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10EE61

Sixth Semester B.E. Degree Examination, June/July 2017
Power System Analysis and Stability

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is meant by one line diagram of a power system? With typical example explain its significance. **(08 Marks)**

b. Draw the per unit reactance diagram for the power system shown in Fig Q1(b) on 20MVA, 6.6kV base in the generator 1 circuit.

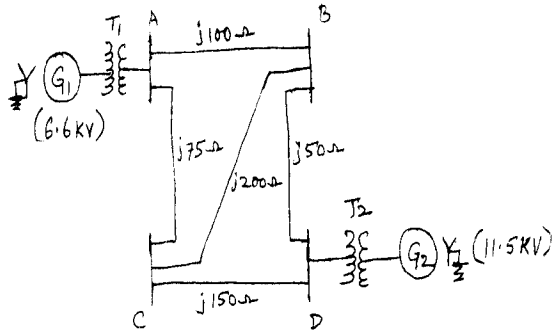

Fig Q1(b)

The rating of the various components.
Gen 1 : 10MVA, 6.6KV, X″ = 0.1 Pu
Gen 2 : 20MVA, 11.5KV, X″ = 0.1 Pu
Transformer 1 : 10MVA, 3phase, 6.6/115KV, X = 0.15Pu
Transformer 2 : 3 1-ϕ units each rated 10MVA, 7.5/75KV, X = 0.1 Pu **(12 Marks)**

2 a. What are symmetrical components and their significance and obtain the equations for their average power and reactive power in terms of symmetrical components. **(08 Marks)**

b. The voltage at the terminals of a three phase balanced load consisting of three (10 + j8)Ω connected in star are $V_{ab} = 100\ \underline{|0^\circ}$ V, $V_{bc} = 90\ \underline{|240^\circ}$ V and $V_{ca} = 94\ \underline{|120^\circ}$ V. Find the power consumed in load using symmetrical components. **(12 Marks)**

3 a. What are sequence impedances and sequence network? Draw the single phase zero sequence networks for the transformers connected in different configuration. **(08 Marks)**

b. A 25MVA, 11KV, 3-ϕ generator has a sub transient reactance of 20%. The generator supplies two motors over a transmission line with transformers at both sides as shown in the one line diagram of Fig Q3(b). The motors have rated inputs of 15MVA and 7.5MVA both at 10KV with 25% sub transient reactance. The three phase transformers are both rated 30MVA, 10.8/121KV, connection Δ-Y with leakage reactance of 10% each. The series reactance of the line is 100Ω. Draw the positive, negative and zero sequence network of the system with all reactances marked in Pu. Assume that the negative sequence reactance of each machine is equal to the sub transient reactance. Select the generator rating as the base in the generator circuit. Assume the zero sequence reactance for the generator and motors are 0.6Pu each. Current limiting reactors of 2.5Ω each are connected in the neutrals of the generator and motors. The zero sequence reactance of the transmission line is 300Ω. **(12 Marks)**

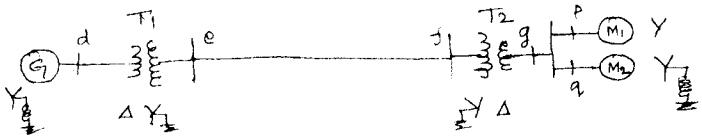

Fig Q3(b)

4 Determine the fault MVA, if a fault takes place at 'F' in the diagram shown in Fig Q4. The P.u values of reactance are given with 100 MVA as base. **(20 Marks)**

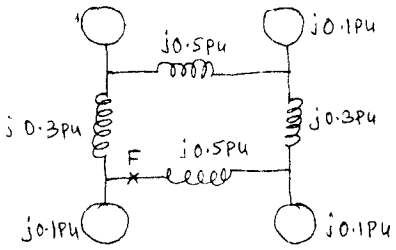

Fig Q4

PART – B

5 a. What are the different types of unsymmetrical faults and explain in brief their frequency of occurrence? **(08 Marks)**

b. A double line to ground fault occurs at the terminals of an loaded generator. Derive an expression for the fault currents; draw the connection of sequence networks. **(12 Marks)**

6 a. For one conductor open fault, derive expressions for currents and show the connections of sequence network to represent the fault. **(08 Marks)**

b. A synchronous motor is receiving 10MW of power at 0.8 p.f lag at 6kV. An LG fault takes place at the middle point of the transmission line as shown in Fig Q6(b) . Find the fault current. The rating of the generator motor and transformer are as under. **(12 Marks)**

Generator	:	20MVA, 11KV, $X_1 = 0.2$Pu, $X_2 = 0.1$Pu, $X_0 = 0.1$Pu
Transformer T_1	:	18MVA, 11.5Y/34.5Y KV, X = 0.1 Pu
Transmission line	:	$X_1 = X_2 = 5\Omega$, $X_0 = 10\Omega$
Transformer T_2	:	15MVA, 6.9Y/34.5Y KV, X = 0.1 Pu
Motor	:	15MVA, 6.9KV, $X_1 = 0.2$Pu, $X_2 = X_0 = 0.1$Pu

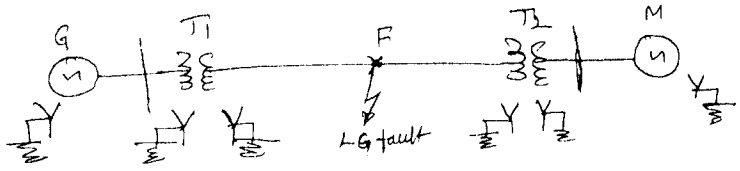

Fig Q6(b)

7 a. Define stability as applied to power system studies and distinguish between i) Steady state stability and ii) Transient stability. **(08 Marks)**

b. The transfer reactance between a generator an infinite bus bar operating at 200KV under various conditions on interconnection are

Pre fault	:	150Ω per phase
During fault	:	400Ω per phase
Past fault	:	200 Ω per phase

If the fault is cleared when the rotor has advanced 60° electrical from the prefault position, determine the maximum load that could be transferred without loss of stability. **(12 Marks)**

8 a. Explain clearly the methods of improving transient stability. **(08 Marks)**

b. Explain the effect of unbalanced voltage on the performance of an induction motor. Find the expressions for power developed and Torque developed under such operating conditions. **(12 Marks)**