

國立臺灣科技大學 111 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；所有試題務必於答案卷內頁依序作答，否則不予計分)

1. (20%) Define the following keywords.

- (a) Utilization factor. (5%)
- (b) Plant factor. (5%)
- (c) Diversity factor. (5%)
- (d) Loss factor (5%)

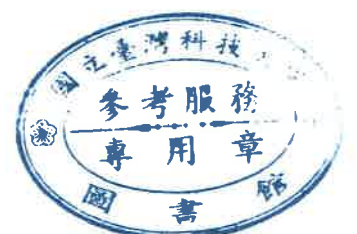
2. (30%) A three 138-kV transmission line is connected to a 49-MW load at a 0.85 lagging power factor. The line constants of the 52-mi-long line are $Z = 95 \angle 78^\circ \Omega$ and $Y = 0.001 \angle 90^\circ S$.

Using nominal- π circuit representation, calculate:

(a) The A, B, C, and D constants of the line. (5%)

Using nominal-T circuit representation, calculate:

- (b) The A, B, C, and D constants of the line. (5%)
- (c) Sending-end voltage. (5%)
- (d) Sending-end current. (5%)
- (e) Sending-end power factor. (5%)
- (f) Efficiency of transmission. (5%)



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3. (30%) The one-line diagram of a simple power system is shown in the following figure. On a chosen base of 100 MVA / 161 kV in the transmission line circuit, the line reactances of L_{12} are $X_1 = X_2 = 10\%$ and $X_0 = 25\%$. The line reactances of L_{13} are $X_1 = X_2 = 10\%$ and $X_0 = 25\%$. The line reactances of L_{23} are $X_1 = X_2 = 20\%$ and $X_0 = 70\%$. The load of bus 3 are 400 MW and 200 Mvar.
- (a) The incremental cost of units in \$/MWh for three thermal plants are given by $IC_1 = 0.016P_1 + 8.0$ and $IC_2 = 0.018P_2 + 6.0$. The operational limits are $50 < P_1 < 200$ and $100 < P_2 < 350$. The real power loss with generation expressed is given by $P_{L(pu)} = 0.02P_{1(pu)} + 0.05P_{2(pu)}$. Determine the optimal economic scheduling of generation and the power loss in the transmission lines. (10%)
- (b) The generating units, G_1 and G_2 equipped with governors and have speed regulation of 6 percent and 5 percent on their respective ratings. The load varies 0.5 percent for every 1 percent change in frequency. Suppose G_1 and G_2 supply power as solution in (a) at 60 Hz for a long time. If the load is suddenly increased by 100 MW, find the steady-state frequency deviation and the new generation on each unit respectively. (10%)
- (c) The ratings and reactances of the generators and transformers are
 G_1 and G_2 : 300 MVA, 30 kV $X''_d = X_1 = X_2 = 12\%$, $X_0 = 6\%$, $X_n = 4\%$
 T_1 and T_2 : 300 MVA, 30/161 kV $X = 9\%$
- The system is operating at nominal voltage without prefault currents. A three-phase fault occurs at bus 3 with a fault impedance $Z_f = j0.1$ per unit. Determine the fault current. (10%)

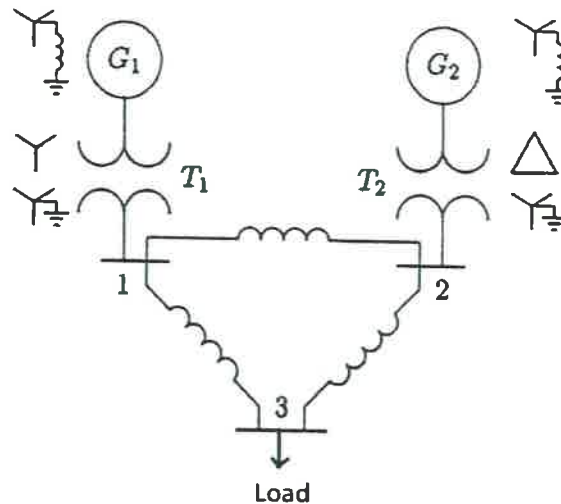


Figure for question 3

4. (20%) Draw the schematic diagram of following devices in a synchronous generator, and describe the operating principles of these two devices in power system.
- (a) load frequency control (LFC) (10%)
- (b) auto voltage regulation (AVR) (10%)

