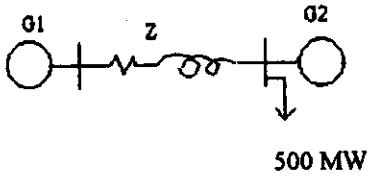
所　別：電機工程技術研究所　　組別：電力組　　科目：電力工程
學程別：

1. A three-phase, 50-Hz induction motor runs at almost 1,500 rpm at no-load and at 1,425 rpm at full load. How many poles does the motor have? What is the per-unit slip at full load? What is the frequency of rotor voltages at full load? At full load, what are the speeds of the rotor field with respect to the rotor, to the stator, and to the stator field? (15%)

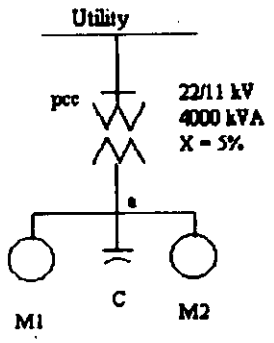
2. A single phase, 165 kVA, 13.2kV:220 Volt, 60Hz distribution transformer has these parameters:
Resistance of the 13.2kV winding R_1 = 1 ohm
Resistance of the 220V winding R_2 = 0.0005 ohm
Leakage reactance of the 13.2kV winding X_{l1} = 10 ohm
Leakage reactance of the 220V winding X_{l2} = 0.005 ohm
The transformer is used as a step down transformer at the load end of a feeder whose impedance is (0.2 + j2.0) ohms. Determine the voltage V_s at the sending end of the feeder when the transformer delivers rated load at rated secondary voltage and 0.8 lagging power factor. Neglect the exciting current of the transformer. (15%)

3. A salient-pole synchronous generator is operating under balanced steady-state conditions at rated voltage, delivering rated load at a lagging power factor of 0.8. The reactances in per-unit are given to be X_d = 1.0 and X_q = 0.6. Neglect armature resistance. Compute the per-unit excitation voltage and the power angle. (20%)

4. For a power system with two generators to supply 500 MW load as shown in the figure, solve the minimum operation cost. (10%)
Fuel cost: $F1 = 0.004\ P_{g1}^2 + 8\ P_{g1} + 29$ \$/Hour　(P_g in MW)
$F2 = 0.0048\ P_{g2}^2 + 6.4\ P_{g2} + 30$ \$/Hour
$P_{loss} = 0.05\ P_{g1}$



5. For the following system as shown,
M1: 1000 HP, pf = 0.8 lag
M2: 2000 HP, pf = 0.8 lag
C: 1000 kVAR
The short circuit capacity at PCC is 500 MVA
and the voltage level at the utility side is 22kV. (15%)
(a) Compute the impedance value for each motor.
(b) Convert results in (a) to per unit on the base of 4000 kVA.
(c) Calculate the voltage level at bus a.



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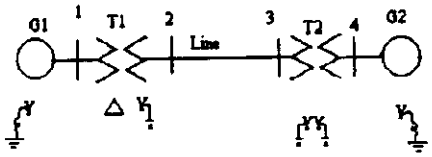
6. For a power system as shown in the figure, find the subtransient short circuit current in amperes when a bolted single line to ground fault occurs at bus 3. (10%)

G1: 100 MVA, 20 kV
$X_d'' = X_1 = X_2 = 20\%$
$X_0 = 4\%$, $X_n = 5\%$
G2: 100 MVA, 20kV
$X_d'' = X_1 = X_2 = 20\%$
$X_0 = 4\%$, $X_n = 5\%$
Line reactances:
$X_1 = X_2 = 15\%$, $X_0 = 50\%$.
T1: 100MVA, 20Δ/345Y kV, X = 8%
T2: 100MVA, 20Y/345Y kV, X = 8%



7. All values in the figure are in per unit. Solve the load flow by Gauss-Seidel Method for one iteration. Initial value $V_3^{(0)} = 1.0$ at 0° (15%)