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B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2012

ELECTRICAL & ELECTRONICS ENGINEERING BRANCH

FIFTH SEMESTER

EE9302 - POWER SYSTEM ANALYSIS

(REGULATIONS 2008)

Time: 3 hr Max. Marks: 100

Answer ALL Questions

PART-A (10 X 2 = 20 Marks)

1. What is one line diagram?
2. Draw a single line diagram showing the essential parts in the power system network.
3. Define primitive network.
4. Draw the π-equivalent circuit of tap changing transformer.
5. Compare Gauss-Seidel and N-R method.
6. How buses are classified in power system?
7. Draw the zero sequence network for Y/Δ connected transformer.
8. Name the fault in which the negative and zero sequence currents are equal to zero.
9. Draw the power angle curve and specify stable and unstable operating region.
10. State the limitations of equal area criterion.

PART-B (5 X 16 = 80 Marks)

11(a). Fig. 11a shows a generator feeding two motors through transformers and a line. The ratings and reactances are as under.

G1: 100 MVA, 11 kV, 3 phase, x= 20%
T1: 3 phase, 100 MVA, 11/132 kV, x=5%
T2: Bank of 3 single-phase transformers, each rated at 35 MVA, 66/11kV, x=4%.
M1: 40 MVA, 3phase, 10 kV, x=20%
M2: 60 MVA, 3phase, 11 kV, x=15%
The line reactance is 80 ohms.

Draw the pu reactance diagram on a base of 100 MVA, 11 kV in the circuit of generator G_1. Indicate pu reactances on the diagram. (16)

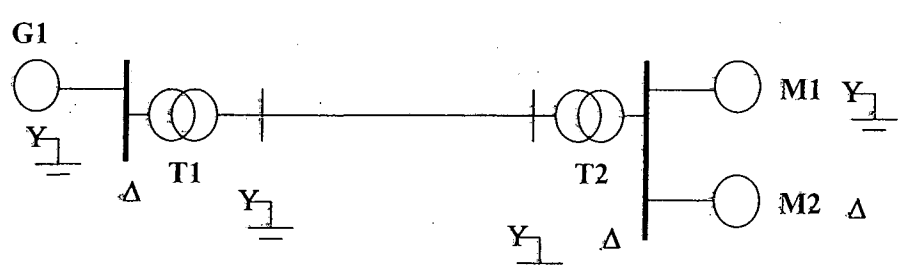


Fig. 11a

12(a). The parameters of a 4-bus system are as under:

Line no.	Line starting bus	Line ending bus	Line impedance (pu)	Line Charging admittance (pu)
1	1	2	0.2 + j 0.8	j0.02
2	2	3	0.3 + j 0.9	j0.03
3	2	4	0.25 + j 1.0	j0.04
4	3	4	0.2 + j 0.8	j0.02
5	1	3	0.1 + j 0.4	J0.01

Draw the network and find bus admittance matrix. (16)

(Or)

(b). The parameters of a 3-bus system are as under:

Element no.	Line starting bus	Line ending bus	Line impedance (pu)
1	1	0 (ref.)	j 0.8
2	1	2	j 0.6
3	1	3	j 0.4
4	2	3	j 0.5

Form the Z-bus using bus building algorithm. (16)

13(a). Fig. 13a shows the one-line diagram of a simple three-bus power system with generators at buses 1 and 3. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltages after one iteration using Newton-Raphson method. (16)

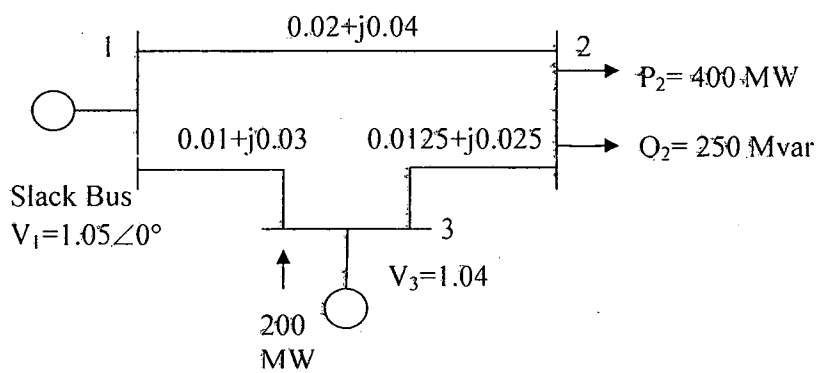


Fig. 13a

(Or)

(b). Consider the simple three-bus power system given in Question 13(a). Find out the bus voltages after one iteration using Gauss-Seidel method. (16)

14(a). The one-line diagram of a simple three-bus power system is shown in Fig.14a. Each generator is represented by an emf behind the transient reactance. All the impedances are expressed in per unit on a common 100 MVA base. The system is considered on no-load with all generators are running at their rated voltage and rated frequency. Determine the fault current, the bus voltages, and the line currents during the fault when a balanced three-phase fault with a fault impedance Z_f = j0.16 pu occurs on bus 3. (16)

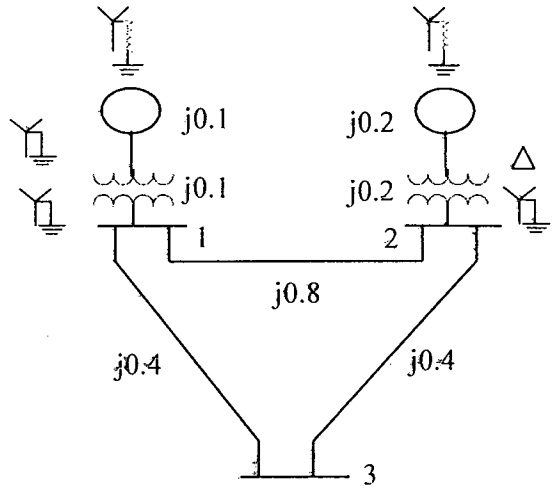


Fig. 14a

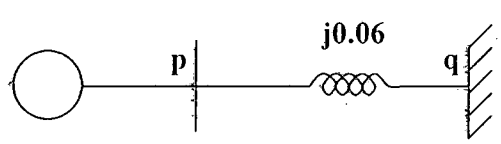
(Or)

(b). Derive the relationship for fault currents in terms of symmetrical components when there is a double line-to-ground (DLG) fault. Also draw a diagram showing interconnection of sequence networks for DLG fault. (16)

15(a). What is Equal Area Criterion? Using equal area criterion, drive an expression for critical clearing angle and critical clearing time for a system having a generator feeding a large system through a double circuit line with a temporary three-phase bolted fault on one of the line at the sending end. (16)

(Or)

(b). The synchronous machine shown in Fig. 15b is delivering 100 MW and 75 MVAR at the infinite bus. The voltage of the infinite bus q is 1+j0 pu. The generator is connected to the infinite bus through a line of reactance 0.06 pu on a 100 MVA base. The machine transient reactance is 0.2 pu on a 100 MVA base and the inertia constant H is 4 sec. A 3-ϕ fault occurs at bus 'p' for a duration of 0.02 sec. Compute the rotor angle at t = 0.02 sec (Δt =0.02 sec) using modified Euler method. The frequency of the supply is 50Hz. (16)



Vq = 1+j 0

Fig. 15b