國立中山大學100學年度碩士班招生考試試題

科目：電力工程【電機系碩士班丁組】

1. Consider two buses connected by a high voltage transmission line with an impedance Z = R + jX, derive the real and reactive power flows on the line in terms of terminal bus voltages. Explain why the real power flow on a transmission line is dependent on phase angle difference, and the reactive power flow is dependent on voltage magnitude difference. (20%)

2. A 50 MVA, 30 kV, three phase 60 Hz synchronous generator has a synchronous reactance of 9Ω per phase and a negligible resistance. The generator is delivering rated power at a 0.8 power factor lagging at the rated terminal voltage to an infinite bus. (a) Determine the excitation voltage per phase and the power angle of the generator. (10%) (b) With the excitation voltage held constant at the voltage found in (a), the driving torque is reduced until the generator is delivering 25 MW. Determine the armature current and the power factor. (10%)

3. (a) Describe the inputs, outputs and applications of a typical power flow program. (10%)
   (b) Describe the solution procedure of a power flow problem solved by a Newton-Raphson technique. (10%)

4. A balanced Δ-connected load consisting of a pure resistance of 18Ω per phase is in parallel with a purely resistive balanced Y-connected load of 12Ω per phase as shown in Figure 1. The combination is connected to a three-phase balanced supply of 346.41-V_{rms} (line-to-line) via a three-phase line having an inductive reactance of j3Ω per phase. Taking the phase voltage V_{an} as reference, determine
   (a) The current, real power and reactive power drawn from the supply. (10%)
   (b) The line-to-neutral and the line-to-line voltage of phase *a* at the combined load terminals. (10%)

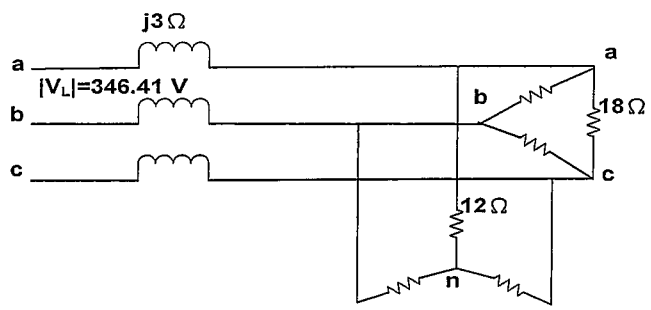

Fig. 1

5. The followings are the production cost functions and operating ranges of three generation units in a power system. Use the equal increment rule to find economic operating point for the three generation units when delivering a total power of 850 MW. (20%)

$C_1(P_1) = 561 + 7.92P_1 + 0.001562P_1^2$ $\quad 150MW \leqq P_1 \leqq 600MW$

$C_2(P_2) = 310 + 7.85P_2 + 0.00194P_2^2$ $\quad 100MW \leqq P_2 \leqq 400MW$

$C_3(P_3) = 78 + 7.97P_3 + 0.00482P_3^2$ $\quad 50MW \leqq P_3 \leqq 200MW$