B.Sc. Engg.(CSE), 2nd Sem. Date: October 25, 2019

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination
Course No.: Phy 4241
Course Title: Physics II

Summer Semester, A.Y. 2018-2019
Time: 3 Hours
Full Marks: 150

There are **8 (eight)** questions. Answer any **6 (six)** questions. All questions carry equal marks. Marks in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Symbols carry their usual meanings.

---

1. a) Define power factor. Why power factor correction is important? 6

b) Find the voltages and currents in the circuit shown in Figure 1(b) by applying Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL), where $E_1 = 10$ V, $E_2 = 5$ V, $R_1 = 2\ \Omega$, $R_2 = 8\ \Omega$ and $R_3 = 4\ \Omega$. 6

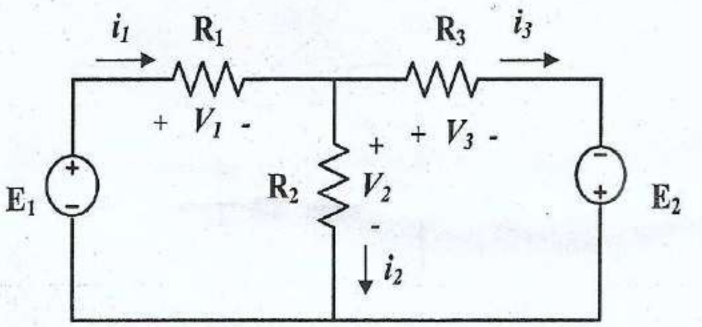


Figure 1(b)

c) Find I_0 in the circuit in Figure 1(c). 13

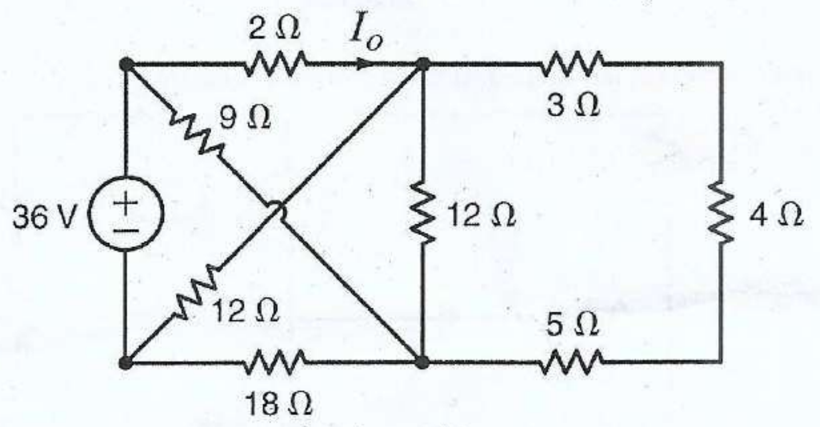


Figure 1(c)

2. a) Use nodal analysis to determine the node voltages defined in the circuit in Figure 2(a). 15

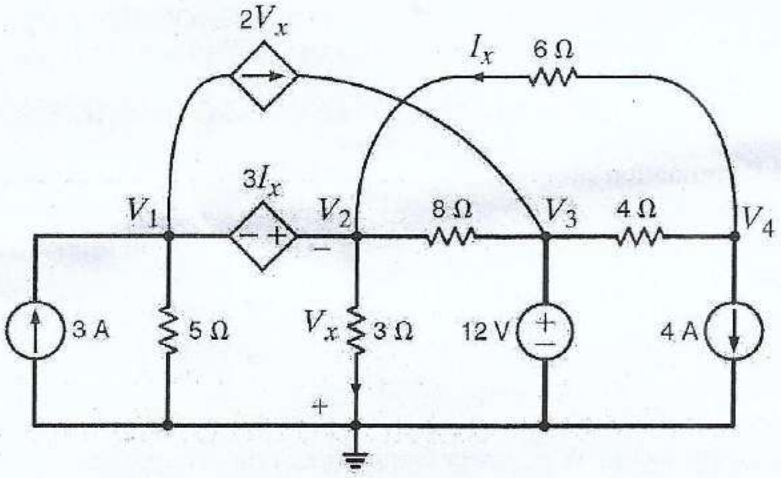


Figure 2(a)

b) Calculate the maximum power that can be transferred to R_L in the circuit of Figure 2(b). 10

