國立成功大學

111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
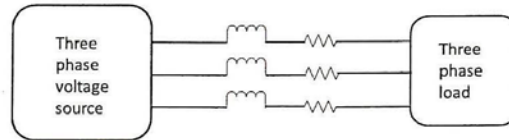
日　期：0219

節　次：第 2 節

備　註：可使用計算機

※ 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. (20%) A three phase balanced source system is providing the power to a three-phase balanced load, which is shown below. Please derive the relationship between the line voltage and line current so that the power factor is kept at one? Please consider the Y and Δ connected sources, respectively.

2. (20%) Consider a three-phase system given in the figure shown below. The positive-, negative-, and zero-sequence impedances are denoted as subscript "1", "2", and "0", respectively. Assume that the given impedance values are in the per unit value. A single line to ground bolted fault occurs at phase a. The fault place is at the middle of the transmission line TL_{23}. Please do the followings.

   A. (5%) Draw the positive-, negative-, and zero-sequence networks without the Thevenin reduction.

   B. (5%) Derive the Thevenin reduction impedance of the positive-, negative-, and zero-sequence networks.

   C. (5%) Derive the sequence currents at fault point F

   D. (5%) Derive the sequence current at the terminal of generator G_1.
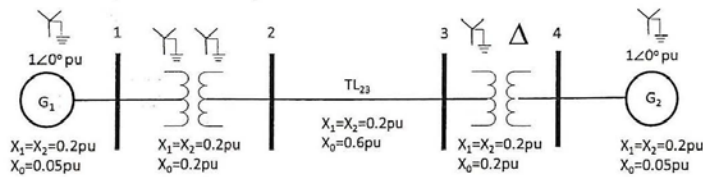
3. (10%) In a boost dc-dc converter, the duty ratio is adjusted to regulate the output voltage V_o at 48V. the input voltage range is between 12 to 36V. The power rating is 120 W. The switching frequency is 50 kHz. Assume the capacitor C is very large, please calculate the inductance of the inductor L such that the converter is operating at the boundary conduction mode.

4. (20%) A 380-V, Y-connected synchronous motor is drawing 60 A at unity power factor from a 380-V power system. Its synchronous reactance is 1.0 Ω and the armature resistance is neglected. The field current flowing under these conditions is 3 A. Assume a linear open-circuit characteristic.

   A. (5%) Find the torque angle.

   B. (5%) What is the static stability power limit under these conditions?

    C.　(6%) How much field current would be required to make the motor operate at 0.8 PF leading for the same motor operating condition?

    D.　(4%) What is the new torque angle in part (c)?

5.　(10%) An induction motor has the following nameplate. Please determine the missing quantities in the table. Assume 1 hp = 750 W.

    A.　(5%) Rated current;

    B.　(3%) Slip at rated output power (assumed less than 5%);

    C.　(2%) Possible number of poles.

NCKU EE Induction Motor Nameplate	
Volts. 460 V	Phase. 3
Amps. (A)	Freq. 60 Hz
Efficiency. 0.92	Rated hp. 100
P.F. 0.87	RPM. 1152
Slip @ Rated hp. (B)	Poles. (C)

6.　(20%) A 3 MVA 240/15-kV single-phase power transformer has a per-unit resistance of 1 percent and a per-unit reactance of 5 percent (data taken from the transformer's nameplate). The open-circuit test performed on the low-voltage side of the transformer yielded the following data:

$$V_{oc} = 15 \text{ kV} \qquad I_{oc} = 15 \text{ A} \qquad P_{oc} = 45 \text{ kW}$$

    A.　(10%) Find the equivalent circuit referred to the low-voltage side of this transformer.

    B.　(10%) If the voltage on the secondary side is 15 kV and the power supplied is 2.4 MW at 0.8 PF lagging, calculate the voltage regulation of this transformer.