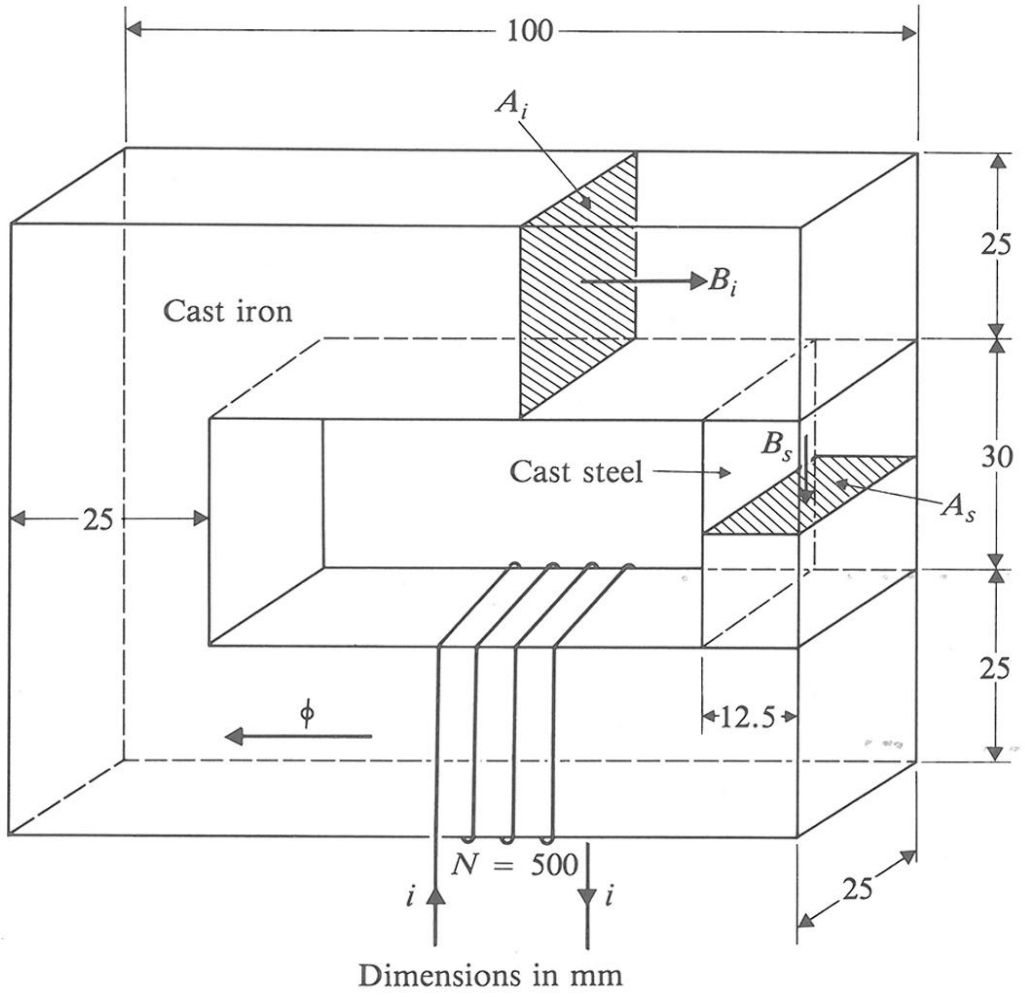

Fig. 1.32 Magnetic system of two different materials for Example 1.5.

