Birla Institute of Technology and Science, Pilani

Comprehensive exam (close book), second semester 2016-17

Power Systems (EEE F312)

Max. Marks – 120 **Duration- 180 minutes** **May 12, 2017**

Instructions: *Write your assumptions clearly with justifications; Doubts are a part of questions. So, no clarification please!*

Q1. For the network shown in fig.Q1, a balanced three-phase resistor is fed by a balanced line (with mutual coupling between phases). Find positive, negative and zero sequence currents and hence the currents in the three phases **a, b** and **c** for $\mathbf{V_a = V; V_b = 0; V_c = 0}$. [10, 10]

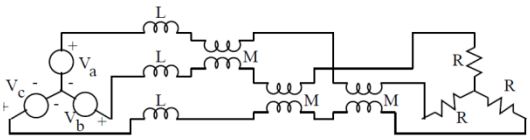

Fig.Q1

Q2. One-line diagram of a power system is shown fig.Q2. Find the per unit fault current (point of fault is shown) in the lines for (a) single Line-Ground fault and (b) Double Line-Ground fault. *[Clearly draw the network in both cases using positive, negative and zero sequence networks for current calculation]*. ***{The system parameters are: System Base Voltage = 138kV; System Base Power = 100MVA; Transformer T_1 Leakage Reactance = 0.1 pu; Transformer T_2 Leakage Reactance = 0.1 pu; Line L_1 Positive and Negative Sequence Reactance = j(0.05)pu; Line L_1 Zero Sequence Impedance = j0.1pu; Line L_2 Positive and Negative Sequence Reactance = j(0.02)pu; Line L_2 Zero Sequence Impedance = j0.1pu}.*** [20, 20]

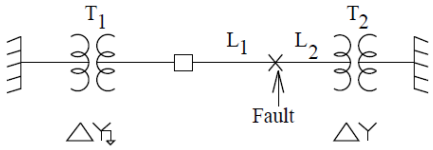

Fig.Q2

Q3. A synchronous generator of reactance ***1.20 pu*** is connected to an infinite bus bar through transformers and a line of total reactance of ***0.60 pu***. The generator no load voltage is ***1.20 pu*** and its inertia constant is *H= 4MW-s/MVA*. The resistance and machine damping is assumed to be negligible. The system frequency is 50 Hz. Calculate the frequency of natural oscillations if the generator is loaded to (a) 50% and (b) 80% of its power limit. [15]

Q4. A power deficient area receives *50MW* over a tie line from another area. The maximum steady state capacity of the tie line is *100MW*. Find the allowable sudden load that can be switched on without loss of stability. [15]

Q5. A three phase feeder having a resistance of 3 ohm and a reactance of 10 ohm supplies a load of 2 MW at ***0.85 pf*** lag. The receiving end voltage is maintained at 11 kV by means of a static condenser drawing 2.1 MVAR from the line. Calculate the sending end voltage and power factor. What is the regulation and efficiency of the feeder? [15]

Q6. Incremental fuel costs in rupees per MWh for a plant consisting of two units are: $\boldsymbol{dC_1/dP_{G1} = 0.20P_{G1} + 40.0}$ and $\boldsymbol{dC_2/dP_{G2} = 0.25P_{G2} + 30.0}$. Assume that both the units are operating at all the times, and load varies from *40 MW* to *250 MW*, and the maximum and minimum loads on each units are to be *125 MW* and *20 MW* respectively. What is the load sharing of each unit for a plant output of *40 MW* and *175 MW*. [15]