本試題是否可以使用計算機：　☑可使用　，　□不可使用　（請命題老師勾選）

1. (15 %) Please sketch the block diagram of an uninterruptible power supply, and describe its corresponding operations in the following two scenarios:
    (1) when the system is performed normally
    (2) when the mains power outage occurs

2. (20 %)
    (1) Please explain the equal-area criterion through a brief drawing of the relationships among electric power P_e, mechanical power P_m and power angle δ.
    (2) Please discuss the importance of critical clearing time in a power system.

3. (15 %) Please discuss what simplifications can be made in the Jacobian matrix such that it would result in the formulation of fast decoupled power flow computation.

4. (25%) An isolated power system consists of two generating units with the following characteristics

Unit	Rating	Speed regulation pu on unit MVA base	Fuel-cost function in $/h
1	800	4%	$C_1 = 400 + 5P_1 + 0.004P_1^2$, P_1 in MW
2	600	5%	$C_2 = 500 + 6P_2 + 0.008P_2^2$, P_2 in MW

The units are operating in parallel, sharing 1000MW at 60 Hz. Unit 1 supplies 600MW and unit 2 supplies 400 MW at 60Hz. System load varies 1.5 percent for every 1 percent change in frequency, i.e., D=1.5.

The load is increased by 100MW, please find the following

A. **steady-state frequency deviation in Hz** after the governor response. (5%)

B. **new generation in MW** for each unit. (8%)

C. **change in MW load** due to frequency drop at the steady state value. (2%)

In order to return frequency back to 60Hz, the supplementary control is activated. With the economic dispatch principle inherits in the supplementary control, please find the following

D. **optimal dispatch in MW** for each unit. (6%)
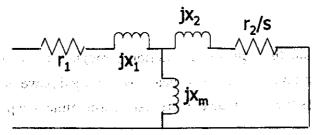
E. **total cost in $/h.** (4%)

（背面仍有題目，請繼續作答）

5. (25%) An induction motor has pu parameters at rated frequency as given below (core loss is neglected)

$$r_1=0.025 \quad x_1=0.12 \quad x_m=3$$
$$r_2=0.025 \quad x_2=0.12$$

Please find the following

A. stator current and rotor current (in pu) required to produce 1.2pu torque at slip s=0.03 at rated frequency (10%)

B. for the same rotor current, what should the slip and output power (in pu) be to yield the same torque as part A at one fourth of the rated frequency (constant torque region)? (10%)

C. find the fifth harmonic torque if a fifth harmonic rotor current of 0.2pu exists with motor running as in part A. (5%)