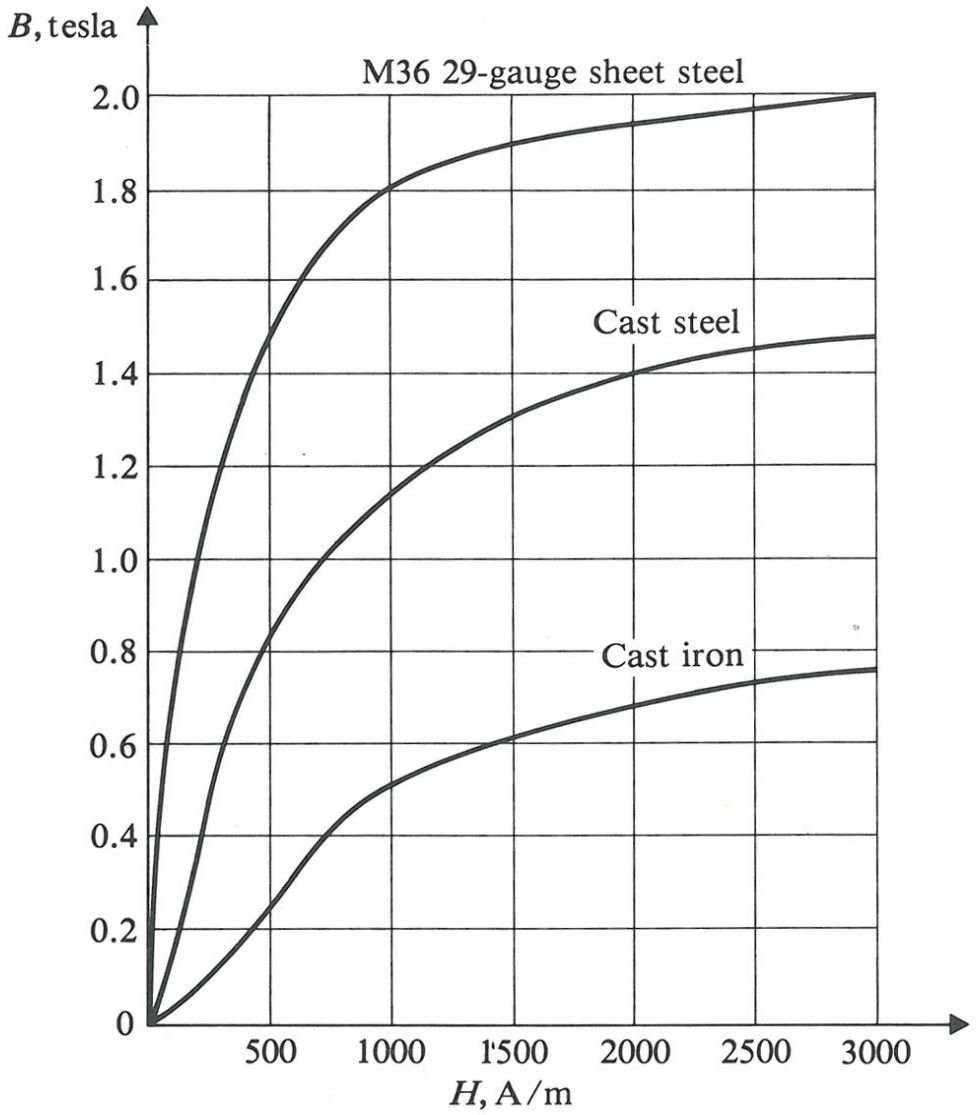

Fig. 1.7 Magnetization curves.

Question 2

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Example 1.6 In the magnetic system shown in Fig. 1.34,

$$l_1 = l_3 = 300 \text{ mm} \qquad l_2 = 100 \text{ mm}$$
$$A_1 = A_3 = 200 \text{ mm}^2 \qquad A_2 = 400 \text{ mm}^2$$
$$\mu_{r1} = \mu_{r3} = 2250 \qquad \mu_{r2} = 1350$$
$$N = 25$$

Determine the flux densities B_1, B_2, and B_3 in the three branches of the circuit when the coil current is 0.5 A.

