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Question Paper Code : 42505

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Sixth Semester

Electrical and Electronics Engineering

EE 2351 – POWER SYSTEM ANALYSIS

(Regulations 2008)

(Common to PTEE 2351 – Power System Analysis for B.E. (Part-Time) Fourth Semester – Electrical and Electronics Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. A 400 kV transmission line has a surge impedance of 400 Ω. What would be its surge impedance loading ?

2. The ABCD constants of a three 345 kV transmission line are A = D = 0.98182 + j0.0012447, B = 4.035 + j 58.947, C = j0.00061137. The line delivers 400 MVA at 0.8 lagging power factor at 345 kV. Determine the sending end voltage.

3. What are the informations that are obtained from a power flow study ?

4. Compare Gauss-Seidel and Newton-Raphson methods of load flow solutions.

5. What is the order of severity and occurrence of different types of fault ?

6. What are the characteristics of shunt and series faults ?

7. State Fortescue Theorem.

8. Which type of fault is very common in power system ?

9. Define infinite bus in a power system.

10. What is meant by power angle curve ?

PART – B (5×16=80 Marks)

11. a) A 90 MVA, 11 KV, 3 phase generator has a reactance of 25%. The generator supplies two motors through transformer and transmission line as shown in figure 11 (a). The transformer T_1 is a 3 – phase transformer, 100 MVA, 10/132 KV, 6% reactance. The transformer T_2 is composed of 3 single phase units each rated 300 MVA, 66/10 KV, with 5% reactance. The connection of T_1 and T_2 are shown. The motors are rated at 50 MVA and 400 MVA both 10 KV and 20% reactance. Taking the generator rating as base, draw reactance diagram and indicate the reactance in per unit. The reactance of line is 100 ohms. **(16)**

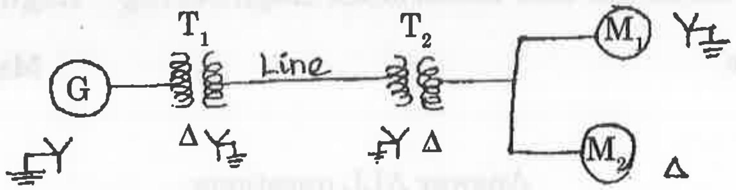

Figure 11 (a)

(OR)

b) i) Determine Y_{bus} for the 3 – bus system shown in Figure 11(b) (i). The line series impedance as follows : **(10)**

Line (bus to bus)	Impedance (pu)
1 – 2	0.06 + j 0.18
1 – 3	0.03 + j 0.09
2 – 3	0.08 + j 0.24

Neglect the shunt capacitance of the lines.

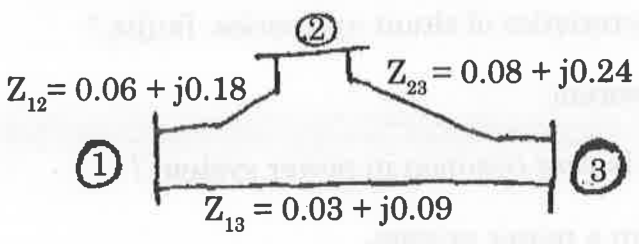

Figure 11(b) (i)

ii) What are impedance and reactance diagram ? Explain. **(6)**

12. a) Figure 12 (a) shows the one line diagram of a simple three bus power system with generation at buses at 1 and 2. The voltage at bus 1 is V = 1 + j 0.0V per unit. Voltage magnitude at bus 2 is fixed at 1.05 p.u. with a real power generation of 400 MW. A load consisting of 500 MW and 400 MVAR is taken from bus 3. Line admittances are marked in per unit on a 100 MVA base. For the purpose of hand calculations, line resistances and line charging susceptances are neglected.