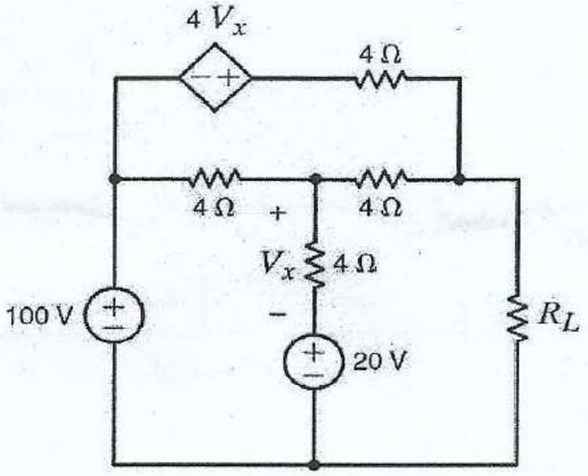


Figure 2(b)

3. a) Determine current I_0 in Figure 3(a) using Norton's theorem. 12

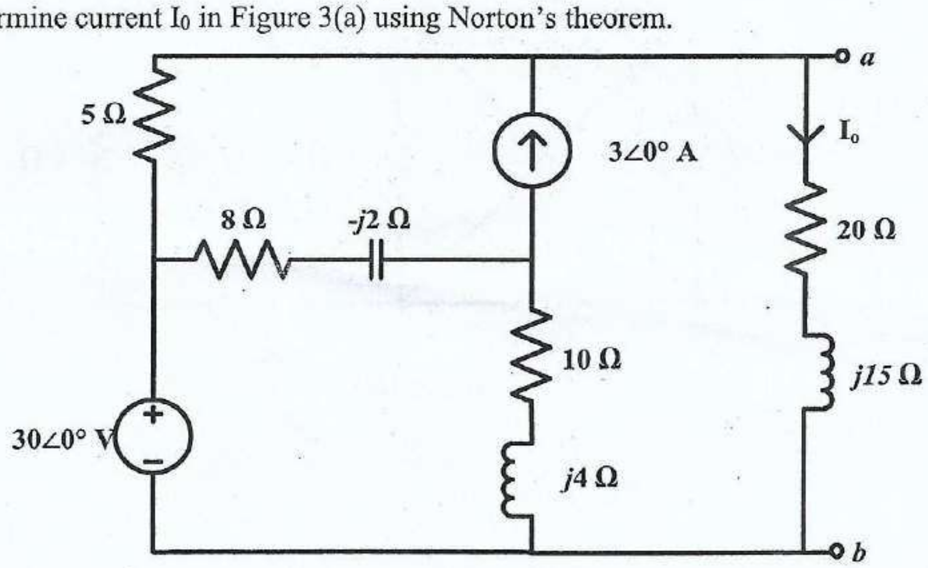


Figure 3(a)

b) What is average power? In Figure 3(b), the resistor R_L is adjusted until it absorbs maximum average power. Calculate R_L and the maximum average power absorbed by it. 8

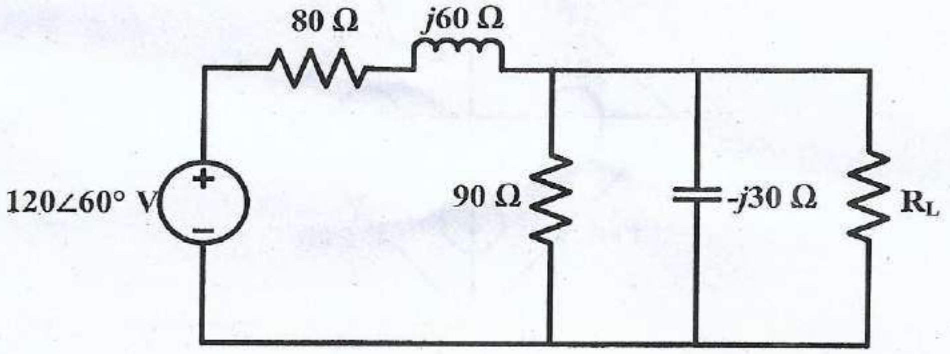


Figure 3(b)

