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**SHORT QUESTIONS AND ANSWERS**

Year/ Semester/ Class : III/ V/ EEE

Academic Year: 2015-2016

Subject Code/ Name: EE6501/ Power System Analysis

**UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS****PART – A**

1. Draw the equivalent sequence network diagram for a single phase to ground fault in a power system.
2. Draw the zero sequence equivalent network diagram for a 3 phase star connected alternator with reactance earthing.
3. Draw the equivalent sequence network for a Line-Line bolted fault in a power system.
4. Draw the zero sequence network of a star-connected alternator with zero sequence impedance  $Z_{g0}$  when the neutral is grounded through an impedance  $Z_n$ .
5. Draw the equivalent sequence network diagram for a single phase to ground fault in a power system.
6. Draw the zero sequence diagram of a synchronous generator with neutral grounded
7. Draw the negative sequence diagram of a synchronous machine
8. What are unsymmetrical faults?
  - Line to ground fault
  - Line to line fault
  - Double Line to ground fault
  - One or two open conductor fault.
9. Write the symmetrical components of three phase system.
 

In a 3-phase system, the 3-phase unbalanced vectors (either current or voltage vectors) can be resolved into three balanced system of vectors. They are

  - Positive sequence components
  - Negative sequence components
  - Zero sequence components

**10. Define positive sequence impedance and negative sequence impedance.**

The positive sequence impedance of equipment is the impedance offered by the equipment to the flow of positive sequence current.

The negative sequence impedance of equipment is the impedance offered by the equipment to the flow of negative sequence current.

**PART- B**

1. Derive the expression for fault current in Line-to-Line fault on an unloaded generator in terms of symmetrical components. (16)
2. Determine the fault current and MVA at faulted bus for a line to ground (solid) fault at bus 4 as shown in Fig.2

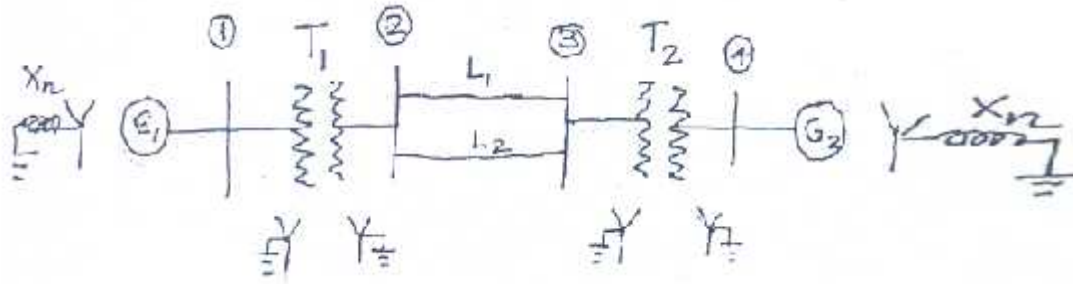


Fig.2

$G_1, G_2$ : 100 MVA, 11kV,  $X^+, X^- = 15\%$ ,  $X^0 = 5\%$ ,  $X_n = 6\%$

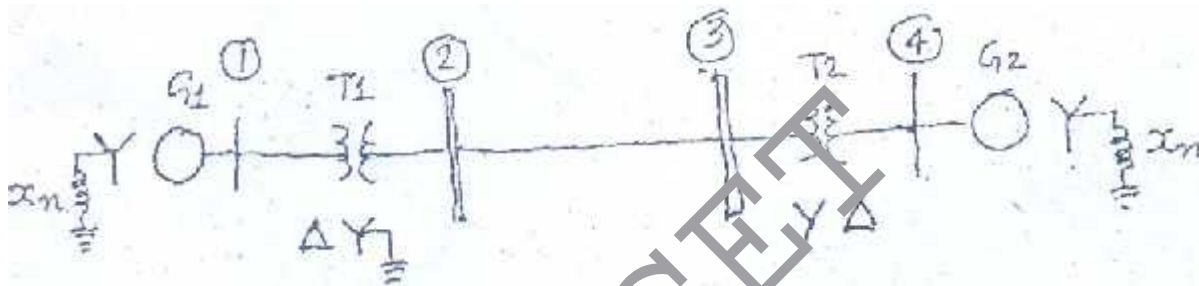
$T_1, T_2$ : 100 MVA, 11kV/220 kV,  $X_{leak} = 9\%$

$L_1, L_2$ :  $X^+ = X^- = 10\%$ ,  $X^0 = 10\%$  on base of 100 MVA. Consider a fault at phase a'. (16)

3. A single line to ground fault occurs on bus 4 of the system shown in Fig.3

(i) Draw the sequence networks and (12)

(ii) Compute the fault current. (4)



Gen 1 and 2 : 100 MVA, 20kV;  $X^+ = X^- = 20\%$ ,  $X_0 = 4\%$ ,  $X_n = 5\%$ .

Transformer 1 and 2 : 100 MVA, 20/345 KV;  $X_{leakage} = 8\%$  on 100 MVA

Tr. Line :  $X^+ = X^- = 15\%$   $X_0 = 50\%$  on a base of 100 MVA, 20 kV.

