Code No: RR410203 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER METHODS IN POWER SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are acceleration factors? Explain their importance in power flow studies.
   (b) Describe load flow solution with P.V buses using G-S method. [4+12]

2. (a) Describe the Newton-Raphson method for the solution of power flow equations in power systems deriving necessary equations.
   (b) What are P-V Buses? How are they handled in the above method. [12+4]

3. For the network shown in figure1, 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

   $V_1 = 1.0\angle 0^0$,

   $P_2 + jQ_2 = -5.96 + j1.46$

   $|V_3| = 1.02$ $P_3 = 2.0$ p.u.

   Assume $V_2^0 = 1\angle 0^0$ and $V_3^0 = 1.02\angle 0^0$.

Figure 1:

[16]

4. (a) Derive the expressions for bus voltages , line currents when a three phase symmetrical fault through a fault impedance occurs at a particular bus , using bus impedance matrix.
   (b) A three phase fault with a fault impedance of 0.16 p.u. occurs at bus 3 , for which Z_{BUS} is given by :

$$Z_{BUS} = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} j_{0.016} & j_{0..8} & j_{0.12} \\ j_{0.08} & j_{0.24} & j_{0.16} \\ j_{0.12} & j_{0.16} & j_{0.34} \end{bmatrix} \end{array}$$

   Compute the fault current, the bus Voltages, and the line currents during the fault. Assume prefault bus voltages 1.0 per unit. [8+8]

5. (a) The bus impedance matrix of an element in a three phase power system is given by

$$Z_{ij}^{abc} = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} j_{0.3} & j_{0.2} & j_{0.0} \\ j_{0.2} & j_{0.4} & j_{0.1} \\ j_{0.0} & j_{0.1} & j_{0.2} \end{bmatrix} \end{array}$$

Find Z_{ij}^{012}. Derive the formula used. [4+4]

(b) For a fault at bus 'p' let the admittance between each phase and neutral be y_a, y_b, y_c and let the admittance between neutral and ground be y_g . Form the fault admittance matrix Y_F^{abc}. [8]

6. (a) Define the following terms :
   i. Steady state stability limit.
   ii. Dynamic state stability limit.
   iii. Transient state stability limit .

   (b) List the assumptions made in the transient stability solution techniques.

   (c) Derive the expression for steady state stability limit using ABCD parameters.

   [2+2+2+4+6]

7. (a) Discuss the methods to improve steady state and transient state stability limits.

   (b) What is equal area criterion? Explain how it can be used to study stability? select any suitable example . [8+8]

8. (a) What are the steps to between followed for determining multi machine stability?

   (b) Write the state variable formulation of swing equations. [8+8]

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Code No: RR410203 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER METHODS IN POWER SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw flow chart for load flow solution by Gauss-Siedel iterative method using Y_{bus}.
   (b) What are P-V buses? How are they handled in the above method. [10+6]

2. (a) Describe the Newton-Raphson method for the solution of power flow equations in power systems deriving necessary equations.
   (b) What are P-V Buses? How are they handled in the above method. [12+4]

3. Develop the power flow model using Decoupled method and explain the assumptions made to arrive at the Fast Decoupled load flow method. Draw the flow chart and explain. [16]

4. Derive the equations for fault Current , line Currents , bus Voltages when a three phase fault occurs (which is not grounded) at a bus, using fault admittance matrix in phase Component form. [16]

5. (a) The bus impedance matrix of an element in a three phase power system is given by

$$Z_{ij}^{abc} = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} j_{0.3} & j_{0.2} & j_{0.0} \\ j_{0.2} & j_{0.4} & j_{0.1} \\ j_{0.0} & j_{0.1} & j_{0.2} \end{bmatrix} \end{array}$$

   Find Z_{ij}^{012}. Derive the formula used. [4+4]
   (b) For a fault at bus 'p' let the admittance between each phase and neutral be y_a, y_b, y_c and let the admittance between neutral and ground be y_g . Form the fault admittance matrix Y_F^{abc}. [8]

6. (a) Define the following terms :
      i. Steady state stability limit.
      ii. Dynamic state stability limit.
      iii. Transient state stability limit .
   (b) List the assumptions made in the transient stability solution techniques.
   (c) Derive the expression for steady state stability limit using ABCD parameters.

   [2+2+2+4+6]

7. (a) What is power system stability? Define stability limit of the system.
   (b) Why transient state stability limit is less than steady state stability limit? Explain.
   (c) Draw diagrams to illustrate the application of equal area criterion to study transient stability when a fault on one of the parallel lines of a two circuit line feeding an Infinite bus. The fault is very close to the sending end bus and is subsequently cleared by the opening of faulted line. Mark the accelerating and decelerating areas in the diagram. [6+4+6]

8. (a) What are the steps to between followed for determining multi machine stability?
   (b) Write the state variable formulation of swing equations. [8+8]

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Code No: RR410203 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER METHODS IN POWER SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. The data for 2-bus system is given below.
   S_{G1} =Unknown; S_{D1}=Unknown
   V_1=1.0∠ 0^0 p.u.; S_1=To be determined
   S_{G2}=0.25+jQ_{G2} p.u.; SD_2=1+j 0.5 p.u. The two buses are connected by a transmission line of p.u. reactance of 0.5 p.u. Find Q_2 and ∠ V_2. Neglect shunt susceptance of the tie line. Assume $|V_2|$=1.0. Perform two iterations using G.S. method. [16]

2. A sample power system is shown in diagram. Determine V_2 and V_3 by N.R method after one iteration. The p.u. values of line impedances are shown in figure2.

