EJ – 1197

VI Semester B.E. (Electrical and Electronics) Degree Examination, June/July 2015
(2K11 Scheme)
EE-602 : POWER SYSTEM ANALYSIS

Time : 3 Hours Max. Marks : 100

Instructions : *Answer **any five full** questions by choosing atleast **two** questions from **each** Part.*

PART – A

1. a) Explain how transmission lines and load are modelled for power system analysis. **6**

   b) What is per unit system ? Mention few advantages of P.U. system. **6**

   c) Two generators rated at 10 MVA, 13.2 KV and 15 MVA, 13.2 KV are connected in parallel to a bus bar. They feed supply to two motors of inputs 8 MVA and 12 MVA respectively. The operating voltage of motors is 12.5 KV. Assuming base quantities as 50 MVA and 13.8 KV, draw the reactance diagram. The pu reactances of generator is 15% and that for motors is 20%. **8**

2. a) Define transient reactance, sub-transient reactance and steady state transient of synchronous generator. **6**

   b) A 50 MVA, Y connected, 13.2 KV synchronous generator is connected to a 13.2/132 KV, 50 MVA, D-Y transformer. The generator reactances are $x_d'' = 0.12$ pu, $x_d' = 0.25$ pu and $x_d = 1.4$ pu on a 50 MVA base, while the transformer reactance is 0.1 pu on the same base. The machine is unloaded when a symmetrical fault occurs at the HT terminals of the transformer. Find the subtransient, transient and steady state symmetrical fault currents in pu and in actual values. $E_g = 1.0$ pu. **6**

   c) Derive the expression of average three phase power in terms of symmetrical components. **8**

P.T.O.

3. a) A delta connected resistive load is connected across a balanced three phase supply of 415 V. $R_{ab} = 30\ \Omega$, $R_{bc} = 15\ \Omega$ and $R_{ca} = 350\ \Omega$. Find the line currents and symmetrical components of line and delta currents. **12**

   b) The line-to-ground voltages on the high voltage side of a step-up transformer are 100 KV, 33 KV and 38 KV on phases a, b and c respectively. The voltage of phase 'a' leads that of phase 'b' by 100° and lags that of phase 'c' by 176.5°. Determine the symmetrical components of voltages. **8**

4. a) A three phase transmission line has a self impedance of Z_s and mutual impedance Z_m. An impedance Z_n is connected in the neutral. Find the sequence impedances. **10**

   b) Explain the phase shift of symmetrical components in star-delta transformer bank. **10**

PART – B

5. a) Derive the necessary equation to determine the fault current for a single line to ground fault. Draw a diagram showing the inter connection of sequence networks. **10**

   b) A 20 MVA, 13.8 KV generator has + ve sequence reactance of 0.35 pu. Its – ve and zero sequence reactances are 0.25 pu and 0.1 pu respectively. The neutral of the generator is grounded. Find the fault current, line-to-ground voltages and the line-to-line voltages. **10**

6. a) Explain different types of open conductor faults in power systems. **8**

   b) A generator of negligible resistance having 1 pu voltage behind transient reactance is subjected to different types of faults.

Type of fault	**fault current in pu**
3-phase	3.33
L-L	2.23
L-G	3.01

   Calculate the per unit value of three sequence reactances. **12**

7. a) Distinguish between steady state and transient stability. Derive power angle equation. **(4+4)**

   b) Starting from first principles, derive the swing equation of a synchronous machine. **6**

   c) Explain using diagrams the application of equal area criterion to study transient stability for the following cases.

      i) a sudden increase in input of the generator.

      ii) a fault on one of the parallel circuits of a double ckt line feeding an infinite bus. The fault is at the mid point of one of the lines and is subsequently cleared by opening of the faulted line.

   Mark the accelerating and decelerating area in each case. **6**

8. a) Obtain the mathematical model of load frequency controller of an isolated power system. **10**

   b) Two generators rated 250 MW and 500 MW are operating in parallel. The droop characteristics of their governors are 4% and 5% from no load to full load. If the nominal frequency is 50 Hz at no load, how would a load of 750 MW be shared between them. What is the system frequency ? **10**
