R16

Code No: 136DK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, May - 2019

POWER SYSTEMS ANALYSIS

(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) What are the advantages of Z_{BUS} building algorithm? [2]

b) Write the Bus Incidence Matrix for the graph shown in figure 1 below. [3]

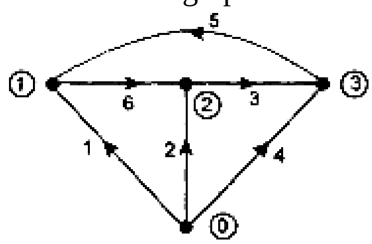

Figure 1

c) What is the necessity of power flow studies? [2]

d) Explain the significance of Slack bus. [3]

e) Compare the Newton-Raphson method with decoupled load flow method. [2]

f) Write the power system characteristics used in decoupled method. [3]

g) Write the applications of Series reactors. [2]

h) Give the zero sequence network of: Y-Y and Δ - Y transformers. [3]

i) List the various methods of improving transient stability. [2]

j) Discuss the limitation in equal area criterion for the study of power system stability. [3]

PART - B

(50 Marks)

2.a) Derive the expression for bus admittance matrix Y_{BUS} in terms of primitive admittance matrix and bus incidence matrix.

b) Form the Y_{BUS} by using singular transformation for the network shown in Figure 2 including the generator buses. [5+5]

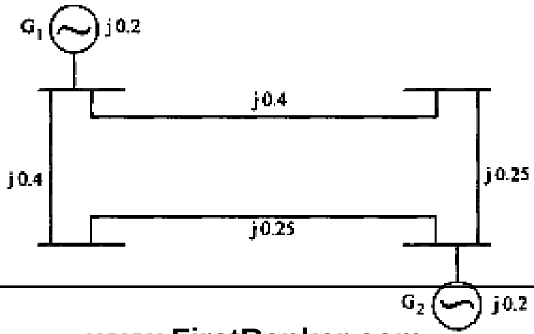

Figure 2

OR

3. For the network shown in Figure 3 below, Determine the modified ZBUS if the line 4 is removed from the network. [10]

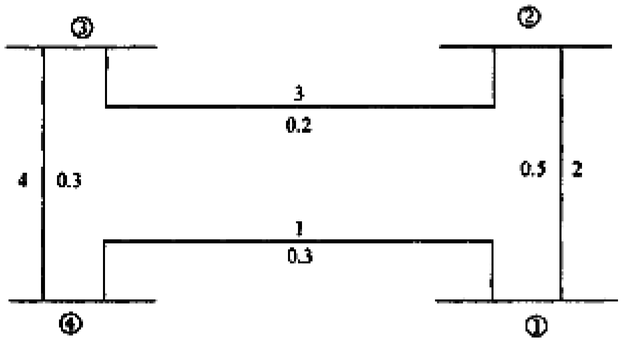

Figure 3

$$Z_{BUS} = \begin{bmatrix} 0.230769 & 0.1153 & 0.0623 \\ 0.1153 & 0.30769 & 0.18461 \\ 0.0623 & 0.18461 & 0.230769 \end{bmatrix}$$

4. Develop load flow equations suitable for solutions by N-R method using rectangular coordinates when both PV and PQ buses are present. [10]

OR

5. A three bus power system is shown in Figure 4. The system parameters are given in Table.l and the load and generation data in Table 2. The voltage at bus 2 is maintained at l.03p.u. The maximum and minimum reactive power limits of the generation at bus 2 are 35 and 0 Mvar respectively. Taking bus 1 as slack bus obtain the load flow solution at the end of first iteration using Gauss - Seidel iterative method using $Y_{Bus.}$ [10]

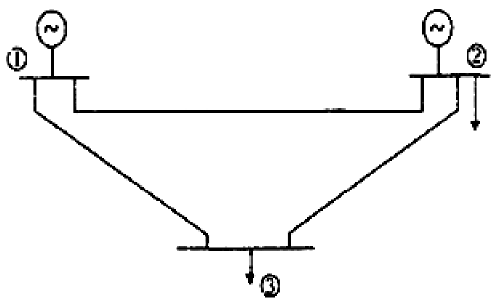

figure 4

Table 1 Impedance and Line charging Admittances

Bus Code	Impedance(p.u)	Line charging Admittance(p.u)
1-2	0.08+j0.24	0
1-3	0.02+j0.06	0
2-3	0.06+j0.018	0

Table 2 Scheduled Generation, Loads and Voltages

Bus No	Bus Voltage	Generation		Load	
		MW	Mvar	MW	Mvar
1	1.05+j0.0	---	---	0	0
2	1.03+j0.0	20	---	50	20
3	----	0	0	60	25

6. Develop the power flow model using Decoupled method and also explain the assumptions made to arrive at the Fast Decoupled load flow method. Draw the flow chart and explain. [10]

OR

7. For the network shown in figure 5 below, obtain the complex bus bar voltages at bus (2) at the end of first iteration, using Fast Decoupled method. Line impedances are in p.u. Given Bus (1) is slack bus with
$V_1 = 1\angle 0^0$, $P_2 + jQ_2 = -5.96 + j1.46$, $|V_3| = 1.02$, $P_3 = 2.0\,p.u$, Assume
$V_2^0 = 1\angle 0^0$ *and* $V_3^0 = 1.02\angle 0^0$. [10]

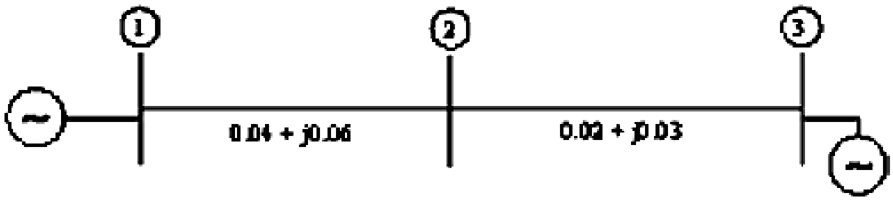

Figure 5

8. Derive an expression for the fault current for a line to ground fault at the terminals of an unloaded generator. [10]

OR

9. A 25 MVA, 13.2 kV alternator with solidly grounded neutral has a subtransient reactance of 0.25 p.u. The negative and zero sequence reactances are 0.35 and 0.1 p.u. respectively. A single line to ground fault occurs at the terminals of an unloaded alternator; Determine the fault current and the line-to-line voltage at the fault when a line-to-line fault occurs at the terminals of the alternator. Neglect resistance. [10]

10. Differentiate between steady state stability and transient stability of a power system. Discuss the factors that affect (a) steady state stability, and (b) transient state stability of the system. [10]

OR

11. Explain the point by point method of solving the swing equation. Compare this method with the equal area criterion method. [10]

---ooOoo---