系所組別：電機工程學系丙組

考試科目：電力工程 考試日期：0223，節次：2

※ 考生請注意：本試題不可使用計算機

1. (a) For a pulse-width-modulated push-pull inverter producing sinusoidal output, please describe the primary reason that results in a higher transformer leakage inductance. (15 %)

   (b) Please describe the scenario when the generation of eddy current is termed as the proximity effect. (10 %)

2. (a) In a split-phase motor with a main stator winding and an auxiliary winding, please illuminate the importance of the higher resistance/reactance ratio that is often considered in the auxiliary winding design. (15 %)

   (b) Please briefly state the reason that leads to the lack of producing reactive power in an induction generator. (10 %)

3. 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 step increase in the mechanical power P_{m1} is applied to the generator and the power angle starts to increase. The power angle reaches its maximum value at δ_2 and then comes back to its new steady state value at δ_1.

   (a) Please **plot** the electrical power curve of P_e, and mechanical power P_m versus power angle δ to describe the equal areas for stability assessment. (10 %)

   (b) Given the swing equation below:

$$\frac{2H}{\omega_{syn}}\frac{d^2\delta}{dt^2} = P_{mp.u.} - P_{ep.u.}$$

   Please **derive the equation** to show that the accelerating area (A_1) should be equal to the decelerating area (A_2) so that the stability is maintained. Hint: using the plot you give in 3(a) to derive the equation. (10 %)

4. Continue on question 3. Assume the unit is delivering the electrical power $P_e=P_{m0}=P_{max}\sin\delta_0$, a temporary fault occurs at the sending end of the line causing no power is transmitted to the infinite bus. When the fault is cleared, the lines are assumed to be intact.

   (a) Please determine the **maximum power angle δ_{max}** allowed for maintaining synchronism. (10 %)

   (b) Please derive the **critical clearing angle δ_C** in terms of P_{m0}, P_{max}, δ_0, and δ_{max}. (10 %)

5. A **complete transposed** three phase line has flat horizontal phase spacing as shown in the figure below. The GMR of each conductor is r′ m. Please derive the inductance L of the line in H/m. Hint: $L=2\times10^{-7}\ln(GMR/GMD)$ H/m (10 %)