4. Draw the Zero sequence diagram for the system whose one line diagram is shown in fig.

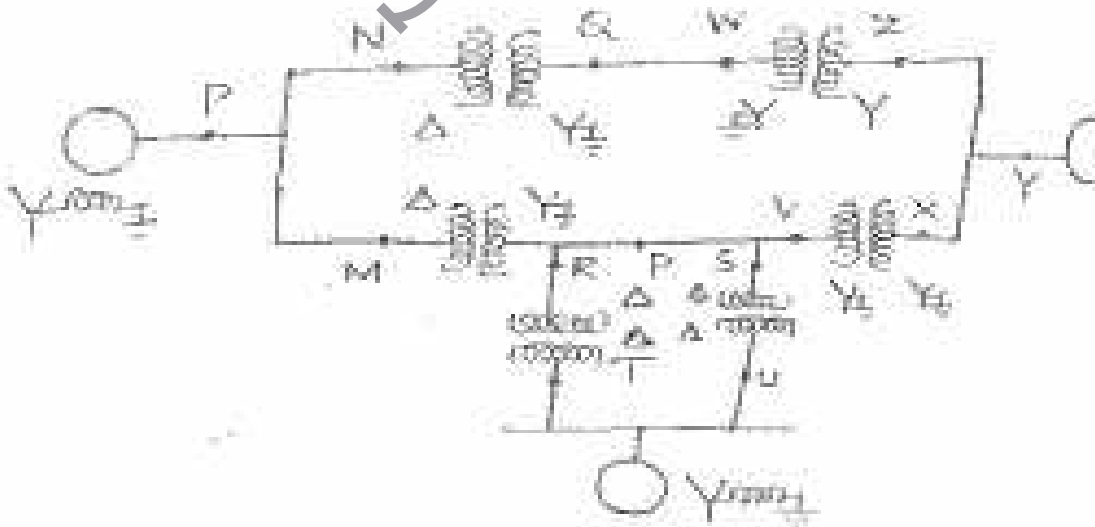


Fig.4

5. Two synchronous machines are connected through three-phase transformers to the transmission line as given below in Fig. 5. The ratings and reactance of the machines and transformers are  
 Machines 1 and 2 : 100 MVA, 20 Kv;  $X''_d = X_1 = X_2 = 20\%$ ,  $X_0 = 4\%$ ;  $X_n = 5\%$ .  
 Transformers  $T_1$  and  $T_2$  : 100 MVA, 20Y/345 YkV ;  $X = 8\%$   
 Both transformers are solidly grounded on two sides. On a chosen base of 100 MVA, 345 kV in the transmission line circuit the line reactance are  $X_1 = X_2 = 15\%$  and  $X_0 = 50\%$ . The system is operating at nominal voltage without prefault currents when a bolted ( $Z_f = 0$ ) single line-to-ground fault occurs on phase A at bus (3) Using the bus impedance matrix for each of the three sequence networks, determine the sub transient current to ground at the fault.

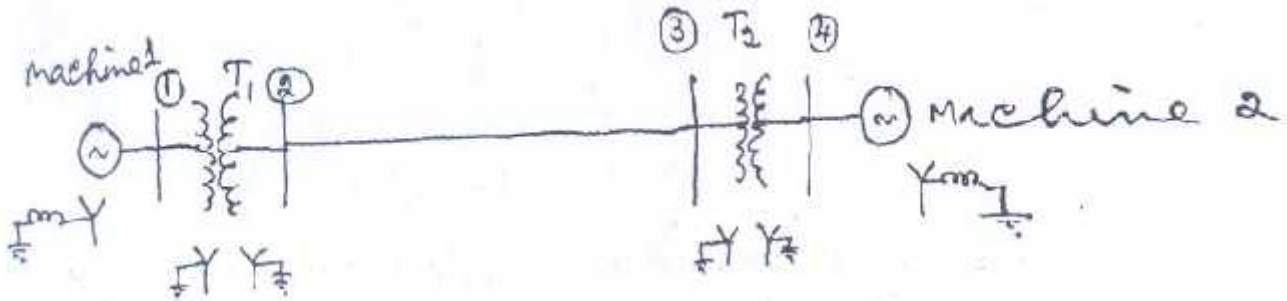


Fig.5

6. Determine the positive, negative and zero sequence networks for the system shown in Fig. 6. Assume zero sequence reactance for the generator and synchronous motors as 0.06 p.u. current limiting reactors of 2.5 are connected in the neutral of the generator and motor No.2 The zero sequence reactance of the transmission line is  $j 300$  . (10)

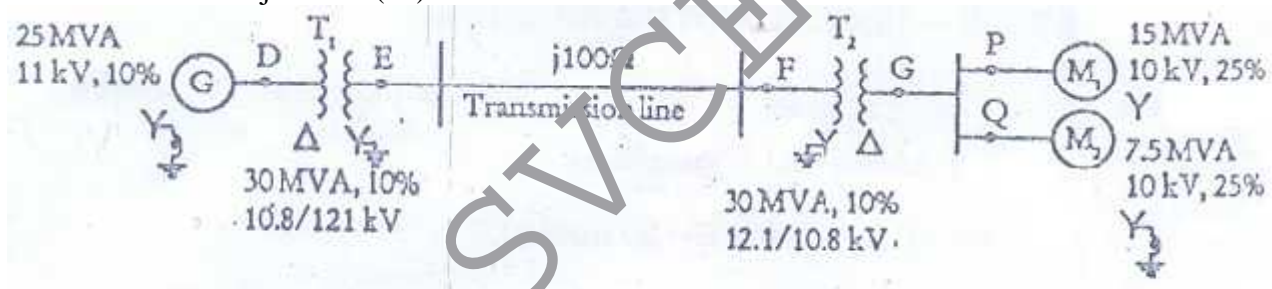


Fig. 6

7. Develop the connection of sequence network when a line to line fault occurs in a power network. (16)  
 8. Derive the expression for fault current in double line to ground fault on unloaded generator. Draw an equivalent network showing the inter connection of networks to simulate double line to ground fault (16)