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、 (20%) **申論題:請提綱契領闡述以下子題。**

(一)、(5%) Describe the differences in the rotors of salient-pole and non-salient pole synchronous machines.

(二)、(5%) Describe the differences between induction motor and synchronous motor in line drawn power factors.

(三)、(5%) What is the v-curve of a synchronous motor?

(四)、(5%) For the given Fig. 1: 1. what is infinite bus? 2. an incoming generator is to be paralleled to the infinite bus, give the conditions for successful operation.

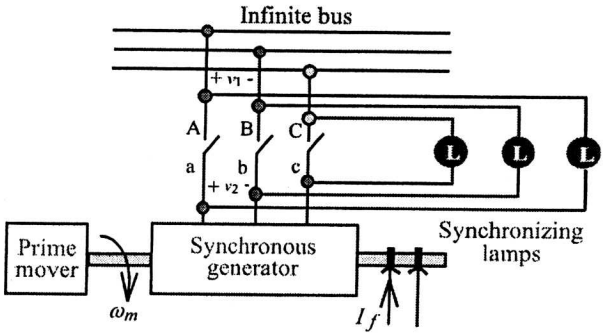


Fig. 1

二、 (10%) **計算題:請詳列計算過程，無計算過程者不予計分。**

(一)、(5%) $i(t)=10+\sqrt{2}\,20\sin(377t)$ (A), find its rms value.

(二)、(5%) A delta-delta three-phase transformer bank has the ratings of 100kVA/2200V. If one transformer cell is faulted and removed, find the new ratings of the resulted V-V three-phase transformer bank.

三、 (15%) **計算題:請詳列計算過程，無計算過程者不予計分。**

As shown in Fig. 2, an 11kV synchronous generator is connected to a 11kV/66kV transformer which feeds a 66kV/11kV/3.3kV three-winding transformer through a short feeder with negligible impedance. Calculate the fault current when a single-phase-to-earth fault occurs on a terminal of the 11kV winding of the three-winding transformer. The relevant data for the system are as follows:

**Generator** X1= j0.15p.u., X2=j0.1p.u., X0=j0.03p.u., all on a 10MVA base; star point of the winding earthed through a 3ohm resistor;

**11kV/66kV transformer** X1=X2=X0=j0.1p.u. on a 10MVA base; 11kV winding delta connected and the 66kV winding star connected with the star point solidly earthed.

**Three-winding Transformer** A 66kV winding, star connected, star point solidly earthed; 11kV winding, star connected, star-point earthed through a 3hom resistor; 3.3kV winding, delta connected; the three windings of an equivalent star connection to represent the transformer have sequence impedances, 66kV winding X1=X2=X0=j0.04p.u., 11kV winding X1=X2=X0=j0.03p.u., 3.3kV winding X1=X2=X0=j0.05p.u., all on a 10MVA base.

Resistance may be neglected throughout.

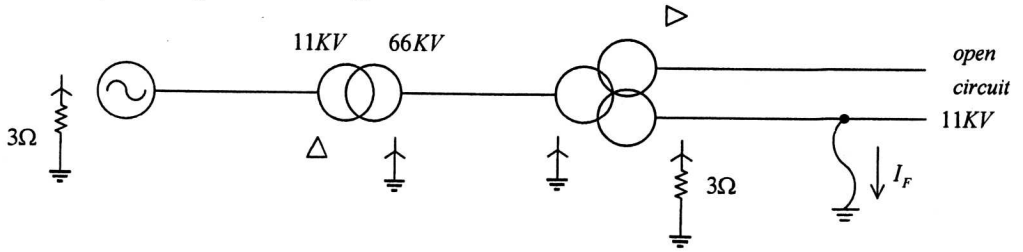


Fig. 2

參考用

注意:背面有試題

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※請在答案卷內作答

四、 (15%) **計算題:請詳列計算過程，無計算過程者不予計分。**

As shown in Fig. 3, a 10kVA 3-phase balanced linear load with a power factor of pf=0.8 (lag) is connected to a 220Vrms, 60Hz utility grid. A conventional voltage source inverter is installed to provide reactive power compensation to reach unity power factor.

(一)、(9%) Calculate how much current the inverter needs to provide to reach the goal of unity power factor.

(二)、(6%) Assuming this inverter operates in sine-PWM mode in the range of linear modulation. What is the lowest DC bus voltage of this inverter?

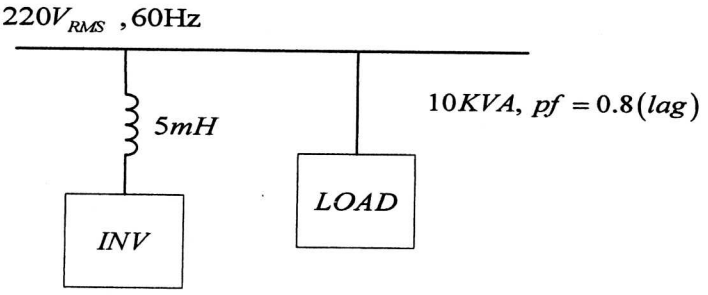


Fig. 3

五、 (10%) **申論題:請提綱契領闡述以下題目。**

Please illustrate the operational principle of the impedance (distance) relay for transmission line protections in power systems.

六、 (10%) **計算題:請詳列計算過程，無計算過程者不予計分。**

A three-phase 60 Hz isolated power system has the following characteristics: The load varies by 0.8 percent for 1 percent change in frequency. The governor speed regulation is set to 0.05 per unit. A sudden load increase of 0.1 per unit occurs. Find the steady-state frequency deviations in Hz.

七、 (10%) **計算題:請詳列計算過程，無計算過程者不予計分。**

The fuel-cost functions for three thermal plants in $/h are given by

$C_1 = 500 + 5.2P_1 + 0.003P_1^2$; $C_2 = 200 + 5.8P_2 + 0.008P_2^2$; $C_3 = 400 + 5.6P_3 + 0.006P_3^2$;

where $P_i$, $i$=1, 2, 3 are in MW. The total load is 800MW. Neglecting line losses and generator limits, find the optimal dispatch and the total cost in $/h.

八、 (10%) **申論題:請提綱契領闡述以下題目。**

Illustrate how to explore the equal-area criterion for transient stability assessment of the one-machine-infinite-bus power system.