ชื่อ-นามสกุล_____รหัส_____section_____

มหาวิทยาลัยสงขลานครินทร์
คณะวิศวกรรมศาสตร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 2 ประจำปีการศึกษา 2547

วันที่ 22 ธันวาคม 2547 เวลา 9.00-12.00 น.

วิชา 211-221 FUNDAMENTAL OF ELECTRIC MACHINES ห้อง หัวหุ่น

คำสั่ง

1. ห้ามนำเอกสารใดๆเข้าห้องสอบ ยกเว้นบันทึกสูตรบนกระดาษ A4 จำนวน 1 แผ่นหน้า/หลังเท่านั้น
2. อนุญาตให้นำเครื่องคิดเลขเข้าห้องสอบได้
3. ข้อสอบมีทั้งหมด 3 ตอน ให้ทำทุกตอนและทุกข้อ
4. เขียนชื่อ-นามสกุล รหัส และ section ลงบนหัวกระดาษทุกแผ่น

PART	คะแนนเต็ม	คะแนนที่ได้
A	70	
B	70	
C	70	
คะแนนรวม	210	

ชื่อ-นามสกุล_____รหัส_____section_____

PART A

1. There are two main losses in magnetic core, hysteresis loss and eddy current loss. Explain briefly the meaning of these two losses.

(15 marks)

2. A conductor carries an electrical current I as shown in Figure A-1. Sketch in the figure the magnetic field and its direction created around the conductor.

(10 marks)

Figure A-1

3. The core shown in Figure A-2 has a mean length of 30 cm and a cross-sectional area of 5 cm^2. The coil has 100 turns and current of 1.5 A. The magnetization curve for the core material is given in Figure A-3

   3.1 Sketch into the figure, the magnetic field direction in the core.
   (5 marks)

   3.2 Calculate the magnetic flux created in the core.
   (10 marks)

   3.3 Find the total reluctance of the core.
   (10 marks)

   3.4 If an air gap 2 mm length is cut in the core and a flux of 0.5 mWb is required in the air gap. Determine the coil current.
   (20 marks)

