

國立臺北科技大學

一〇六學年第二學期電機系博士班資格考試

電力系統保護與協調 試題

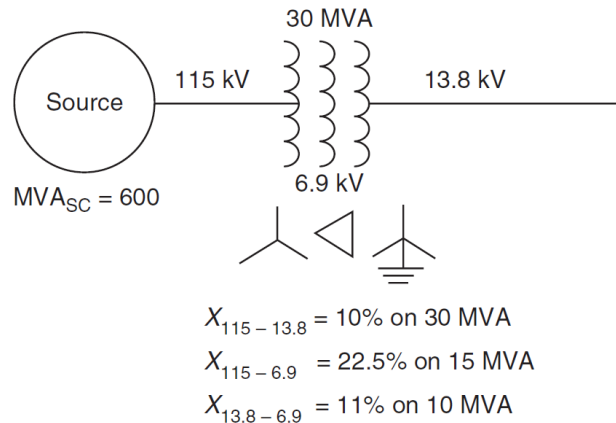
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注意事項：

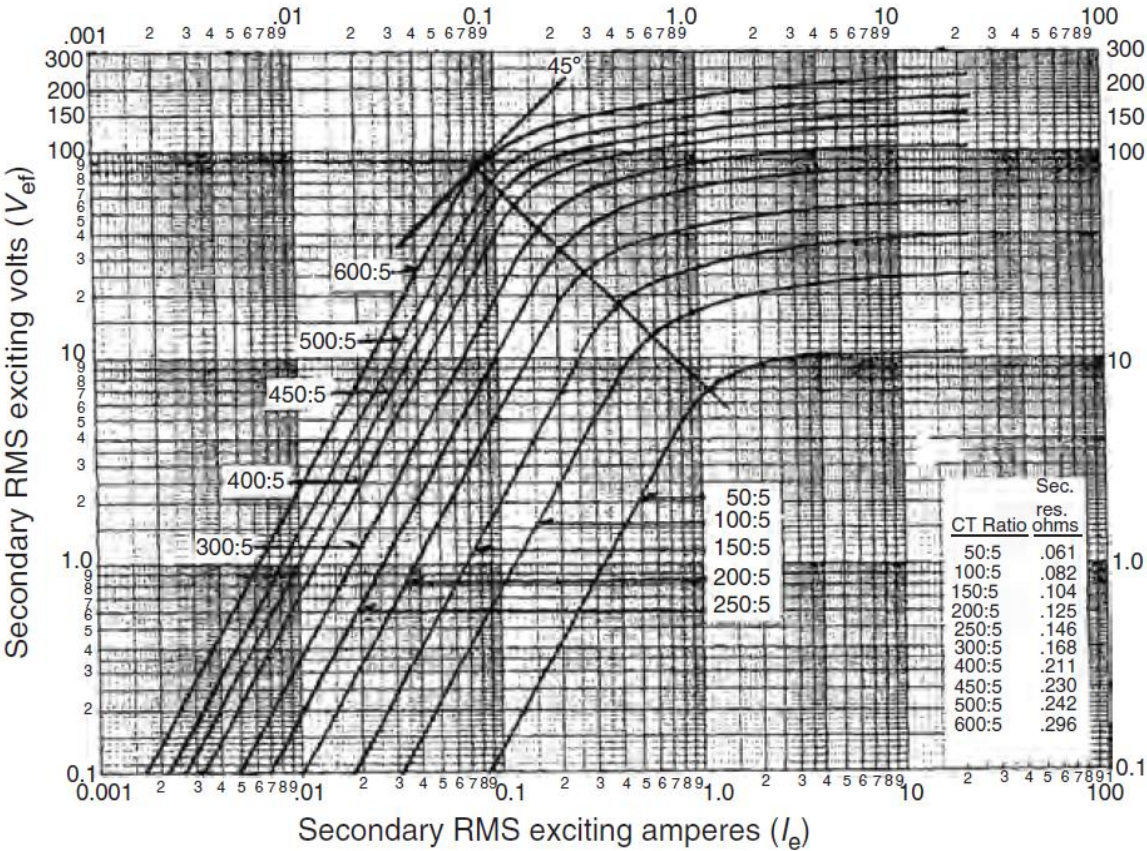
1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (20%) For the system shown in the figure below:



- (1) (4%) Determine the source and equivalent star reactances of the transformer on a 30 MVA base.
- (2) (10%) Set up the positive, negative, and zero sequence networks. There are no fault sources in the 13.8 kV and 6.9 kV systems. Reduce these networks to single-sequence reactances for faults on the 13.8 kV side.
- (3) (3%) Calculate a three-phase fault at the 13.8 kV terminals of the transformer.
- (4) (3%) Calculate a single-phase-to-ground fault at the 13.8 kV transformer terminals.

- 2. (20%) From harmonic point of view, please briefly describe the major advantages and disadvantages of the Full Cycle Fourier Transform and the Half Cycle Fourier Transform for digital filtering.
- 3. (20%) A 13.8 kV feeder circuit breaker has a 600:5 multiratio current transformer with characteristics as shown in the figure below. The maximum load on the feeder is 85 A primary. Phase time inverse overcurrent relays are connected to the CT secondaries. The relay burden is 3.2 VA at the tap values selected, and the lead burden is 0.38 Ω.



- (1) (6%) If the 150:5 CT ratio is used, and a relay tap of 4.0 A is required. With these, determine the minimum primary current to just operate the relays.
- (2) (8%) For the selection of part (1), what is the approximate maximum symmetrical fault current for which the CTs will not saturate (use the ANSI/IEEE knee point)?
- (3) (6%) If considering CT saturation, do you select 200:5 CT ratio with relay tap of 4.0 A? Answer YES or NO and give your reason.

4. (20%) Assume that in one certain application, the polarity quantity $|\bar{V}| \angle \theta$, and operating quantity $|\bar{I}| \angle \theta_i$ have been obtained by digital filter algorithm of the directional overcurrent relay. If the maximum torque angle is θ , please explain how to determine the relay working on blocking zone or tripping zone.
5. (20%) A typical signal sampling system is adopted to sample a signal which contains the 3rd, 5th, 7th, 11th, 13th, and 17th order harmonics components beside the fundamental quantity, and assume that the sampling rate is 1920 Hz (32 sample/cycle). Please explain:
- (1) (6%) What is aliasing?
 - (2) (6%) The principles of countermeasures.
 - (3) (8%) Explain the Nyquist criterion, and calculate the Nyquist frequency of this problem.