國立中正大學104學年度碩士班招生考試試題

系所別：電機工程學系-電力與電能處理乙組　　科目：電力系統

1. Please explain the differences between DC power flow and AC power flow. (10%)
2. Please introduce the fundamental principle of overcurrent relay, differential relay, and distance relay. (10%)
3. A balanced delta connected load of $15 + j18\ \Omega$ per phase is connected at the end of a three-phase line as shown in Fig. 1. The line impedance is $1+j2\Omega$per phase. The line is supplied from a three-phase source with a line-to-line voltage of 207.85 V rms. Taking Van as reference, determine the following:
   (a) Current in phase a. (5%)
   (b) Total complex power supplied from the source. (5%)
   (c) Magnitude of the line-to-line voltage at the load terminal. (5%)

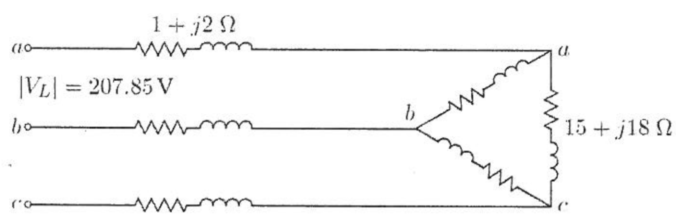

Fig. 1

4. A three-phase, Y-connected, 75-MVA, 27-kV synchronous generator has a synchronous reactance of 9.72Ω per phase. Using rated MVA and voltage as base values, determine the per unit reactance (5%). Then refer this per unit value to a 100-MVA, 30-kV base (5%).
5. A power system network is shown in Fig. 2. The values marked are impedances in per unit on a base of 100 MVA. The currents entering buses 1 and 2 are $I1$ = 1.72-j2.36 pu, I_2= 0.36-j1.85 pu. Determine the bus admittance matrix? (10%)

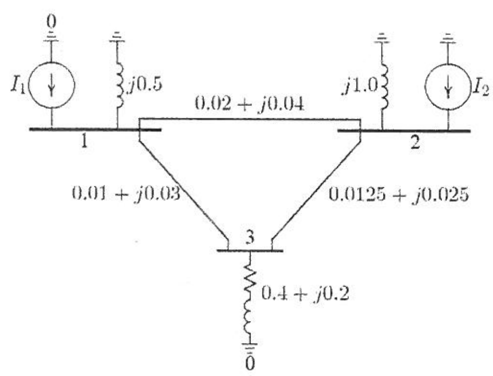

Fig. 2

6. The fuel-cost functions in $/h for three thermal plants are given by

$C1 = 350 + 7.2P_1 + 0.0040\,P_1^2$

$C2 = 500 + 7.3P_2 + 0.0025\,P_2^2$

$C3 = 600 + 6.74P_3 + 0.003\,P_3^2$

where P_1, P_2, and P_3 are in MW. The governors are set such that generators share the load equally. Neglecting line losses and generator limits, find the total cost in $/h when the total load is

(i) $P_D = 450$ MW (5%)

(ii) $P_D = 745$ MW (5%)

(iii) $P_D = 1335$ MW (5%)

7. The one-line diagram of a simple four-bus power system is shown in Fig. 3. Each generator is represented by an emf behind the transient reactance. All impedances are expressed in per unit on a common MVA base. All resistances and shunt capacitances are neglected. The generators are operating on no load at their rated voltage with their emfs in phase. A bolted three-phase fault occurs at bus 4. Using Th´evenin's theorem obtains the impedance to the point of fault and the fault current in per unit. (10%)

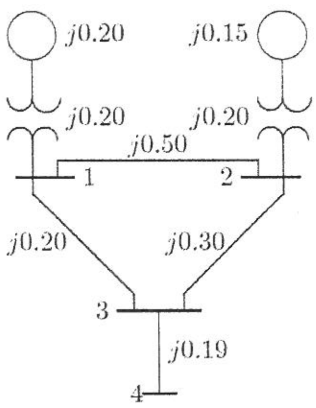

Fig. 3

8. In the two-bus system shown in Fig. 4, bus 1 is a slack bus with $V1 = 1\angle 0^0$ pu. A load of 100MWand 50 Mvar is taken from bus 2. The line impedance is $z12$ = 0.12 + j0.16 pu on a base of 100 MVA. Using Newton-Raphson method, obtain the voltage magnitude and phase angle of bus 2. Start with an initial estimate of $V2$ = 1.0 pu and $\delta_2 = 0^0$. Perform two iterations. (20%)

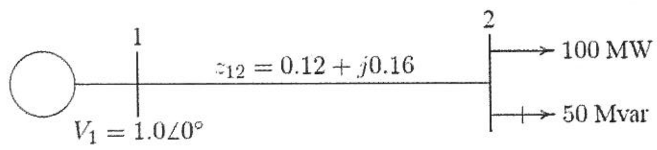

Fig. 4