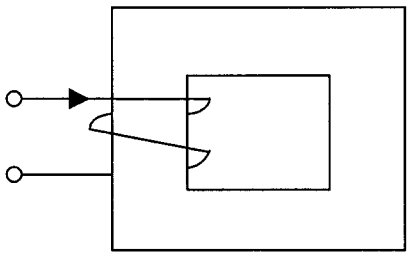

Figure A-2

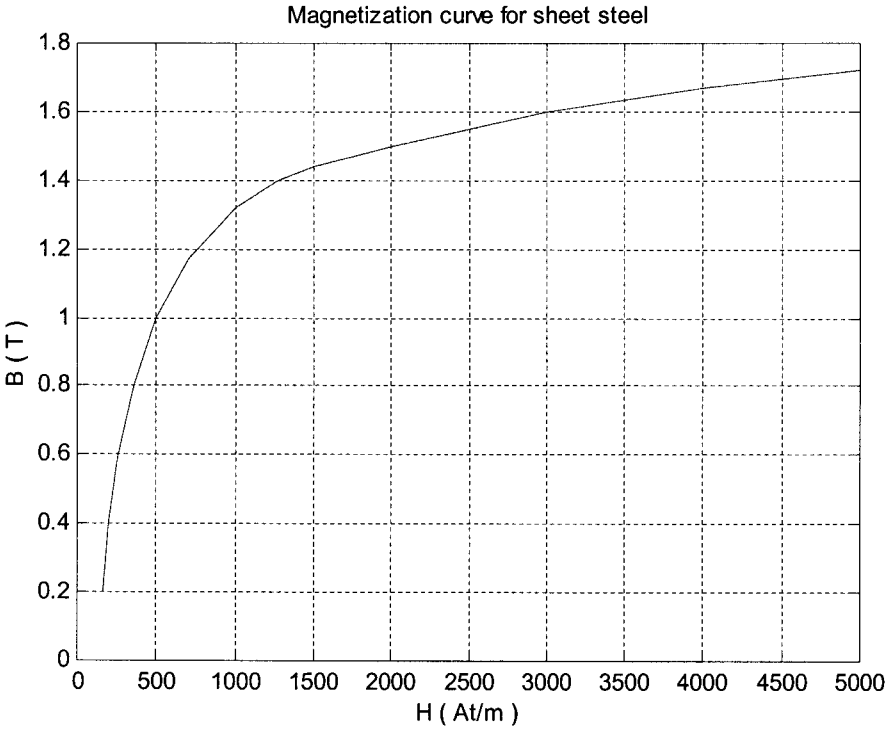

Figure A-3

ชื่อ-นามสกุล_____รหัส_____section_____

PART B

1. A 20-kVA 240/120-V 50-Hz single-phase transformer has the following resistance and reactance values :

   Rp=0.008 ohm Xp=0.04 ohm

   Rs=0.004 ohm Xs=0.02 ohm

   1.1 draw a simplified transformer circuit when secondary parameters transferred to the primary.
   (5 marks)

   1.2 calculate the equivalent transformer values in primary terms
   (10 marks)

   1.3 determine the rated currents in primary and secondary windings.
   (5 marks)

2. The secondary of the transformer in problem 1. is connected to a load of 15 kW at 120 V at a power factor of 0.8 lagging. Determine
   2.1 the current in each of the primary and secondary windings of the transformer
   (15 marks)
   2.2 the voltage applied to the terminals of the primary winding.
   (15 marks)

ชื่อ-นามสกุล_____รหัส_____section_____

3. 500-kVA 33,000/400-V 3-phase transformer are connected in Δ-Y connection to supply a balanced three-phase load of 300 kW at 400 v at a power factor of 0.8 lagging
   3.1 draw the Δ-Y 3-phase transformer connection diagram
   (10 marks)
   3.2 determine line and phase voltages, line and phase currents in primary winding
   (5 marks)
   3.3 determine line and phase voltages, line and phase currents in secondary winding
   (5 marks)

ชื่อ-นามสกุล_____รหัส_____section_____

PART C

1. A four-pole dc machine has an armature radius of 25 cm and an effective length of 50 cm. The pole covers 75% of the armature periphery. The armature winding is double-layered and has 66 coils, each having 7 turns. The average flux density under each pole is 0.8 T. For a lap-wound armature winding, determine
   1.1. the machine constant,
   1.2. the induced armature voltage when the armature rotates at 800 rpm,
   1.3. the power developed by the armature when the current in each coil is 50 A,
   1.4. the electromagnetic torque developed in 1.3 at speed of 800 rpm.

   (20 marks)

2. The data obtained for the magnetization curve of a dc machine when run at 1,000 rpm are represented by the magnetization curve given in Figure C-1. The machine has the field-winding resistance of 100 Ω. Neglect the armature reaction. The machine is connected as a shunt generator.
   2.1. Sketch the field-connection diagram.
   2.2. Determine the build-up voltage and the field current at no load.
   2.3. Determine the critical external resistance connected in series with the field winding.
   2.4. Determine the field current and the external resistance connected in series with the field winding to obtain the no-load voltage in 2.2. The generator is now running at 1,200 rpm.

(20 marks)