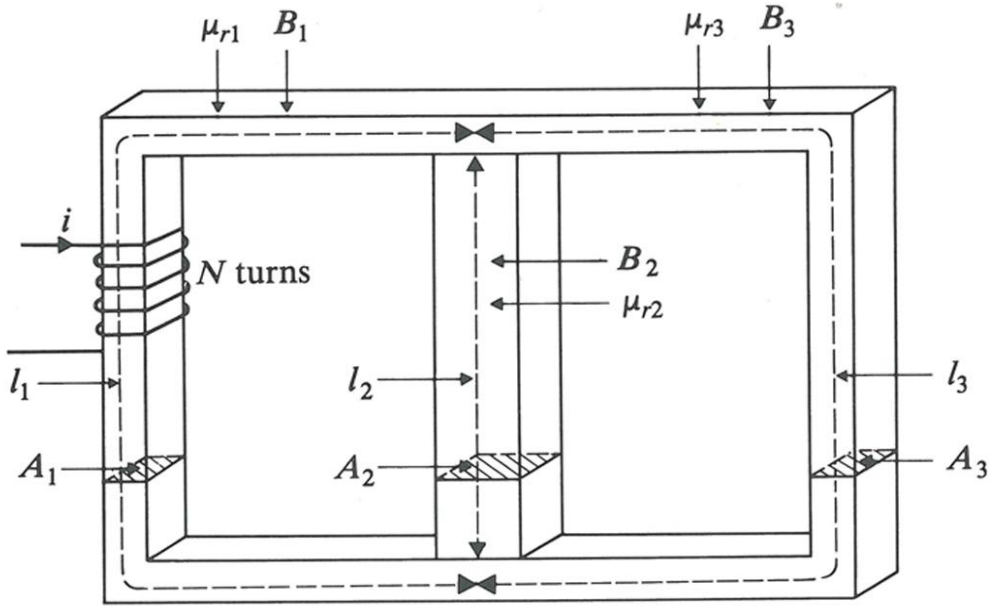

Fig. 1.34 Magnetic circuit for Example 1.6.

Question 3

G.R. Sleman and A. Straughen, Electric Machine, Addison-Wesley

Example 2.7 Consider the magnetic structure shown in Figure 2.22. Assume that section 1 is made of sheet steel and section 2 is made of cast steel. Let

$$l_1 = l_2 = 0.4 \text{ m}$$
$$A_1 = A_2 = 8 \times 10^{-4} \text{ m}^2$$

Find the flux, flux densities B_1 and B_2, and magnetic field intensities H_1 and H_2, for the following MMFs.

(a) $\mathcal{F} = 800$ At.
(b) $\mathcal{F} = 1200$ At.
(c) $\mathcal{F} = 1400$ At.

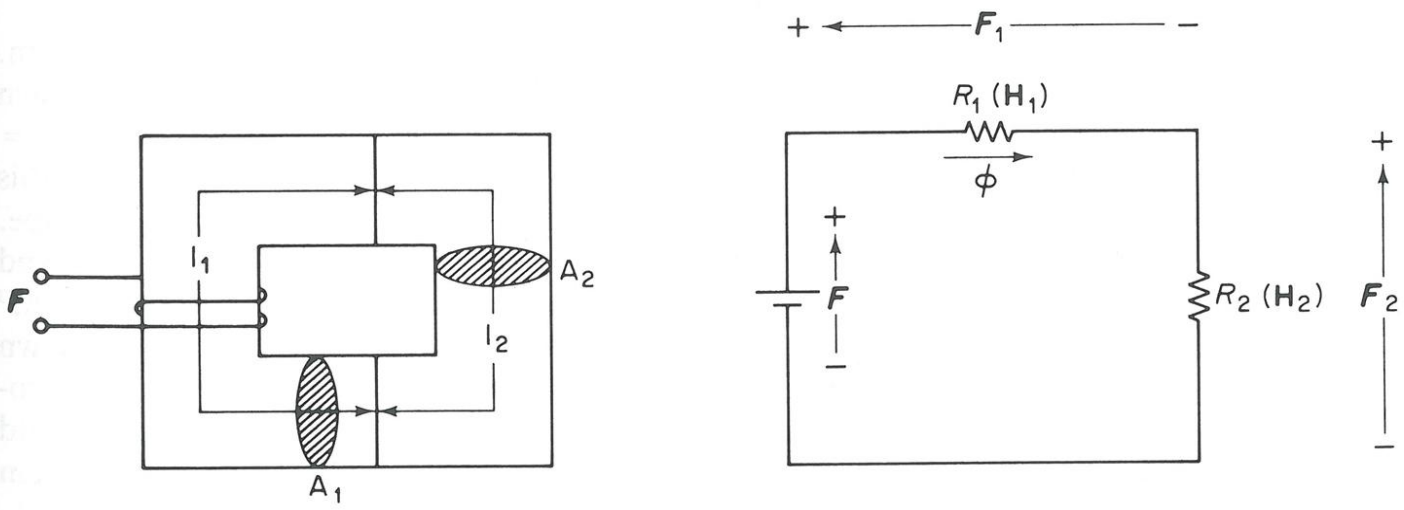

FIGURE 2.22 A Single-loop magnetic structure and its equivalent circuit.

