類組：電機類　科目：電力系統(3008)　　共 1 頁 第 1 頁

一. (20%) 計算題 The per-phase equivalent circuit of a non-salient synchronous generator is as shown in Fig. 1. The generator is connected to the infinity bus with $\tilde{V}_t = 120\angle 0°$ (V) and $\tilde{E}_f = E_f\angle\delta = 207\angle 25°$ (V):

(一) Find $\tilde{I}_a$, power factor, P and Q. (10%)

(二) If the real power P is fixed, and E_f is increased from 207 V to 227 V, find the new power angle δ and reactive power Q. (10%)

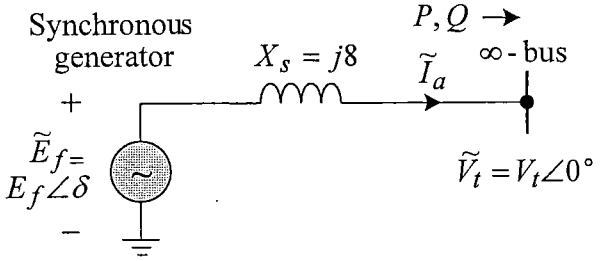

Fig. 1

二. (10%) 申論題 Consider a transformer and an induction motor.

(一) Draw the equivalent circuits of a transformer and an induction motor. (5%)

(二) Describe their differences and similarities. (5%)

三. (30%) 計算題 A salient-pole generator without dampers is rated 20 MVA, 13.8 kV and has a direct-axis sub-transient reactance of 0.25 per unit. The negative- and zero-sequence reactances are, respectively, 0.35 and 0.10 per unit. The neutral of the generator is solidly grounded. With the generator operating unloaded at rated voltage with $E_{an} = 1.0\angle 0°$ per unit, a single line-to-ground fault occurs at the machine terminal, which then have per-unit voltages to ground, $V_a = 0$　$V_b = 1.013\angle -102.25°$　$V_c = 1.013\angle 102.25°$

Determine the sub-transient current in the generator and the line-to-line voltages for sub-transient conditions due to the fault.

四. (15%) 申論題 Consider the power flow study of a transmission system.

(一) Let one bus without any loads and any generators. Is this bus be classified as a load bus or a generator bus? Please provide your justifications. (5%)

(二) Let all transmission lines be pure inductive. Will any active power loss exist in this transmission system? (5%)

(三) Please state these conditions such that the conventional power flow can be solved by the decoupled method and the fast-decoupled method. (5%)

五. (10%) 計算題 Find the following optimal economic dispatch problem by neglecting system losses and generator limit if the total demand is 800 MW. Cost functions of these three generator in \$/MW Hr are $C_1(P_1)=500+5.3P_1+0.004P_1^2$; $C_2(P_2)=400+5.5P_2+0.006P_2^2$; *and* $C_3(P_3)=200+5.8\,P_1+0.009\,P_3^2$.

六. (15%) 申論題 Consider the transient stability of the one-machine-infinite-bus system. Please justify your answer which of these following methods can improve the transient stability. (i) Increase of system voltages, and use of automatic voltage regulators; (ii) Use of quick response excitation systems; (iii) Compensation for transfer reactance; (iv) Use of high-speed circuit breakers which reduce the fault duration time; (v) Increase the system inertia.