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B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2011

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 are the advantages of pu representation?
2. What are the models used to represent generators, transmission lines and loads in short circuit analysis?
3. Define primitive network. Give an example.
4. Draw the zero sequence network for Y/Δ connected transformer.
5. Compare Gauss-Seidel and N-R method.
6. How buses are classified in power system?
7. What is meant by 'fault level'?
8. Define the term "transient stability".
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 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 = 16 ohms/phase on h.t side

T2: Bank of 3 single-phase transformers, each rated at 35 MVA, 66/11kV, x = 10 ohms/phase on h.t side.

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, 12 kV in the circuit of generator G_1. Indicate pu reactances on the diagram. (16)

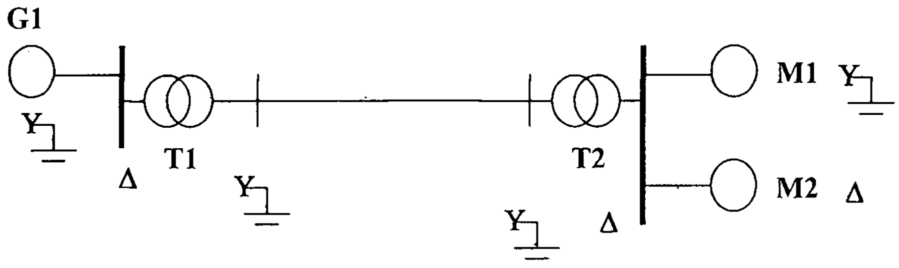

Fig. 11a

12(a). For a network shown in the Fig. 12a form the bus admittance matrix. (16)

Z_a = j0.1; Z_b =j 0.2; Z_c = j0.4 = Z_d ; Z_e = j0.2; Z_m = j0.1 All data are in p.u

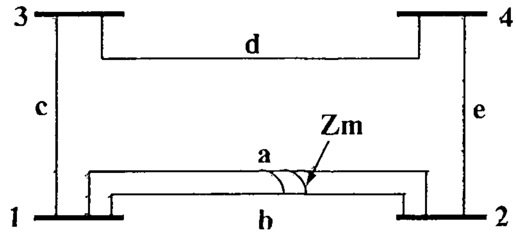

Fig 12a

(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
5	3	0	j 0.4

Form the Z-bus using bus building algorithm. Add the element in a sequence given in the table starting from element 1. (16)

13(a). Fig. 13a shows the one-line diagram of a Two-bus system. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltage using Newoton-Raphson method at the end of second iteration. (16)

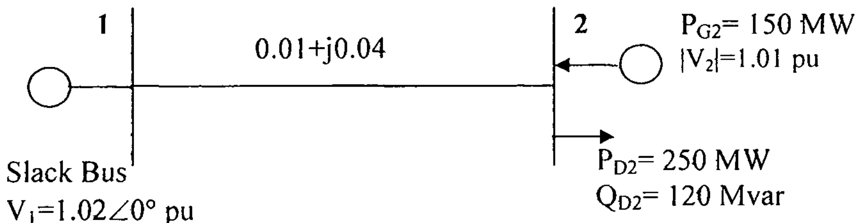

Fig. 13a

(Or)

(b). Fig.13b shows the one-line diagram of a simple three-bus power system with generators at buses 1 and 2. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltages after one iteration using Gauss-Seidel method. Use acceleration factor α = 1.2. (16)