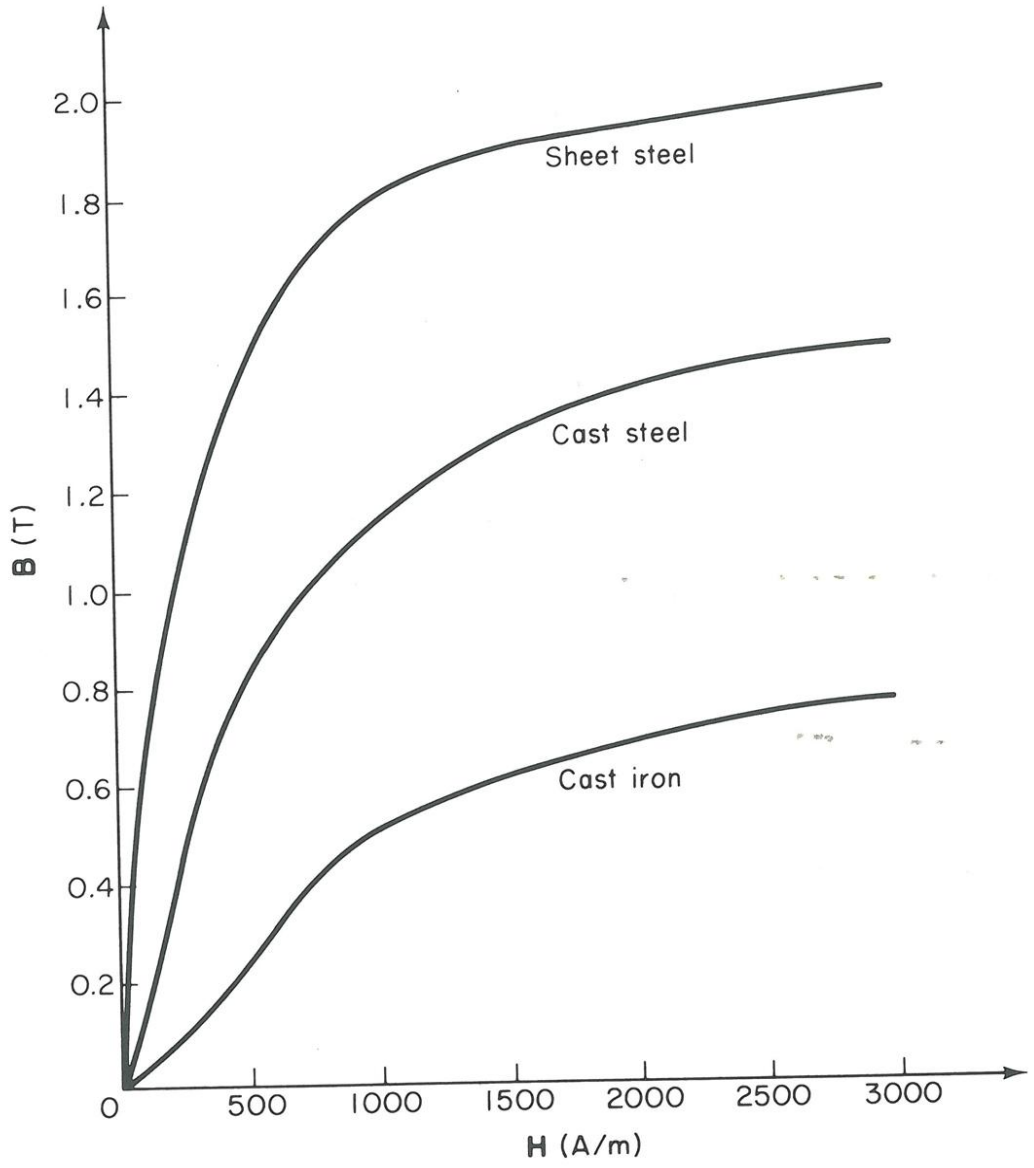

FIGURE 2.25 Magnetization curves for three soft ferromagnetic materials.

