

※ 考生請注意：本試題 可 不可 使用計算機

1. Fig. P1 is an equivalent circuit for a 1200/120V, 60Hz, 50kVA transformer. Assume the transformer is operating at rated secondary voltage and apparent power, with 0.9 power factor (lagging).

- (a) Estimate the iron loss. (5%)
- (b) Estimate the copper loss. (5%)
- (c) What is the exciting current I_e ? (5%)
- (d) Estimate efficiency of the transformer. (5%)

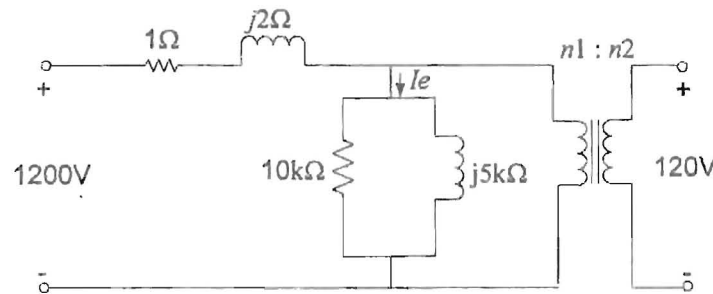


Fig. P1

2. A 380V, four-pole, 60 Hz, three-phase synchronous generator is required to supply 20kW to a load at power factor of 0.9 lagging. The synchronous reactance of the generator is 5Ω. Suppose all the losses and leakage reactance are neglected.

- (a) What is the output voltage of the generator, if the load is disconnected? (10%)
- (b) If one wants to improve the power factor into 0.92 lagging, what can you do on the load side? (10%)

3. Suppose you have the following components: an inductor L , a diode D , a power MOSFET switch S , a capacitor C , and a load R supplied from a DC source V_s . By using the components above, please sketch

- (a) a basic Boost DC-DC converter (5%)
- (b) a basic Buck DC-DC converter (5%)

(Note: to be continued in next page)

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4. Consider a system with the one-line diagram shown in the figure below, the name plate ratings of the generator, transformer and motor load are listed as follows:

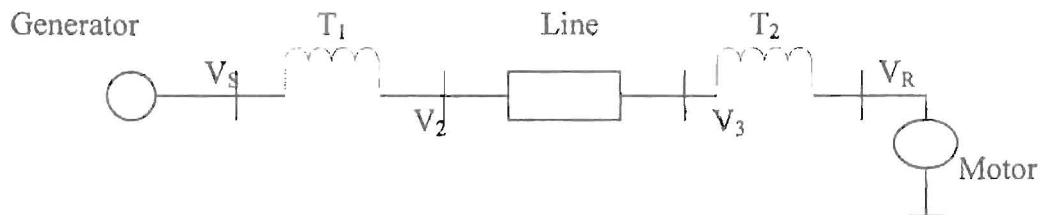
Generator: 30MVA, 69kV, $X_d=j0.4pu$

Transformer T_1 : 20MVA, 69kV-132kV, $X_l=j0.1pu$

Transformer T_2 : 40MVA, 138kV-13.8kV, $X_l=j0.1pu$

Transmission line : $20+j100\Omega$

Motor: 20MVA, 13.8kV, $X_s=j0.2pu$



Pick **generator ratings** for the common base, Draw an **impedance diagram** and label all the per unit impedances for the impedance diagram. (20%)

5. Using the impedance diagram in Question 4 above, assume that the terminal voltage of motor is 13.2kV when the motor draws 15MW at a power factor of 0.8 lagging. Taking the receiving end voltage angle to be zero as reference, determine the following quantities:

internal emfs of generator and motor in **per unit in polar form**, **receiving end current** in **actual value in polar form**, **complex power** supplied by the internal emf of generator in **actual value in polar form**. (20%)

6. Continue on Question 5. When the system is running steady at Question 5 condition, a three-phase short circuit fault occurs at V_2 , the transient reactance of the generator X_d' becomes 0.1pu for its name plate rating.

Find the **generator transient current** in **per unit in polar form**. (10%)