# PRINCE OF SONGKLA UNIVERSITY
## FACULTY OF ENGINEERING

Midterm Examination: Semester 1

Date: 4 สิงหาคม 2548

Subject: 211–221 Fundamentals of Electrical Machines

Academic Year: 2005

Time: 9:00–12:00

Room: A 302

คำสั่ง
- ข้อสอบมีทั้งหมด 5 ข้อ ข้อละ 20 คะแนน
- อนุญาตให้จดสูตรในกระดาษ A4 และนำเข้ามาในห้องสอบได้
- อนุญาตให้ใช้เครื่องคิดเลขได้

1. A 280-turn coil is wound on the centre leg of the sheet steel core shown in Figure 1. A flux density of 0.8 T is required in each outer leg. The core is built up to a thickness of 3 cm.
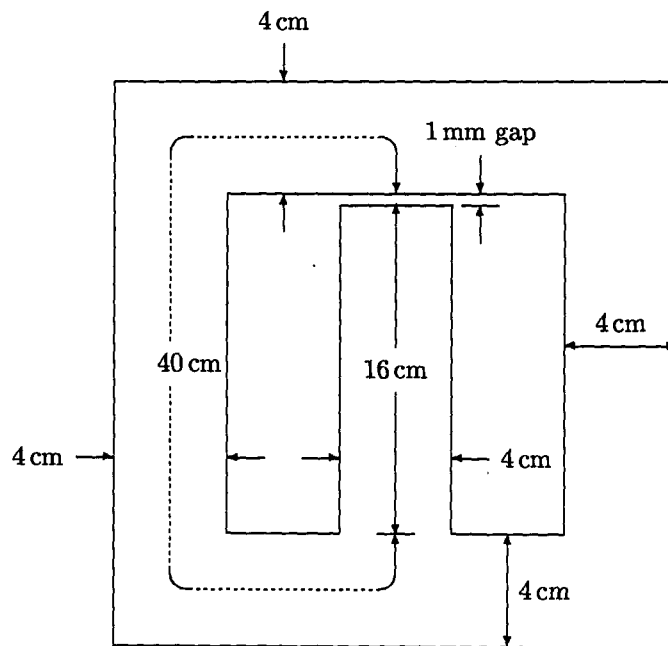
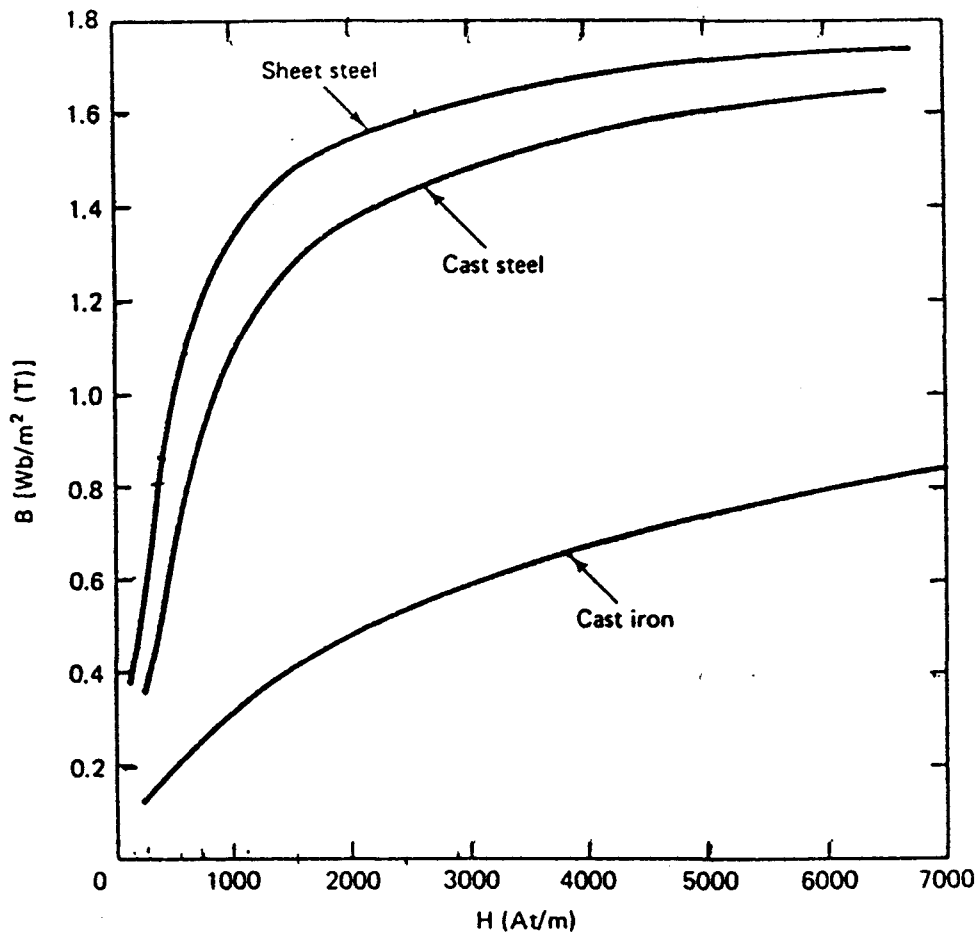- Determine the coil current.



Figure 1: Sheet steel core.

*FIGURE 1.11.* **Magnetization curves for commonly used magnetic materials.**

**2.** A two-pole motor has 260 conductors on its armature, and 70% are directly under the pole faces (*i.e.* active). The armature length is 16 cm, its radius 12 cm, and the field 0.8 T at the conductor locations. The armature current is 60 A (this means the currents in the conductors is 30 A because there are 2 parallel paths). The motor is rotating at 1600 r/min.

- Calculate

    1. the total force developed by the armature,

    2. the torque developed by the armature,

    3. the mechanical power developed by the motor,

    4. the counter EMF.

**3.** A short-shunt compound generator delivers 50 A at 500 V to a resistive load. The armature, series field and shunt field resistances are 0.16 Ω, 0.08 Ω and 200 Ω respectively.

- Calculate

    1. the generated EMF,

    2. the armature current,

    3. if the rotational losses are 520 W, determine the efficiency of the generator.

**4.** A 120 V shunt motor has the following parameters: $R_A = 0.40\,\Omega$, $R_F = 120\,\Omega$, and rotational loss = 240 W. On full load the line current is 19.5 A and the motor runs at 1200 r/min.

- Determine

    1. the developed power,

    2. the output power,

    3. the developed torque,

    4. the efficiency at full load.

**5.** A 220 V dc shunt motor has an armature resistance of 0.3 Ω.

- Calculate

    1. the resistance required in series with the armature to limit the armature current to 80 A at starting,

    2. the value of the counter EMF when the armature current has decreased to 30 A with the resistor still in the circuit.

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