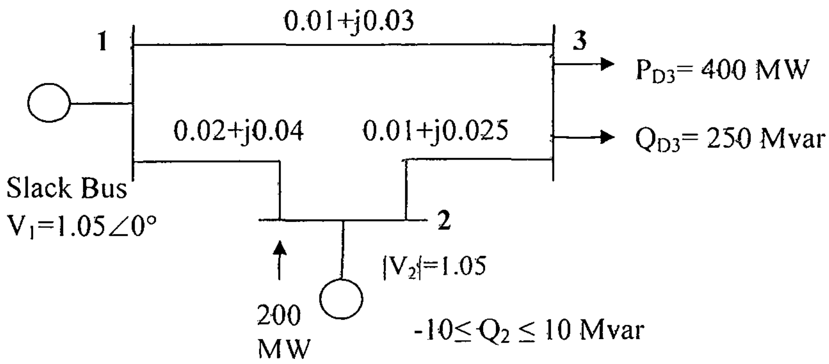

Fig. 13b

14(a). A synchronous generator and motor are rated 30 MVA, 11 kV and both have subtransient reactances of 20%. The line connecting them has a reactance of 10% on the base of the machine ratings. The motor is drawing 20 MW at 0.8 p.f. leading and a terminal voltage of 10.8 kV when a symmetrical three-phase fault occurs at the motor terminals. Find the subtransient currents in the generator and the motor and fault level by using the internal voltages of the machines. (16)

(Or)

(b). Figure 14b shows the system representation applicable to a 1000 MVA, 20kV, 50Hz generating unit. The transmission data shown in the figure are in p.u on 1000MVA, 20 kV base. The generator data in p.u on the rating of the unit are as follows:

X_1 = 0.25 X_2=0.25 Xo = 0.04

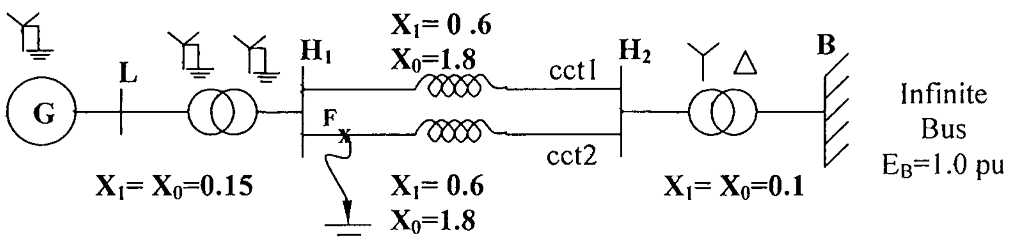

Fig. 14b

A Double line to ground (DLG) fault occurs on circuit 2 at the point F as shown in Fig.14b. Compute the magnitude of the positive, negative and zero sequence currents flowing through generator immediately after the fault. (16)

15(a). Fig. 15a shows transmission network. The pu reactances of the equipments are as shown. The voltage behind transient reactance of generator is 1.1 pu. The system is transmitting 1 pu real power when fault occurs at the middle of one of the line. Determine (i) transfer reactance for prefault, during fault and post fault conditions and (ii) critical clearing angle. (16)

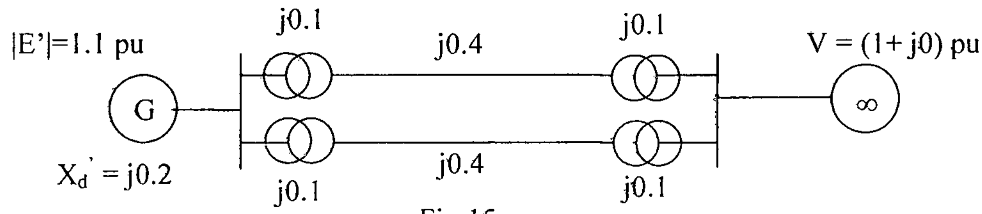

Fig 15a

(Or)

(b). The synchronous machine shown in Fig. 15b is delivering 100 MW and 75 MVAR to 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 0.08 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 = 0.04 sec (Δt =0.02 sec) using modified Euler method. The frequency of the supply is 50Hz. (16)

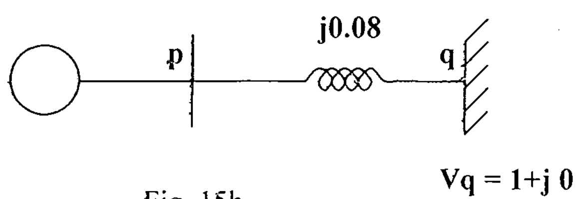

Fig. 15b