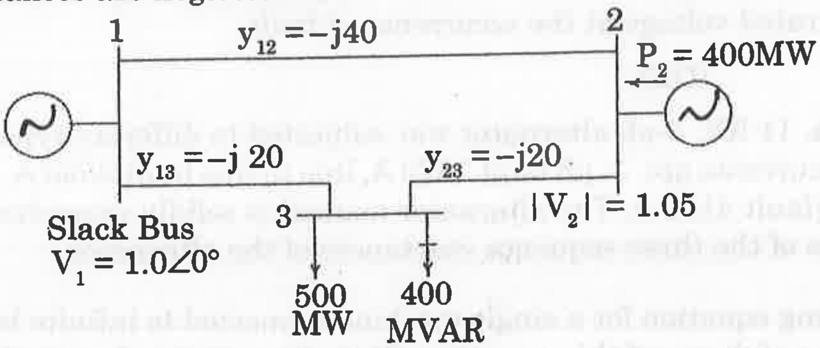

Figure 12 (a)

Using Newton-Raphson method, start with the initial estimates of $V_2^{(0)} = 1.05 + j\,0.0$ and $V_3^{(0)} = 1.05 + j0.0$ and keeping $|V_2| = 1.05$ p.u., determine the phasor values V_2 and V_3. Perform two iterations. **(16)**

(OR)

b) In the power system network shown in Figure 12 (b), bus 1 is slack bus with $V_1 = 1.0 + j\,0.0$ per unit and bus 2 is a load bus with $S_2 = 280$ MW + j 60 MVAR. The line impedance on a base of 100 MVA is Z = 0.02 + j 0.04 per unit. Using Gauss-Seidel method, determine V_2. Use an initial estimate of $V_2^{(0)} = 1.0 + j\,0.0$ and perform four iterations. Also find S_1 and the real, reactive power loss in the line, assuming that the bus voltages have converged. **(16)**

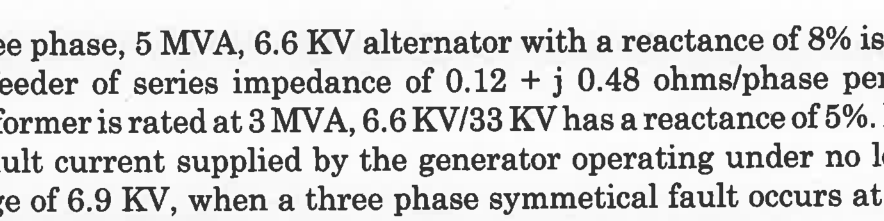

Figure 12 (b)

13. a) A three phase, 5 MVA, 6.6 KV alternator with a reactance of 8% is connected to a feeder of series impedance of 0.12 + j 0.48 ohms/phase per KM. The transformer is rated at 3 MVA, 6.6 KV/33 KV has a reactance of 5%. Determine the fault current supplied by the generator operating under no load with a voltage of 6.9 KV, when a three phase symmetical fault occurs at a point 15 KM along the feeder. **(16)**

(OR)

b) Describe the bus impedance matrix method of fault current calculation. **(16)**

14. a) i) 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. **(8)**

ii) A 30 MVA, 11 KV generator has $Z_1 = Z_2 = j\,0.2$ p.u. $Z_0 = j\,0.05$ p.u. A line to ground fault occurs on the generator terminals. Find the fault current and line to line voltages during fault conditions. Assume that the generator neutral is solidly grounded and that the generator is operating at no-load and at rated voltage at the occurrence of fault. **(8)**

(OR)

b) A 50 MVA, 11 KV, 3-ph alternator was subjected to different types of faults. The fault currents are 3- ph fault 1870 A, line to line fault 2590 A, single line to ground fault 4130 A. The alternator neutral is solidly grounded. Find the p.u. values of the three sequence reactances of the alternator. **(16)**

15. a) Derive swing equation for a single machine connected to infinite bus system. State the usefulness of this equation. State the reasons for non-linearity of this equation. **(16)**

(OR)

b) State and explain equal area criterion and discuss how you will apply it to find the maximum additional load that can be suddenly added. **(16)**