



- 3 a. Prove that a balanced set of three phase voltages will have only positive sequence components of voltages only. (06 Marks)
- b. A balanced delta connected load is connected to a symmetrical supply. The line currents are each 10A in magnitude. If fuse in one of the lines blows out, determine the sequence components of line current. (08 Marks)

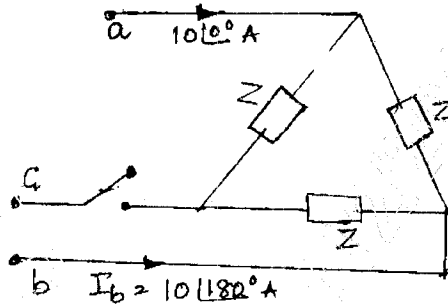


Fig.Q3(b)

- c. Derive an expression for complex power in terms of the symmetrical components. (06 Marks)
- 4 a. Draw the zero sequence equivalent circuit for the following conditions of transformer. (10 Marks)

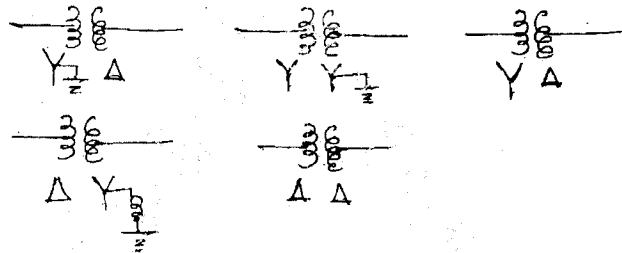


Fig.Q4(a)

- b. The one-line diagram of a power system is as shown in Fig.Q4(b). The ratings of the devices are as follows :

$G_1$  and  $G_2$  : 104MVA, 11.8KV,  $x_1 = x_2 = 0.2p.u$ ,  $x_0 = 0.1p.u$   
 $T_1$  and  $T_2$  : 125MVA, 11Y – 220YKV,  $x_1 = x_2 = x_0 = 0.1p.u$   
 $T_3$  and  $T_4$  : 120MVA, 230Y – 6.9YKV,  $x_1 = x_2 = x_0 = 0.12p.u$   
 $M_1$  : 175MVA, 6.6KV,  $x_1 = x_2 = 0.3p.u$   $x_0 = 0.15 p.u$   
 $M_2$  : 50MVA, 6.9KV,  $x_1 = x_2 = 0.3p.u$   $x_0 = 0.1p.u$   
 Transmission line reactance :  $x_1 = x_2 = 30\Omega$   $x_0 = 60\Omega$ .

Draw the sequence impedance diagram in p.u on a base of 200MVA, 220KV in transmission (10 Marks)

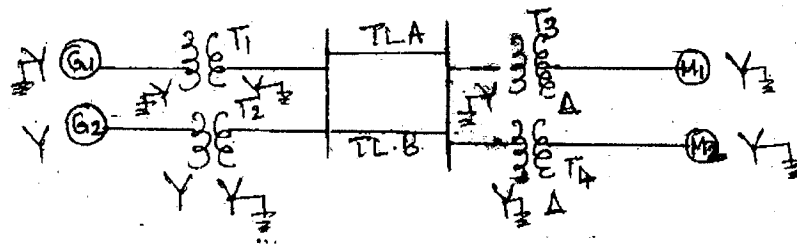


Fig.Q4(b)

## PART – B

- 5 a. Derive an expression for fault current when an line to line (LI.) fault occurs on the terminals of an unloaded generator. (08 Marks)
- b. A synchronous motor is receiving 10MW of power at 0.8pu. lag at 6KV. An LG fault takes place at the middle point of the transmission line as shown in the Fig.Q5(b). Find the fault current. The ratings of the generator, motor and transformer are as given :
- |                              |   |
|------------------------------|---|
| Generator                    | : 20MVA, 11KV, $x_1 = 0.2\text{p.u.}$ , $x_2 = 0.1\text{p.u.}$ , $x_0 = 0.1\text{p.u.}$ |
| Transformer : T <sub>1</sub> | : 18MVA, 11.5Y – 34.5YKV, $x = 0.1\text{p.u.}$  |
| Transmission line            | : $x_1 = x_2 = 5\Omega$ , $x_0 = 10\Omega$  |
| Transformer T <sub>2</sub>   | : 15MVA, 6.9Y – 34.5YKV, $x = 0.1\text{p.u.}$   |
| Motor                        | : 15MVA, 6.9KV, $x_1 = 0.2\text{p.u.}$ , $x_2 = x_0 = 0.1\text{p.u.}$                   |
- (12 Marks)

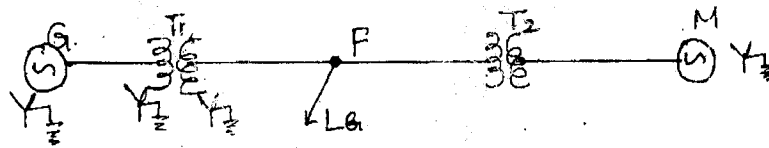


Fig Q5(b)

- 6 a. Discuss “open conductor faults”. (10 Marks)
- b. Derive an expression for L–I–G fault occurs through fault impedance ( $z_f$ ) in a power system. Show the inter connection of sequence networks. (10 Marks)
- 7 a. Derive the expression for swing equation. (06 Marks)
- b. Explain equal area concept when a power system is subjected to sudden increase in load. (06 Marks)
- c. A turbo alternator, 6-pole, 50Hz of capacity 80MW working at 0.8p.f has an inertia of 10MJ/MVA. Calculate :
- The energy stored in the rotor at synchronous speed
  - Find rotor acceleration if the mechanical input is suddenly raised to 75MW for an electrical load of 60MW
  - Suppose the above acceleration is maintained for a duration of 6 cycles. Calculate the change in torque angle and the rotor speed at the end of 6 cycles. (08 Marks)
- 8 Write short notes on :
- Power angle equation of a non salient pole synchronous machine
  - Classification of stability
  - Single phasing of 3 phase induction motor
  - Critical clearing angle and critical clearing time. (20 Marks)

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