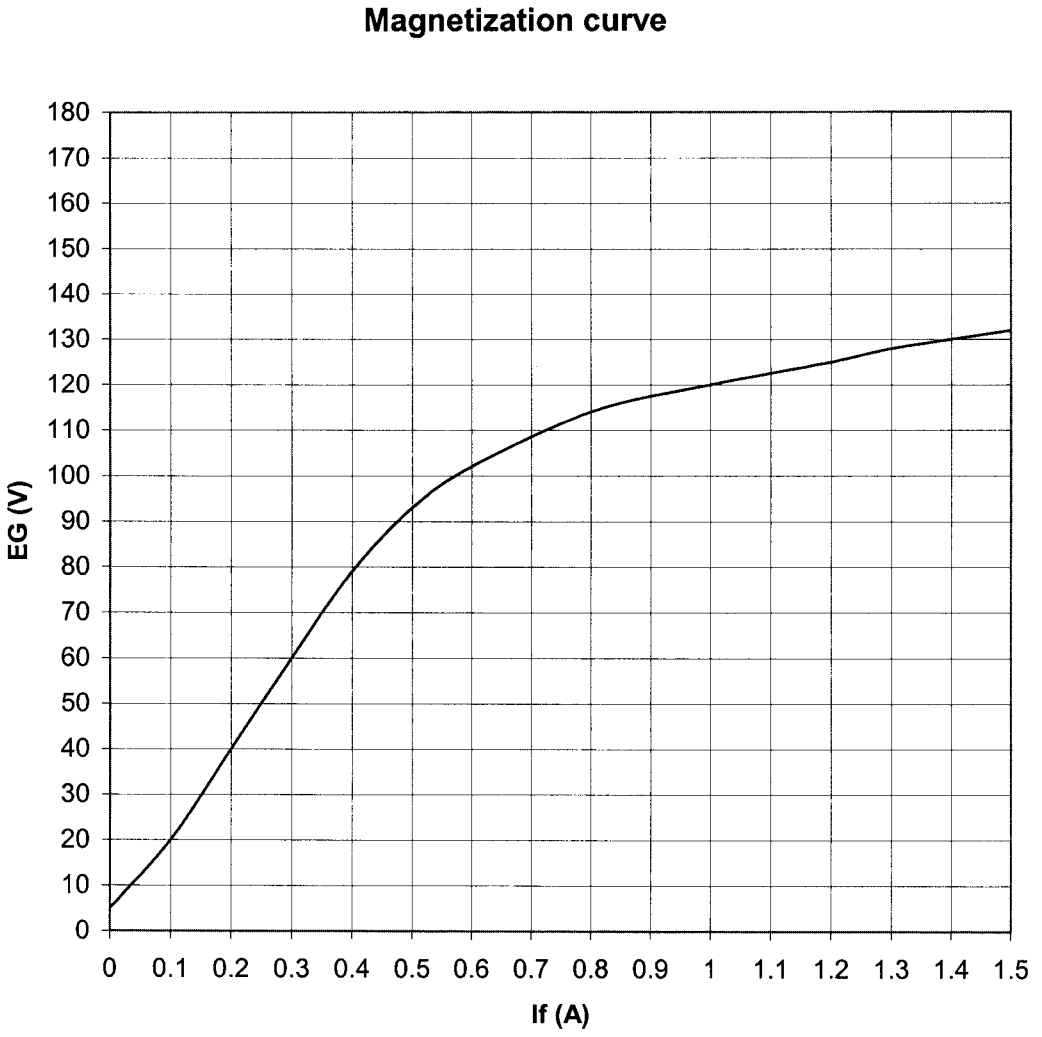

Figure C-1

3. A 10-kW shunt dc generator has the armature resistance of 0.1 Ω and the shunt-field resistance of 100 Ω.
   3.1. Determine the full-load efficiency if it has the rotational losses of 800 W and the full-load voltage of 200V. Neglect other losses.
   3.2. Determine the turns per pole of the series-field winding needed to compensate the shunt-field winding to obtain the flat-compound generator. The field currents at no-load and full-load are 1A and 2A, respectively. The shunt-field winding has 600 turns. The connection of series-field winding forms a long shunt compound generator.

(10 marks)

4. Explain briefly how the armature reaction occurs and how to eliminate its effect.
(5 marks)

5. Explain briefly how the self-excited dc generator can generate voltage.
(5 marks)

6. Explain briefly. Why is the variation of terminal voltage with load for a shunt generator greater than that of the separately excited generator?

(2 marks)

7. Explain briefly the function of

7.1 Commutator

7.2 Brush

7.3 Yoke

7.4 Field winding

7.5 Armature winding

7.6 Left-hand rule

7.7 Right-hand rule

Explain briefly the meaning of

7.8 Magnetic neutral axis

(8 marks)