c) When connected to a 120 V (rms), 60 Hz power line, a load absorbs 4 kW at a lagging power factor of 0.8. Find the value of capacitance necessary to raise the pf to 0.95. 5

4. a) Use nodal analysis to find V_0 in the circuit of Figure 4(a). Let $\omega = 2$ krad/s. 13

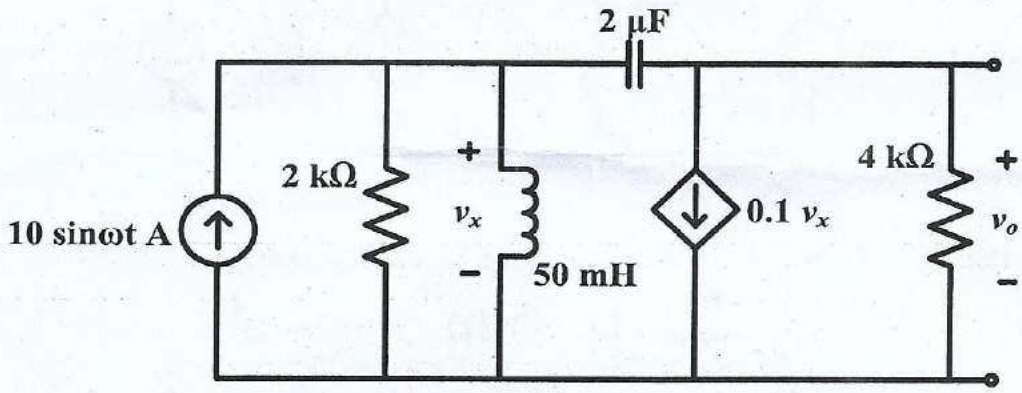


Figure 4(a)

b) What is admittance? Find I in the circuit of Figure 4(b). 12

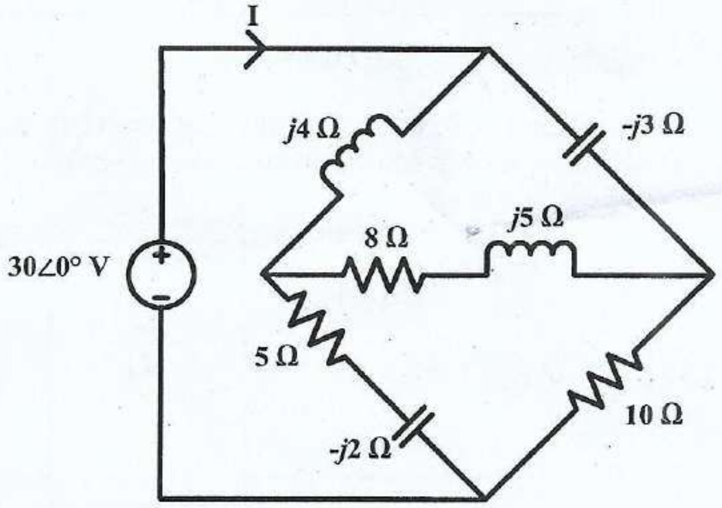


Figure 4(b)

