

國立臺北科技大學

九十二學年度電機工程系碩士班入學考試

電機機械試題

填准考證號碼

第一頁 共一頁

--	--	--	--	--	--	--	--	--	--

注意事項：

1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. A coil of wire with 100 turns is wrapped around an iron core. If the flux in the core is given by $\phi = 0.05 \sin 377t$, what voltage is produced at the terminals of the coil?(10 分)
2. A 20-kVA 8000/277-V distribution transformer has the following impedance values:
 $R_p = 32\Omega$; $R_s = 0.05\Omega$; $X_p = 45\Omega$; $X_s = 0.06\Omega$; $R_c = 250k\Omega$; $X_m = 30k\Omega$
The excitation branch impedances are given referred to the high-voltage side of the transformer.
 - (a) Find the equivalent circuit of this transformer referred to the high voltage side. (6 分)
 - (b) Find the per-unit equivalent circuit of this transformer. (6 分)
 - (c) Assume that this transformer is supplying rated load at 277V and 0.8 PF lagging. What is this transformer's input voltage? What is the voltage regulation? (8 分)
 - (d) What is this transformer's efficiency under the conditions of part (c)? (5 分)
3. A 480-V, 50-Hz, Y-connected, six-pole synchronous generator has a per-phase synchronous reactance of 1.0Ω . Its full-load armature current is 60A at 0.8 PF lagging. This generator has friction and windage losses of 1.5kW and core losses of 1.0kW at 60 Hz at full load. Since the armature resistance is being ignored, assume that the I^2R losses are negligible. The field current has been adjusted so that the terminal voltage is 480V at no load.

- (a) What is the speed(in rpm) of this generator? (4 分)
- (b) What is the terminal voltage of this generator if it is loaded with the rated current at 0.8PF leading? (7 分)
- (c) What is the efficiency of this generator(ignoring the unknown electrical losses) when it is operating at the rated current and 0.8 PF lagging? (6 分)
- (d) How much shaft torque must be supplied by the prime mover at full load? How large is the induced countertorque? (8 分)

4. A 460-V, 25-hp, 60-Hz, four-pole, Y-connected induction motor has the following impedances per phase referred to the stator circuit:

$$R_1 = 0.641\Omega; R_2 = 0.332\Omega; X_1 = 1.106\Omega; X_2 = 0.464\Omega; X_M = 26.3\Omega$$

The total rotational losses are 1100 W and are assumed to be constant. The core loss is lumped in with the rotational losses. For a rotor slip of 2.2 percent at the rated voltage and rated frequency, find the motor's

- (a) speed; (2 分)
- (b) stator current; (3 分)
- (c) power factor; (4 分)
- (d) P_{conv} and P_{out} ; (6 分)
- (e) τ_{ind} and τ_{load} ; (6 分)
- (f) efficiency(4 分).

5. Describe the operational principle of DC brushless motors. (15 分)