國立臺灣科技大學103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. The three-phase power and line-line ratings of the electric power system shown in Fig. 1 are given below.
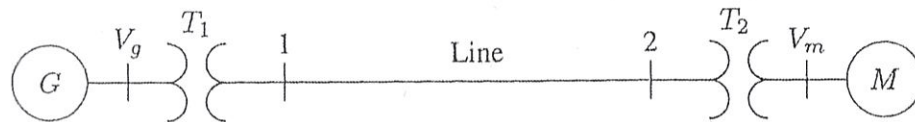

Fig. 1 System diagram for Problem 1.

G_1 :	60 MVA	20 kV	X = 9%
T_1 :	50 MVA	20/200 kV	X = 10%
T_2 :	50 MVA	200/20 kV	X = 10%
M :	43.2 MVA	18kV	X = 8%
Line:		200 kV	Z = 120 + j200 Ω

Draw an impedance diagram showing all impedances in p.u. on a 100-MVA base. Choose 20 kV as the voltage base for generator. **(25%)**

2. Fig. 2 shows the one-line diagram of a simple three-bus power system with generation at buses 1 and 2. The voltage at bus 1 is $V_1 = 1.0\angle 0°$ p.u. Voltage magnitude at bus 2 is fixed at 1.05 p.u. with a real power generation of 400 MW. A load consisting of 500 MW and 400 Mvar is taken from bus 3. Line admittances are marked in p.u. on a 100 MVA base. For the purpose of hand calculations, line resistances and line charging susceptances are neglected. Obtain the power flow solution using the fast decoupled algorithm. Perform the first iteration. **(25%)**
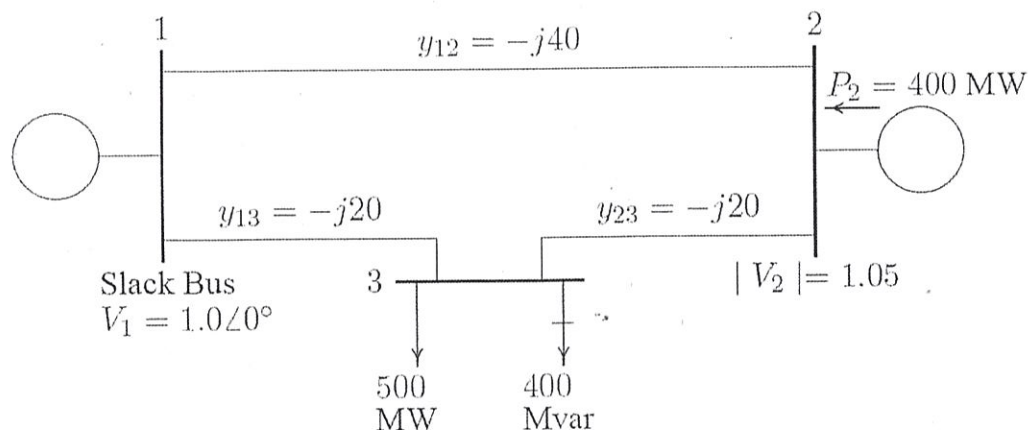

Fig. 2 System diagram for Problem 2.

3. A synchronous generator is operating at an infinite bus and supplying 0.40 p.u. of its maximum power capacity. A fault occurs, and the reactance between the generator and the line becomes four times its value before the fault. The maximum power that can be delivered after the fault clear is 65% of the original maximum value. Determine the critical clearing angle. **(20%)**

4. An area includes two turbine generator units, rated at 500 and 750 MVA and 60 Hz, for which their speed regulation R1 and R2 are 0.04 p.u. and 0.05 p.u., respectively. Each unit carries a 300 MVA steady-state load. The load on the system suddenly increases by 250 MVA. Determine the frequency deviation. **(10%)**

5. Synchronous generators SGA and SGB whose voltage are both 1 p.u. are connected as shown in Fig. 3. Note that TRA and TRB are transformers while TL is the transmission line. Their positive, negative and zero sequence impedance are shown in Table I. If a bolted double line-to-ground fault occurs at point F, what are the phase currents at that point? **(20%)**
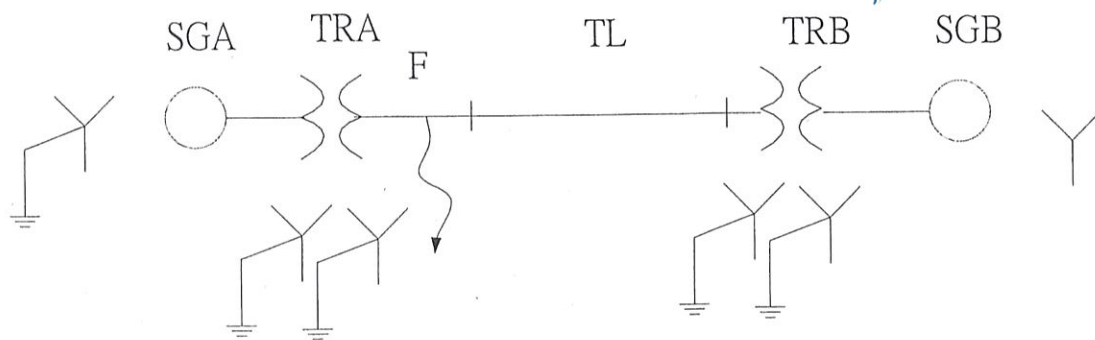

Fig. 3 System diagram for Problem 5.

Table I.　Impedance values

	Positive(p.u.)	negative(p.u.)	zero(p.u.)
SGA	0.35	0.2	0.05
SGB	0.2	0.15	0.03
TRA	0.15	0.15	0.15
TRB	0.1	0.1	0.1
TL	0.2	0.2	0.35