※ 考生請注意：本試題 □可 ☑不可 使用計算機

1. (15 %) Please explain the reason why a negative current with a large magnitude is found to flow during the control and operation of Gate-Turn-Off (GTO) thyristors.

2. (15 %) Please describe the operation when the load-commutated inverter (LCI) drives are operated to provide regenerative braking.

3. (a) (10 %) For a reluctance motor, please explain how the induced reluctance torque help perform the self-starting operation.

   (b) (10 %) Please explain the reason that leads to the occurrence of inductive kick in direct current machinery.

4. (10%) Please explain the causes of voltage collapse in a power system, and how to avoid the voltage collapse.

   (10%) Please describe the purpose of power flow in the power system and why we need to assign a swing bus in the power flow analysis.

5. (15%) Please describe how the protection systems work to protect generators, transformers, buses and lines, respectively, in the power system.

6. Suppose a 60-Hz power system consists of two interconnected areas, Area A and Area B. In the two areas, there are two composite fossil-fuel generating units, A and B, respectively, operating on economic dispatch. The variable operating costs of these units are given by

$$C_A = 20 + 2P_A + 0.02 P_A^2 \text{ \$/hr}, \text{for } 100 < P_A \le 500 \text{ MW}$$

$$C_B = 0.03 P_B^2 \text{ \$/hr}, \text{for } 50 < P_B \le 300 \text{ MW}$$

The units of P_A and P_B are in MW.

Let the load P_T now be changed from 200MW to 600MW. The line losses are neglected.

   (a) (10%) Please determine how the two generating units should be dispatched for such change.

   (b) (5%) What is the incremental cost change for this load variation?