UNIVERSITY OF THE WEST INDIES

ECNG3015 (2021/2022)

Midterm

Time – 1.5 hours

This exam consists of **two (2)** questions. Attempt all parts.

Q1

A Star connected generator with the neutral solidly grounded is connected to a Bus A that supplies a transformer T/F1 which is connected Delta/Star with the Star point solidly grounded. The secondary side of transformer T/F1 is connected to a Bus B that supplies a feeder, Line 'Y'. This feeder is connected to a Bus C that supplies a transformer T/F2 that is connected Star/Delta with the Star point solidly grounded. The secondary side of transformer T/F2 is connected to a Bus D that supplies a load. Transformer T/F2 is protected using fuses on all three phases on the primary side. The data on this system is given below:

Generator – 66 kV, 30 MVA, 0.18 p.u.

T/F1 – 30 MVA, 66/12 kV, 9%

T/F2 – 1 MVA, 12000/230 V, 3%

Line 'Y' – j6.0 Ω

a. Draw the single line equivalent circuit of this system and label all components. ***(3 marks)***

b. Draw the p.u. impedance diagram for this system using the base as 20MVA and 66 kV respectively. ***(8 marks)***

c. Calculate the fault level at Bus A, B, C and D. ***(6 marks)***

d. Suggest the fuse rating of transformer T/F2 when the available fuse sizes are 30, 40 and 50A. ***(3 marks)***

Q2

For the system above, it was observed that for a SLG fault on any of the phases on the feeder, all the fuses protecting the 12000/230 V transformer kept blowing, which is undesirable under such fault condition. The P.U. data on all the equipment on a 66kV, 30MVA base is given below.

Equipment	**Positive Seq. Impedance**	**Neg. Seq. Impedance**	**Zero Seq. Impedance**
Generator	XG1=0.18	XG2=0.09	XG0=0.27
Feeder	XL1=0.19	XL2=0.19	XL0=0.66
TF1	XTF11=0.09	XTF12=0.09	XTF10=0.10
TF2	XTF21=0.9	XTF22=0.9	XTF20=1.0

a. Draw the positive, negative and zero sequence networks of this system for a SLG fault on the A - phase midway on the supply feeder, Line 'Y'. ***(6 marks)***

b. Using the theory of symmetrical components calculate the fault current for the condition in (a) above. ***(8 marks)***

c. Based on your calculation in (a) and (b) explain the reason for the blowing of the fuses protecting T/F2. ***(3 marks)***

d. How can this problem be solved without increasing the size of the fuses? ***(3 marks)***