5. a) Find V_o in the network in Figure 5(a) using superposition. 12

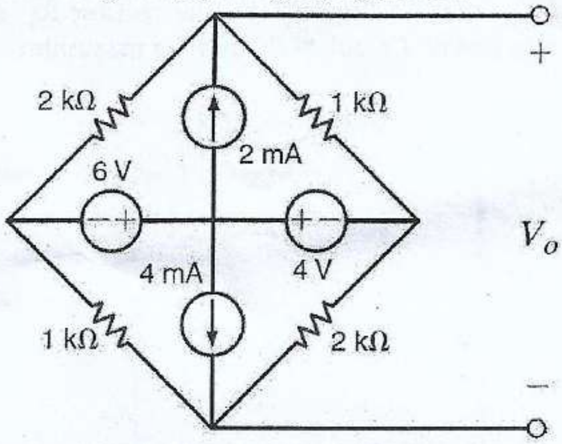


Figure 5(a)

b) Find the Thévenin's equivalent of the circuit shown in Figure 5(b). 13

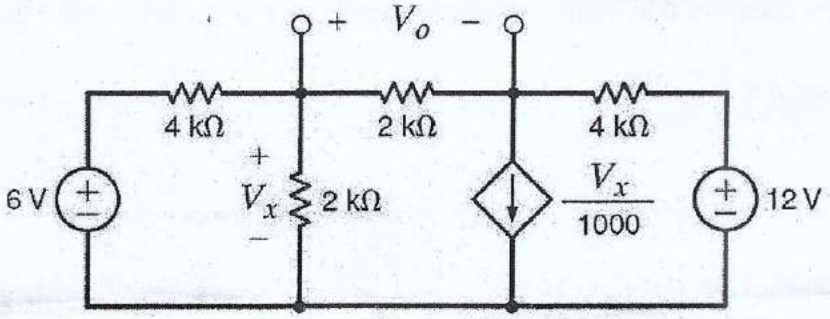


Figure 5(b)

6. a) Determine the hybrid parameters for the network in Figure 6(a). 12

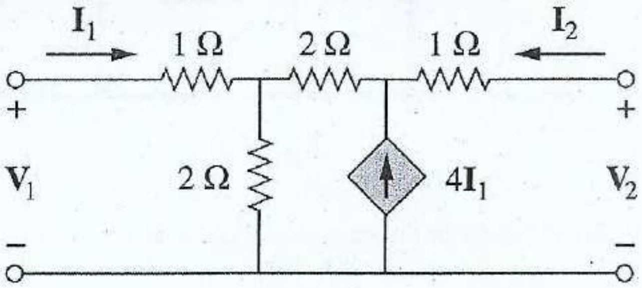


Figure 6(a)

b) For the circuit in Figure 6(b), at ω = 2 rad/sec, $z_{11} = 10\ \Omega$, $z_{12} = z_{21} = j6\ \Omega$ and $z_{22} = 4\ \Omega$. Obtain the Thevenin equivalent circuit at terminals $a - b$ and calculate v_0. 13

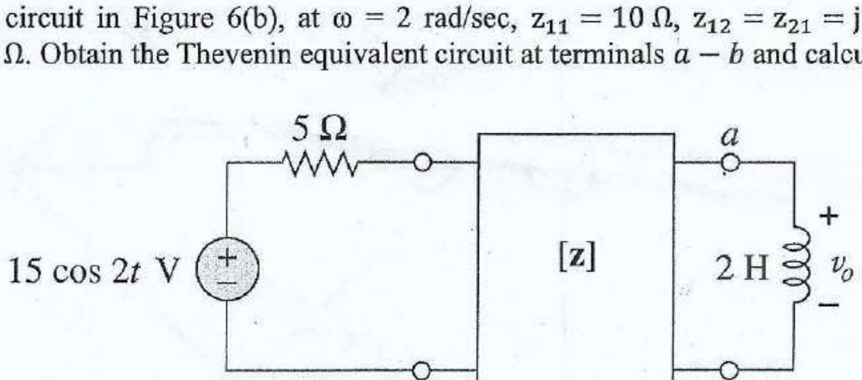


Figure 6(b)

