

PART I

1. One 480V, 37.5kVA, three-phase power system is supplied by a transmission line with 0.5% resistance and 5% reactance. The transmission line is fed directly by two generators, G1 and G2. G2 is directly connected to the transmission line, and G1 is linked by an additional transmission line having 1% resistance and 10% reactance (on the power system base). The system is at 480V, 30kW, three-phase with a lagging power factor of 0.8. G2 provides 15kW at a lagging power factor 0.8.

Determine (a) the output voltage of Generator G1 (5%), (b) the kVAs of Generator G1 (5%), (c) power factor of Generator G1 (5%).

2. One 60-cycle-per-second, two-winding transformer is rated 3kVA, 220/110 volts. This transformer is reconnected as a step-up autotransformer to deliver 330 volts to a resistive load when the input is from a 220-volt source. Assume that the transformer is ideal.

Find (a) the value of the load resistance for which rated current will flow in each winding (5%), (b) the load power (5%), (c) the power delivered by transformer action and the power delivered by conduction (10%), (d) the input impedance looking into the low side (5%).

3. One 13.8kV three-phase generator supplies two loads: a balanced 30kW Y-connected load with 0.8 lagging power factor, and an unbalanced delta-connected load. The delta-connected load has the following impedances:

$$Z_{ab} = 10 \text{ k}\Omega + j 10 \text{ k}\Omega$$

$$Z_{bc} = 5 \text{ k}\Omega + j 15 \text{ k}\Omega$$

$$Z_{ca} = j 20 \text{ k}\Omega$$

Determine (a) the line current I_a of the generator (5%), (b) the total generator power (5%).

(背面仍有題目,請繼續作答)

PART II

4. 一回授控制系統之特徵方程式(characteristic equation)為

$$s^3 + Ks^2 + 2s + (K + 1) = 0$$

其中 K 為正數。

(a) 利用 Routh-Hurwitz 方法，計算此一系統穩定時 K 之範圍

(5%)。

(b) 當 K 為何值時此一系統為臨界穩定(marginally stable)，並計算

出此時之共振頻率 (10%)。

5. 對於一單一回授(unity feedback)系統，若開回路(open loop)系統轉

移函數為

$$G(s) = \frac{\omega_n^2}{s(s + 2\zeta\omega_n)}$$

(a) 此時閉回路(closed-loop)系統轉移函數為何 (5%)？

(b) 若阻尼(damping)係數 ζ 介於 0 與 $1/\sqrt{2}$ 之間，閉回路系統頻率

響應之最大值為何 (10%)？

(c) 承(b)部分，計算此時系統之 3dB 頻寬 (10%)。

6. 一系統之轉移函數為

$$G(s) = \frac{Y(s)}{U(s)} = \frac{2s + 8}{s^3 + 4s^2 + 3s + 8}$$

試寫出此一系統之一種狀態方程式 (10%)。