國立成功大學

110學年度碩士班招生考試試題

編　號：171

系　所：電機工程學系

科　目：電力工程

日　期：0202

節　次：第 2 節

備　註：可使用計算機

編號： 171

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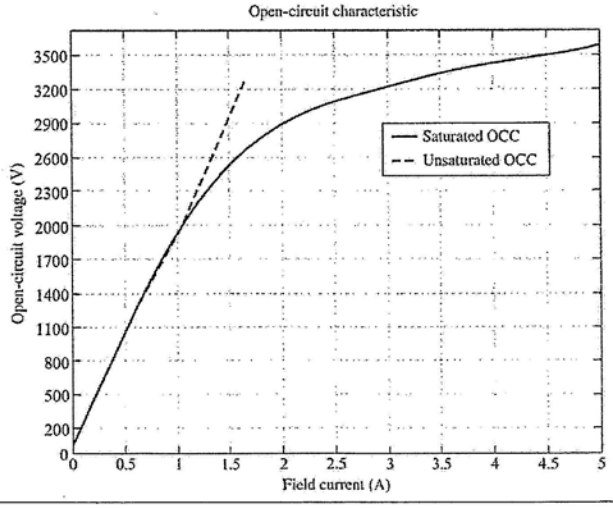
※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) The power crossing the air gap of a 60-Hz, six-pole induction motor is 50 kW, and the power converted from electrical to mechanical form in the motor is 47.5 kW.
   (a) (3%) What is the slip of the motor at this time?
   (b) (4%) What is the induced torque in this motor?
   (c) (3%) Assuming that the mechanical losses are 750 W at this slip, what is the load torque of this motor?

2. (20%) A 100-MVA, 10/200-KV, single-phase power transformer has a per-unit resistance of 1.0 percent and a per-unit reactance of 5.0 percent. The magnetizing impedance is j100 per unit.
   (a) (5%) Find the equivalent circuit referred to the low-voltage side of this transformer.
   (b) (5%) Calculate the voltage regulation of this transformer for a full-load current at power factor of 0.8 lagging.
   (c) (4%) Calculate the copper loss in the transformer at the conditions in (b).
   (d) (6%) Calculate the voltage regulation of this transformer for a full-load current at power factor of 1.0 and 0.8 leading.

3. (20%) A six-pole, Y-connected synchronous generator rates at 345 kVA, 2.0 kV, 0.9 PF lagging, and 60 Hz. Its armature resistance R_A is 1.0 Ω. The open-circuit and short-circuit characteristics are shown in the following figures.
   (a) (6%) What is the saturated synchronous reactance of this generator at the rated conditions?
   (b) (6%) What are the rated current and internal generated voltage of this generator?
   (c) (4%) What field current does this generator require to operate at the rated voltage, current and power factor?
   (d) (4%) What is the voltage regulation at the rated condition and power factor?



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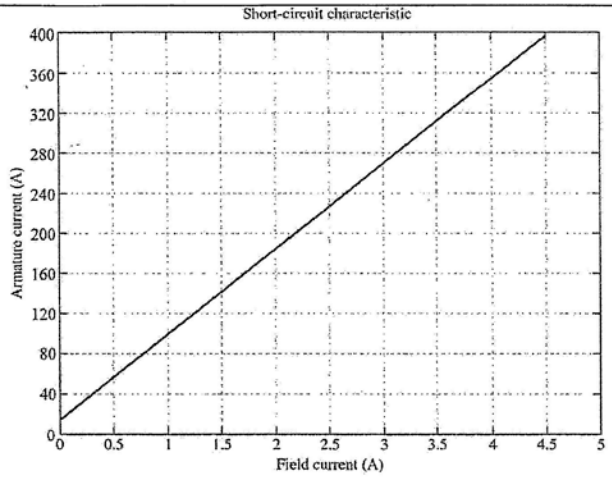

4. (35%) A 10kVA, 220∠0° V, single phase generator is connected to a 20kVA 240/120V step-down transformer with a series reactance of 0.1pu on its own base. The load is connected at the 120V terminal with Z_{load}=1.21+j0.968Ω. Take 10kVA and 220V as a common base and do the followings:
   a. (10%) Draw the per-unit circuit and determine the per-unit impedances and per-unit source voltage.
   b. (10%) Calculate the load current both in per-unit and in ampere.
   c. (5%) If the power factor at load side needs to be improved to 0.95 lagging, please calculate the reactive power in per-unit of the capacitor that is delivered at the load side.
   d. (10%) If a sudden three phase fault occurs at the 120V side of the transformer, calculate the current in per-unit at the point of fault and the current in per-unit from the generator side.

5. (15%) Consider a synchronous generating unit connected through two parallel lines to an infinite bus. Suppose the unit is initially operating in steady state at mechanical power P_{m0} with power angle δ_0, a three-phase short circuit bolted fault occurs at one of the line closing to the sending end bus and causes the generator power angle start to increase from δ_0. As the power angle increase from δ_0 to δ_1, the faulted line was removed. Then the power angle reaches its maximum value at δ_2 and then comes back to its new steady state value at the new steady state point δ_3. Please **plot** the electrical power curve of P_e, and mechanical power P_m versus power angle δ by notating δ_0~δ_3 to describe the equal-area criterion.