國立臺灣科技大學 104 學年度碩士班招生試題

系所組別：電機工程系碩士班甲組

科　　目：電力系統

(總分為 100 分)

1. Please using any generation, transmission, distribution and utilization point of views, explain what is "Smart Grid" ? (10%)

2. A high voltage, three-phase long transmission line is provided and ending in substation as shown in Fig. 1. To make reactive power compensation a shunt reactor set or shunt capacitor bank may be installed in substation. Please using light load and heavy load point of view answer which one is going to use and explain the reason why? (9%)

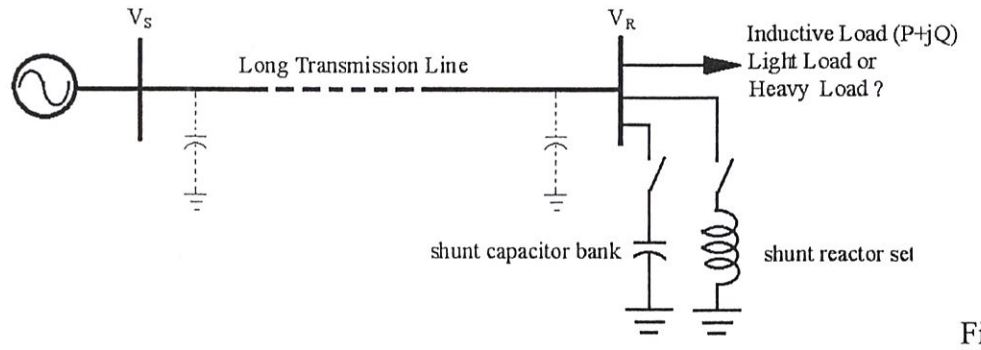

Fig. 1.

3. Three loads are connected, as shown in Fig. 2, in parallel across a 12.47 kV three-phase supply.
   Load 1: Inductive load, 60 kW and 660 kvar.
   Load 2: Capacitive load, 240 kW at 0.8 power factor
   Load 3: Resistive load of 60 kW.

(a) Find the total complex power, power factor, and the supply current. (5%)

(b) A △-connected capacitor bank is connected in parallel with the loads. Find the total kvar and the capacitance per phase in μF to improve the overall power factor to 0.95 lagging. (5%)

(c) What is the new supply current ? (5%)

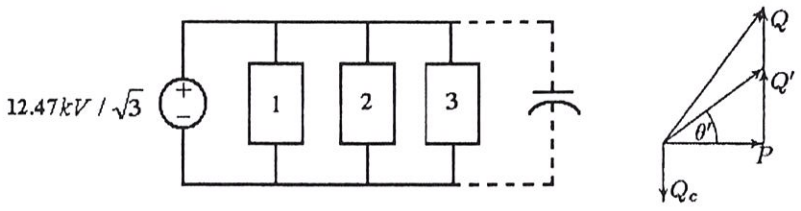

Fig. 2

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4. A 400 km long, three-phase 765 kV, 60 Hz transposed line. The line inductance is 0.88853 mH/km per phase and its capacitance is 0.01268 μF/km per phase. Assume a lossless line. Determine the transmission line

(a) Surge impedance Z_C (2%)

(b) Phase constant β (2%)

(c) Line wavelength λ (2%)

(d) Velocity of propagation v (2%)

(e) Surge impedance loading *SIL* (2%)

(f) The ABCD constant (2%)

The receiving end rated load is 2000MVA, 0.8 power factor lagging at 735kV, determine

(g) The sending end quantities V_S (2%)

(h) The voltage regulation %VR (2%)

5. What is swing equation? What is equal-area criterion? (10%)

6. The fuel-cost functions in \$/h for two 1000 MW thermal plants are given by

$$C_1 = 450 + 6.5\,P_1 + 0.005P_1^2 \quad (\$/h)$$

$$C_2 = 600 + \beta\,P_2 + \gamma\,P_2^2 \quad (\$/h)$$

where P_1 and P_2 are in MW. First, the incremental cost of power λ is \$9.5/MWh when the total power demand is 800 MW. Neglecting losses, determine the optimal generation of each plant. Second, the incremental cost of power λ is \$11.6/MWh when the total power demand is 1500 MW. Neglecting losses, determine the optimal generation of each plant. Finally, from the results of first and second part, find the fuel-cost coefficients β and γ of the second plant. (20%)

7. The reactance data for the power system shown in Fig. 3 in per unit on a common base is as Table 1. Obtain the Thevenin sequence impedances for the fault at bus 1 and compute the fault current in per unit for the bolted double line-to-ground fault at bus 1. (20%)

Table 1. Table for Problem 7

Item	X^1	X^2	X^0
G_1	0.15	0.15	0.05
G_2	0.15	0.15	0.05
T_1	0.10	0.10	0.10
T_2	0.10	0.10	0.10
L_{12}	0.25	0.25	0.50

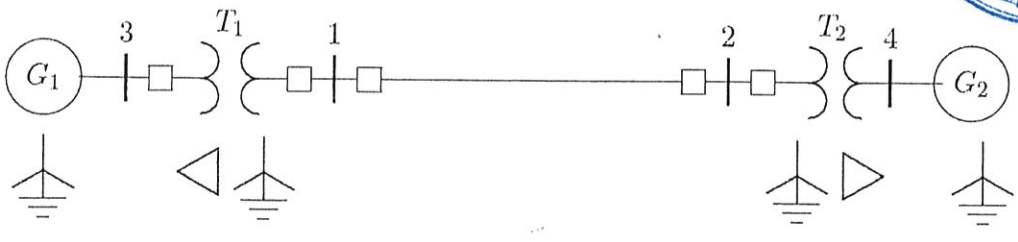

Fig. 3 Circuit for Problem 7.