Code No: 126AG **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, December - 2017
COMPUTER METHODS IN POWER SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Define the terms tree and co-tree with suitable examples. [2]
b) Explain demerits of Z-bus over Y-bus. [3]
c) What is the effect of acceleration factor in the load flow solution algorithm? [2]
d) What is the necessity of conducting power flow studies? [3]
e) What are the assumptions made in short circuit studies of a large power system network? [2]
f) What are the applications of series reactors? [3]
g) How can the steady state stability of power system be increased? [2]
h) Distinguish between steady state and dynamic stability of a power system. [3]
i) Write the state variable formulation of swing equation. [2]
j) What is the significance of Critical Clearing Angle? [3]

PART - B

(50 Marks)

2.a) Derive the expression for bus admittance matrix in terms of primitive admittance matrix and bus incidence matrix.
b) For the power system network shown in Figure 1, use ground as a reference bus. Form Y_{BUS} by direct inspection method. Line and generator reactances are mentioned in the figure 1. [5+5]

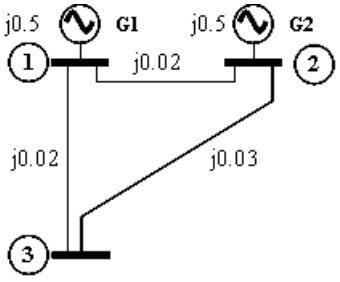

Figure 1

OR

3. Assume the bus impedance matrix for a partial network is known. Now explain the Z bus building algorithm for the following modifications. (a) Addition of a branch and (b) Addition of a link. [10]

4.a) What are the advantages of NR-method over GS-method? Explain.

b) For the system shown in below figure 2. P_2 = 0.5 p.u., Q_2 = -0.2 p.u., P_3 = -1 p.u., Q_3 = 0.5 p.u., P_4 = 0.3 p.u., Q_4 = -0.1 p.u., and $V_1 = 1.04 \angle 0^0$ p.u. Determine the value of V_2 after the first iteration of Gauss Seidel (GS) method. Line admittances are as shown in the figure 2. [5+5]

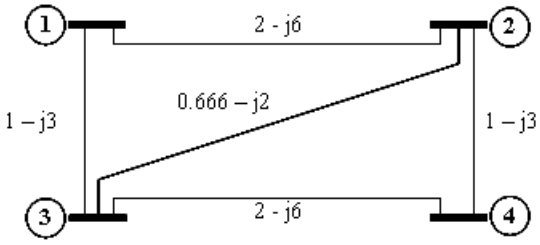

Figure 2

OR

5.a) What are the assumptions made in reducing Decoupled method to Fast Decoupled method of power flow solution?

b) The magnitude of voltage at bus-1 is adjusted to 1.05 p.u, voltage magnitude at bus-3 is fixed at 1.04 p.u with a real power generation of 2.0 p.u. A load consisting of Pd_2 = 4.0 p.u and Qd_2 = 2.5 p.u. is taken from bus-2. Given line admittances y_{12}= (10- j20) p.u., y_{13} = (10-j30) p.u.,y_{23} = (16 - j32) p.u. Obtain the power flow solution using FDLF method. [5+5]

6.a) The voltages across a 3-phase unbalanced load are $V_a = 300$ Volts, $V_b = 300 \angle -90^0$ Volts and $V_c = 800 \angle -143^0$ Volts respectively. Determine the sequence components of voltages. Phase sequence is ABC.

b) Draw the pu impedance diagram for the system shown in figure 3. Choose Base MVA as 100MVA and Base kV as 20kV. [5+5]

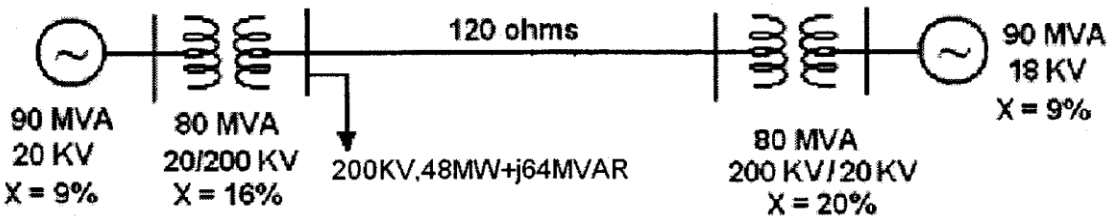

Figure 3

OR

7.a) Derive an expression for the fault current for a line-to-line fault at an unloaded generator.

b) A 20MVA, 11KV, 3-Φ, 50HZ generator has its neutral earthed through a 5% reactor. It is in parallel with another identical generator having isolated neutral. Each generator has a positive sequence reactance of 20%, Negative sequence reactance of 10% and zero sequence reactance of 15%. If a line to ground short circuit occurs in the common bus-bar, determine the fault current. [5+5]

8. Write short notes on:
   a) Selection of circuit breakers.
   b) Synchronizing coefficient and
   c) Transfer reactance. [10]

OR

9. A 50Hz, 4 pole generator rated 100MVA, 11kV has an inertia constant of 8MJ/MVA
   a) Find the stored energy in the rotor at synchronous speed
   b) If the mechanical input is suddenly raised to 80MW for electrical load of 50MW find rotor acceleration.
   c) i) if the acceleration calculated in ii) is maintained for 10cycles, find the change in torque angle and rotor speed in rpm at the end of this speed.
   d) Another generator 200MVA, 3000rpm having H=6MJ/MVA is put in parallel with the above generator. Find the inertia constant for equivalent generator on a basis of 100MVA. [10]

10.a) Explain clearly the application of equal area criterion for studying the transient stability of a system.
   b) Why transient state stability limit is less than steady state stability limit? Explain. [5+5]

OR

11. Consider the system shown in Figure 4 below.

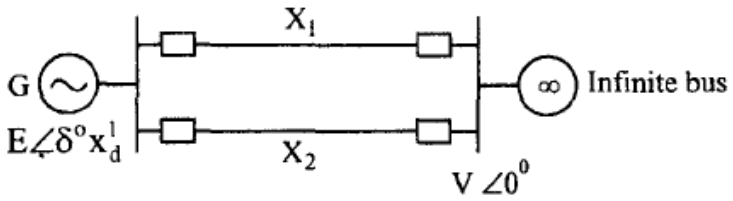

Figure 4

$x'_d = 0.25$ p.u

$|E| = 1.25$ p.u and $|V| = 1.0$ p.u ; $X_1 = X_2 = 0.4$ p.u

Initially the system is operating stable while delivering a load of 1.25 p.u. Determine the stability of the system when one of the lines is switched off due to a fault. Also determine the maximum value of the rotor swing. [10]

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