

※ 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. (30%) Given parameters of a round-rotor synchronous generator shown in the following table (All parameters are referred to the stator side).

Stator side leakage reactance X_l	Rotor side damper winding reactance X_k
Magnetizing reactance X_m	Rotor side field winding resistance R_f
Rotor side field winding reactance X_f	Rotor side damper winding resistance R_k

Please complete the following:

- I. (5%) Draw the **equivalent circuit** of the generator during **subtransient** period as it is under three phase short circuit bolted fault.
- II. (10%) Derive the **subtransient reactance** and **time constant** using the parameters shown in the table.
- III. (5%) Draw the **equivalent circuit** of the generator during **transient** period as it is under three phase short circuit bolted fault.
- IV. (10%) Derive the **transient reactance** and **time constant** using the parameters shown in the table.

2. (10%) Given a ABCD transmission matrix as shown below:

$$\begin{bmatrix} |V_S| \angle \delta \\ I_S \end{bmatrix} = \begin{bmatrix} |A| \angle \alpha & |B| \angle \beta \\ |C| \angle \theta_C & |D| \angle \theta_D \end{bmatrix} \begin{bmatrix} |V_R| \angle 0^\circ \\ I_R \end{bmatrix}$$

where the subscript S and R are referred to sending end and receiving end, respectively.

Please derive the **complex power** received at the receiving end and **show** that the receiving end can receive the maximum active power as $\delta = \beta$.

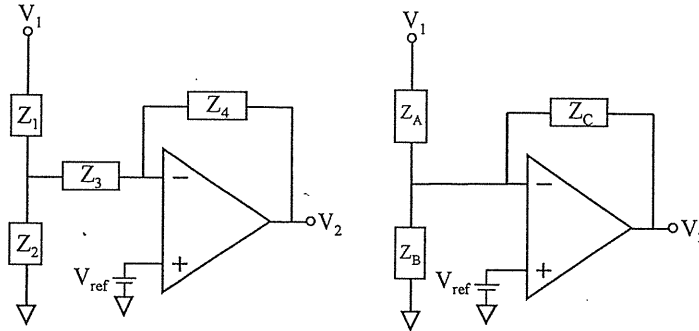
3. (10%) Draw CCM Buck-Boost converter circuit with ideal components (2%) and plot the following waveforms following its gate signal.

- (1) inductor voltage waveform (2%),
- (2) inductor current waveform (2%),
- (3) switch current waveform (2%),
- (4) diode current wave form (2%).

4. (10%) Draw the equivalent circuit of one ideal autotransformer (4%) and derive its voltage conversion ratio from the low-voltage side to the high-voltage side (6%).

5. (5%) What is the value of the capacitor in parallel with one series L-R network to make their total impedance pure resistive at operating frequency f ? Write the capacitor value in terms of L, R, and f .

6. (15%) Find Z_A , Z_B and Z_C in terms of Z_1 , Z_2 , Z_3 , and Z_4 , as shown in the following two circuits with ideal operational amplifier to have the same transfer function V_2/V_1 .



7. (4%) Use Voltage-Second Balance Equation to derive the voltage conversion ratio of CCM SEPIC (Single-Ended Primary-Inductance Converter) circuit with ideal components.

8. (16%) Draw the equivalent circuits of the following DC machines.

- (1) Cumulatively Compounded Short-Shunt DC Generator (2%),
- (2) Cumulatively Compounded Long-Shunt DC Generator (2%),
- (3) Differentially Compounded Short-Shunt DC Generator (2%),
- (4) Differentially Compounded Long-Shunt DC Generator (2%),
- (5) Cumulatively Compounded Short-Shunt DC Motor (2%),
- (6) Cumulatively Compounded Long-Shunt DC Motor (2%),
- (7) Differentially Compounded Short-Shunt DC Motor (2%),
- (8) Differentially Compounded Long-Shunt DC Motor (2%).