類組：電機類　科目：電力系統(3008)　　共 2 頁 第 1 頁

※請在答案卷內作答

一、 (25%) For the power system as shown in Fig. 1.

(一)、 (5%) Find $I_a\angle\theta$.

(二)、 (5%) Describe the harmonic problems being existed in the Y-Y connected three-phase transformer.

(三)、 (8%) Draw the equivalent circuit of a single-phase transformer, and describe how to estimate their parameters from measurements.

(四)、 (7%) Draw the equivalent circuit of a non-salient pole (or cylindrical type) synchronous generator, and describe how to estimate the synchronous reactance from measurements.

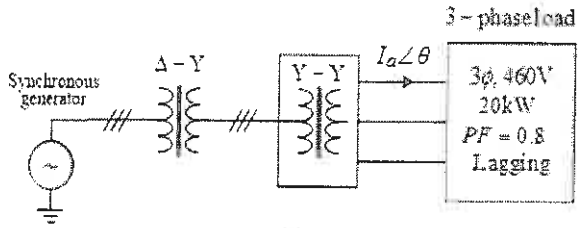

Fig. 1

二、 (20%) For the given rectifier circuit in Fig. 2, the supply voltage v_s is a square wave of magnitude V_0, and the load current i_d on the DC side is a constant DC current of magnitude I_0.

(一)、 (5%) Draw the waveforms of the AC side current i_s and the DC side voltage v_d.

(二)、 (5%) Calculate the power factor of this rectifier load.

(三)、 (10%) If a line inductance of 0.01 *p.u.* exists between the supply voltage v_s and the diode rectifier, please sketch the waveform of AC side current i_s to show how it is affected by the line inductance.

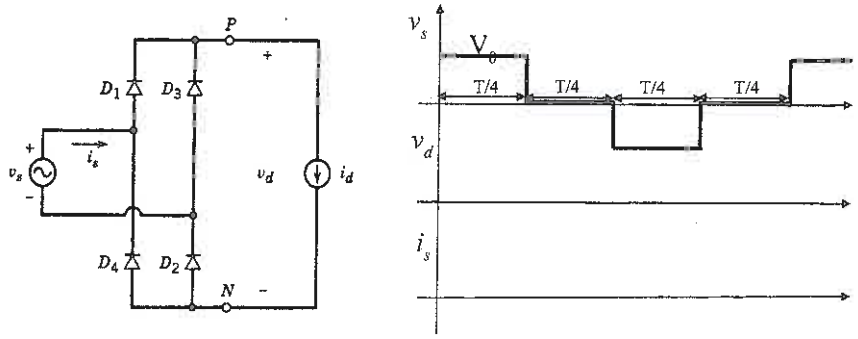

Fig. 2

三、 (20%) A 25000kVA 13.8kV generator with $X_d'' = 15\%$ is connected through a transformer to a bus supplying four identical motors, as shown in Fig. 3. The subtransient reactance X_d'' of each motor is 20% on a base of 5000kVA, 69kV. The three-phase rating of the transformer is 25000kVA, 13.8kV/6.9kV with a leakage reactance of 10%. The bus voltage at the motor is 6.9kV when a three-phase fault occurs at point P. For the fault specified, determine

(一)、 (5%) The subtransient current in the fault.

(二)、 (7%) The subtransient current in the breaker A.

(三)、 (8%) The symmetrical short circuit interrupting current (as defined for circuit-breaker applications) in the fault and in circuit breaker A.

注意：背面有試題

類組：電機類　科目：電力系統(3008)　　共 2 頁 第 2 頁

※請在答案卷內作答

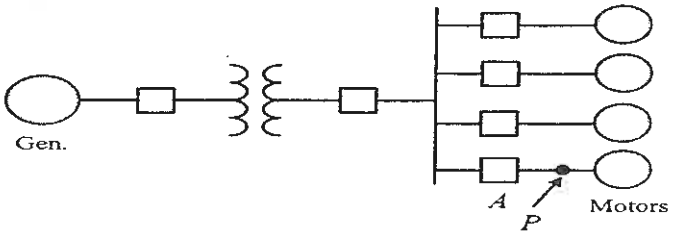

Fig. 3

四、 (9%) Consider the 3-bus power system shown in Fig. 4. All quantities are in per unit. All lines are purely inductive. The reactance of all transmission lines is 0.5 *p.u.* and the shunt capacitances of transmission lines are ignored. Bus 1 is the slack bus.

(一)、 (3%) Find the Y-bus of this system.

(二)、 (3%) Write down the power flow equations of this system.

(三)、 (3%) Perform the DC load flow to find all bus angles.

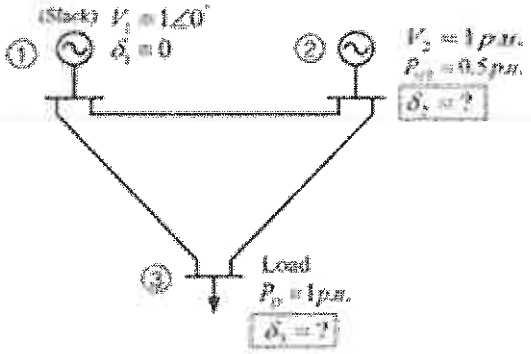

Fig. 4

五、 (6%) Please describe operational principles of the directional relay and that of the impedance relay.

六、 (5%) Two thermal generating units are operating in parallel at 60 Hz to supply a total load of 700MW. Unit 1, with a rated output of 600 MW and 4% speed-droop characteristic, supplies 400MW, and Unit 2, which has a rated output of 500 MW and 5% speed droop, supplies the remaining 300 MW of load. If the total load increases to 800 MW and disregard losses, determine the new loading of each unit and the common frequency change before any supplementary control action occurs.

七、 (10%) Consider a power system with three fossil-fuel generation units. If the generation operating cost of each unit is $a_iPg_i^2+b_iPg_i+c_i$, i=1 to 3. Each generator output satisfies the following limit: $0 \leqq Pg_1 \leqq 300$ MW, $10\text{ MW} \leqq Pg_2 \leqq 400$ MW, and $20\text{ MW} \leqq Pg_3 \leqq 500$ MW. The total system load demand is 900 MW. The task is to minimize the instantaneous operating cost needed to serve the system load.

(一)、 (5%) Formulate this problem if the total system loss is considered.

(二)、 (5%) Find the necessary condition of this problem if all generator limits are neglected.

八、 (5%) Illustrate the equal area criterion to find the critical angle and the critical clearing time of the one-machine-infinite-bus power system.

注意：背面有試題