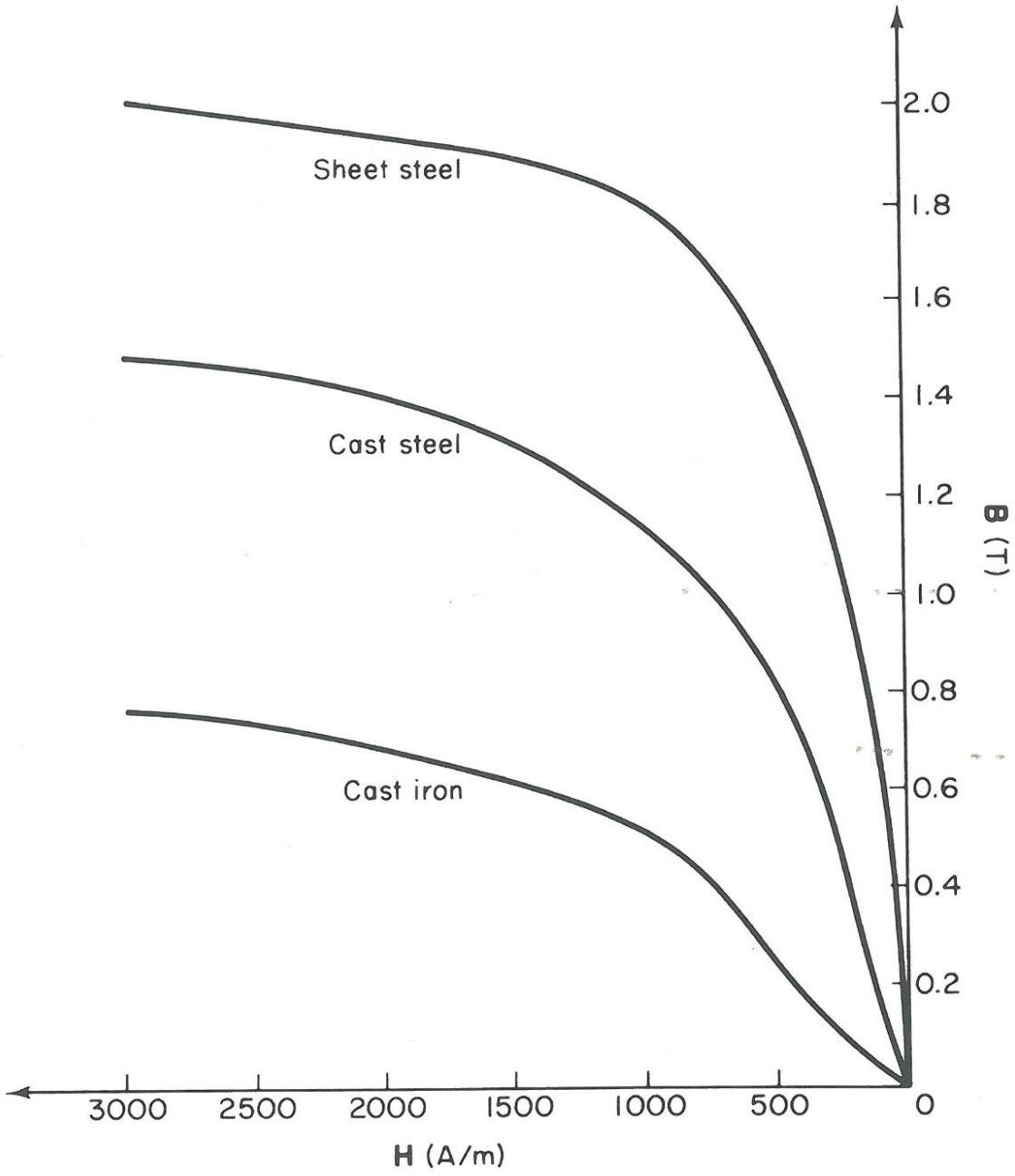

FIGURE 2.26 Reversed magnetization curves for three soft ferromagnetic materials.

Question 4
G.R. Sleman and A. Straughen, Electric Machine, Addison-Wesley

Example 2.8 Find the flux density in the structure shown in Figure 2.30 given that the source MMF is 2400 At. The material of section 1 is cast steel, with a length of 80 cm, while the air-gap length is 0.4π mm.

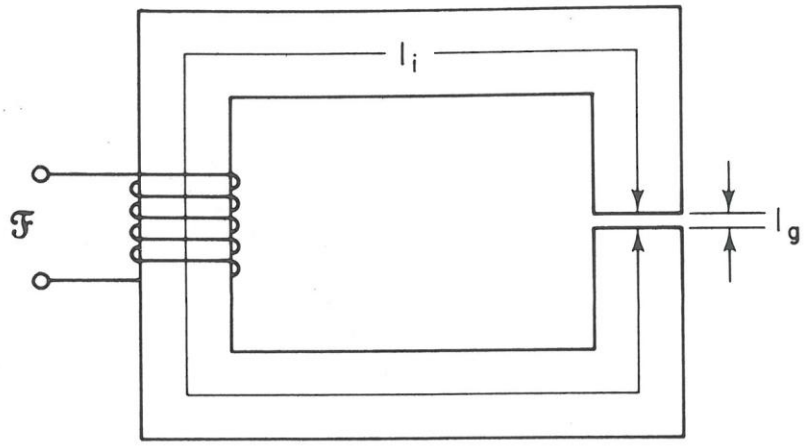

FIGURE 2.30 Magnetic structure for Example 2.8.