

UNIVERSITY OF THE WITWATERSRAND  
SCHOOL OF ELECTRICAL AND INFORMATION ENGINEERING  
ELEN4018A/ELEN5008A: POWER SYSTEMS  
TUTORIAL 3: INSTRUMENT TRANSFORMERS

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Question 1

What is the rated secondary accuracy limit current of the following current transformers

Ratio	Rated Burden	Accuracy class	Accuracy limit factor
300/1	10 VA	10P	15
1000/5	30 VA	5P	15

Question 2

What is the minimum secondary saturation voltage that can be expected from the following current transformers?

300/1 with designation 15VA-5P15  
1000/5 with designation 10VA-10P15

Question 3

Three current transformers with ratios 200/1 supply three overcurrent relays and one earth fault relay. Each current transformer has negligible internal impedance and the magnetization characteristic below

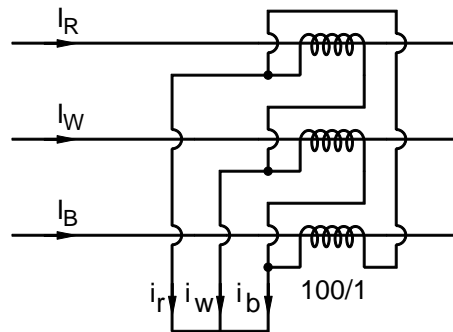
Secondary voltage	Secondary magnetizing current
5 V	25 mA
10 V	75 mA
15 V	90 mA
20 V	100 mA
25 V	110 mA
30 V	130 mA
35 V	150 mA
40 V	180 mA
45 V	500 mA

The earth fault relay has a burden of 3 VA and has been set at 0,2 A.

Calculate the nominal primary earth fault current setting of the protection.

#### Question 4

A set of current transformers is connected in delta as indicated in the following sketch



What are the secondary currents  $i_r$ ,  $i_w$  and  $i_b$  for the primary currents  $I_R$ ,  $I_W$  and  $I_B$  shown below (answers in the form of sketches)?

- (a)  $150\angle 0^\circ$ ,  $150\angle -120^\circ$  and  $150\angle -240^\circ$
- (b) 0,  $1000\angle 0^\circ$  and  $1000\angle -180^\circ$  (typical phase-phase fault)
- (c)  $500\angle 0^\circ$ ,  $250\angle -180^\circ$  and  $250\angle -180^\circ$  (common 2/1/1 distribution)

#### Question 5

A set of voltage transformers (each voltage transformer rated at 132 kV/110 V) is connected with secondaries connected open delta to a 132 kV system.

What will be the output voltage for the following conditions?

- (a) Normal balanced condition
- (b) Single-phase-to-ground fault on a solidly earthed system (neutral solidly earthed)
- (c) Single-phase-to-ground fault on a system that is unearthed (neutral unearthed)