7. a) Mathematically derive the condition for maximum power transfer in an AC circuit where source voltage is V_{Th}, line impedance is $Z_{Th} = R_{Th} + jX_{Th}$ and load impedance is $Z_L = R_L + jX_L$. 10

b) Using mesh analysis, find I_0 in the network in Figure 7(b). 15

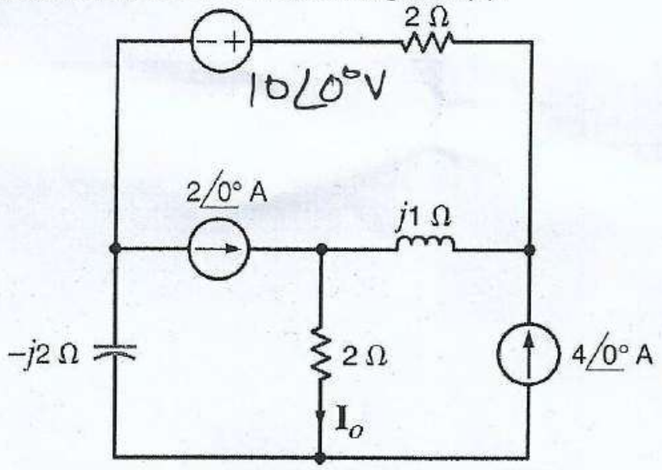
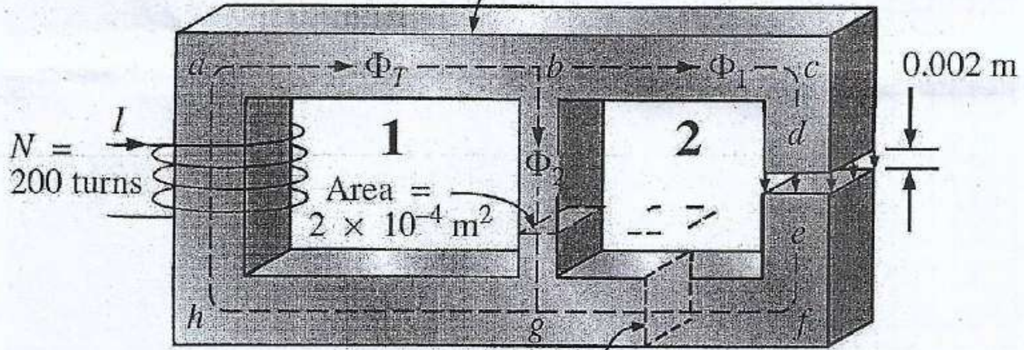


Figure 7(b)

8. a) For the series-parallel magnetic circuit shown in Figure 8(a), find the value of I required to establish a flux of $\phi_g = 2 \times 10^{-4}$ Wb in the air gap. Use the two B-H curves supplied at the end. 13



Area for sections other than $bg = 5 \times 10^{-4}$ m²

$l_{ab} = l_{bg} = l_{gh} = l_{ha} = 0.2$ m

$l_{bc} = l_{fg} = 0.1$ m, $l_{cd} = l_{ef} = 0.099$ m

Figure 8(a)

b) Calculate the value of Z_{ab} of the network shown in Figure 8(b). 12

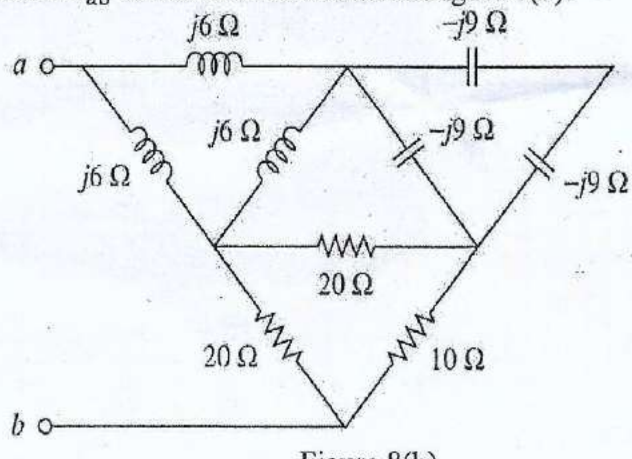
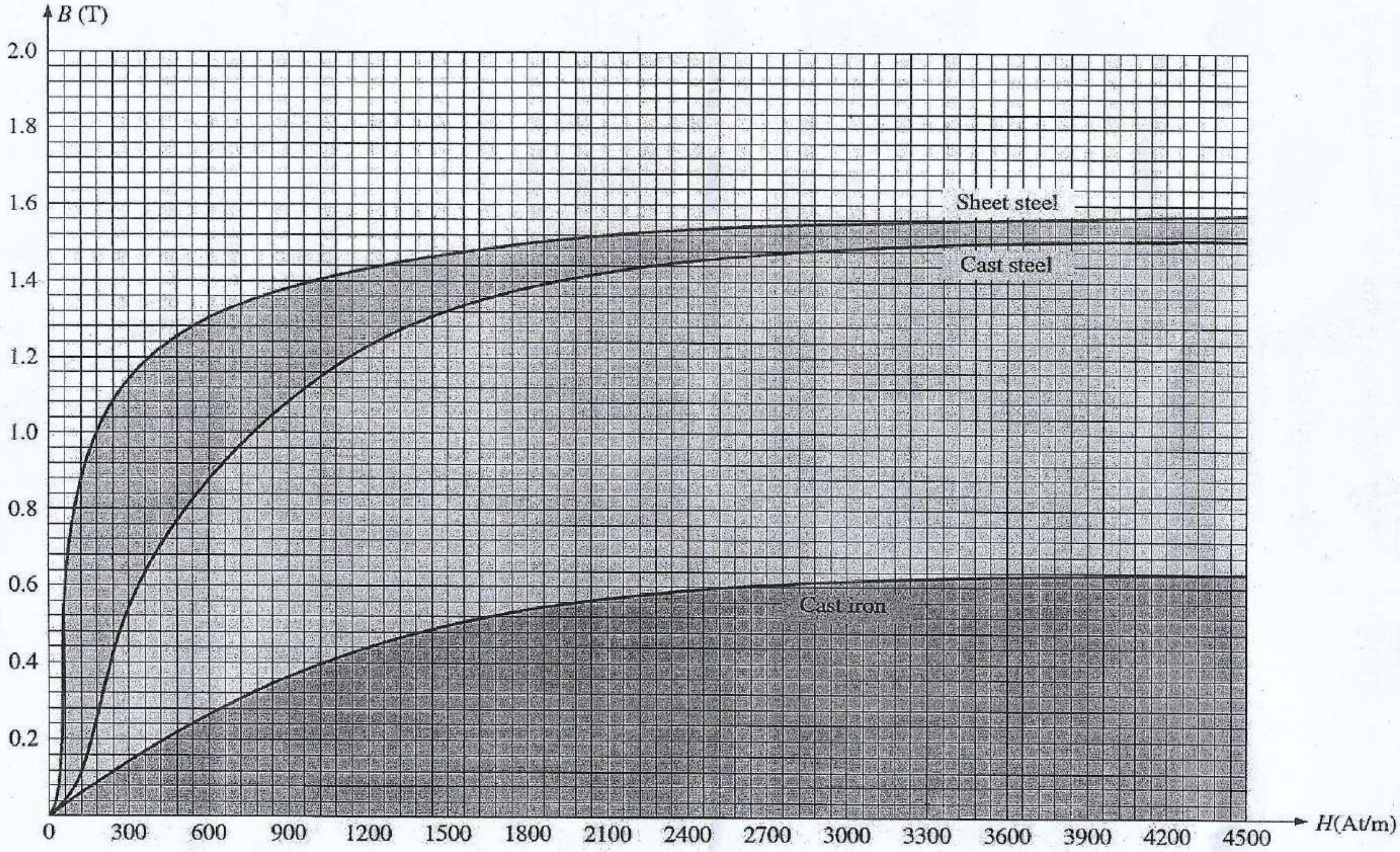
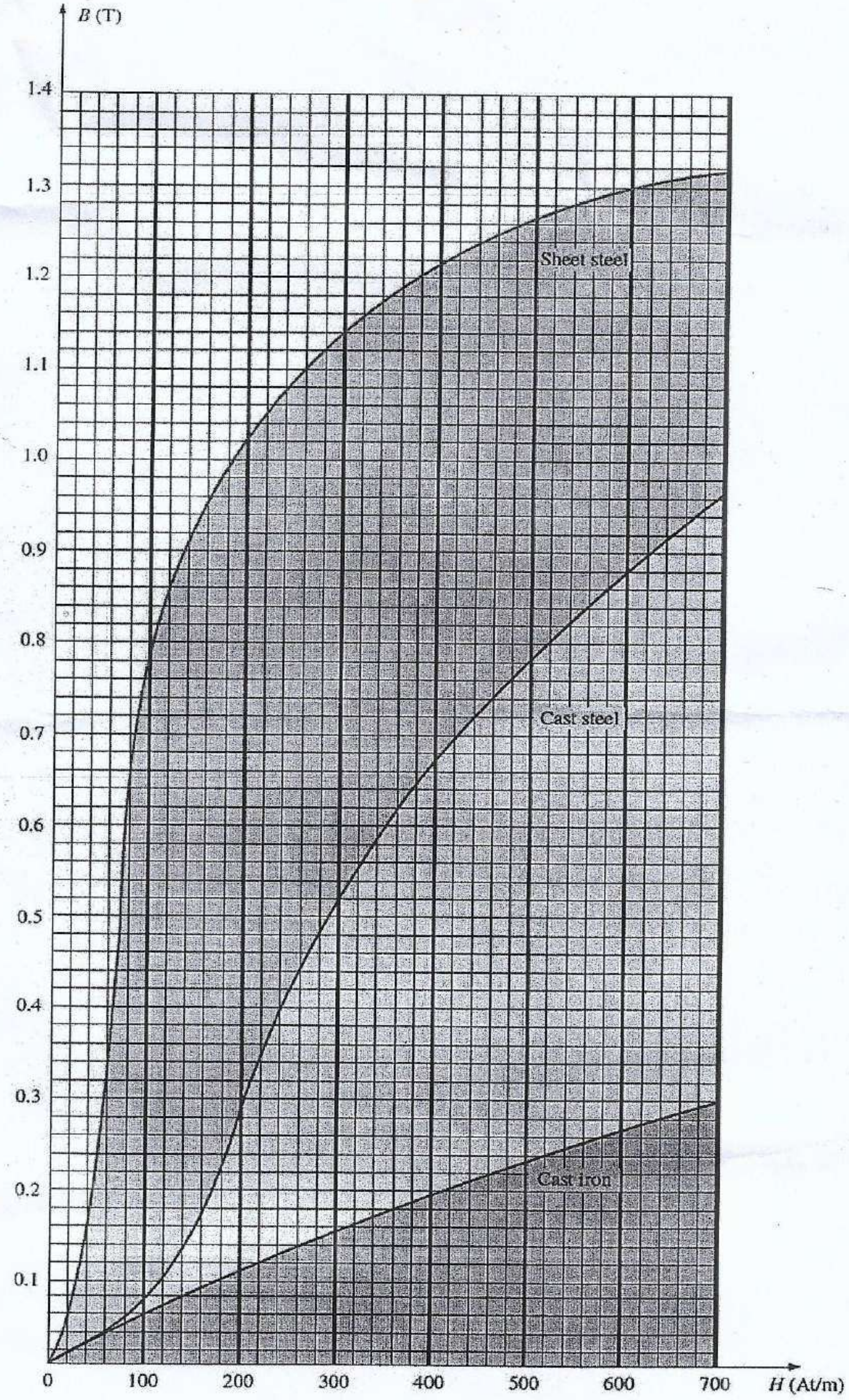


Figure 8(b)



B-H curve 1 for Q. 8(a)



B-H curve 2 for Q. 8(a)