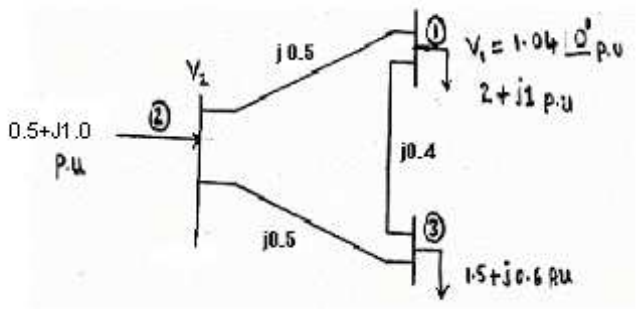

Figure 2:

[16]

3. Carry out one iteration of load flow solution for the system shown by Fast – Decoupled methodas shown in the figure3. Take Q limits of generator 2 as

   Q_{min} = 0, Q_{max} = 5.

   Bus 1 slack bus $V_{specified} = 1.05\angle\ 0^0$.

   Bus 2 PV bus $|\ V\ |_{\ specified}$ = 1.00 p.u., P_G = 3 p.u.

   Bus 3 PQ bus P_D = 4 p.u., Q_D = 2 p.u. [16]

4. (a) Derive the expressions for bus voltages , line currents when a three phase symmetrical fault through a fault impedance occurs at a particular bus , using bus impedance matrix.

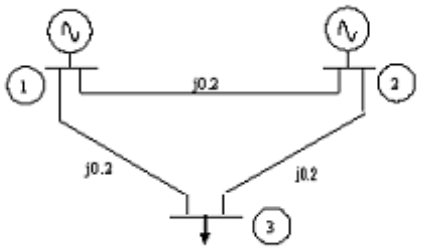

Figure 3:

(b) A three phase fault with a fault impedance of 0.16 p.u. occurs at bus 3 , for which Z_{BUS} is given by :

$$Z_{BUS} = \begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} j_{0.016} & j_{0..8} & j_{0.12} \\ j_{0.08} & j_{0.24} & j_{0.16} \\ j_{0.12} & j_{0.16} & j_{0.34} \end{bmatrix} \end{array}$$

Compute the fault current, the bus Voltages, and the line currents during the fault. Assume prefault bus voltages 1.0 per unit. [8+8]

5. Develop the expressions for the following matrices which are used for shunt fault analysis for a Line-to-Line fault occurring on conventional phases.

   (a) Fault admittance matrix in phase and sequence component form. [5+5]

   (b) Derive the formulae used. [6]

6. (a) Define the following terms :

      i. Steady state stability limit.

      ii. Dynamic state stability limit.

      iii. Transient state stability limit .

   (b) List the assumptions made in the transient stability solution techniques.

   (c) Derive the expression for steady state stability limit using ABCD parameters.

   [2+2+2+4+6]

7. (a) Write a short notes on methods of improving stability of power system.

   (b) A generator operating at 50Hz delivers 1 p.u. power to an infinite bus through a transmission circuit in which resistance is neglected. A fault takes place reducing the maximum power transferable to 0.3 p.u. where as before the fault this power was 2.0 p.u. and after the clearance of the fault it is 1.5 p.u.. By the use of equal area criterion determine the critical clearing angle. [8+8]

8. (a) What are the factors that affect transient stability?

   (b) What are the methods used to improve the transient stability limit?

   (c) Write some of the recent methods for maintaining stability. [6+6+4]

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Code No: RR410203 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER METHODS IN POWER SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw flow chart for load flow solution by Gauss-Siedel iterative method using Y_{bus}.
   (b) What are P-V buses? How are they handled in the above method. [10+6]

2. Find δ_2 and Q_2 for the system shown in figure4 use. N.R. method upto one iteration.

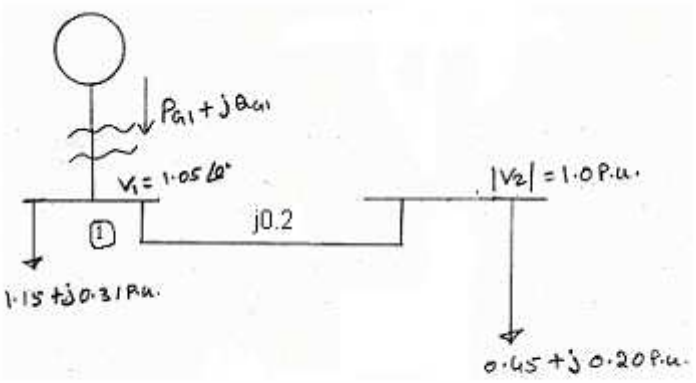

Figure 4:

[16]

3. Derive fast - Decoupled power flow analysis algorithm and give steps for implementation of this algorithm. [16]

4. Develop the necessary matrices of
   (a) Fault admittance matrix is phase and sequence component form. [6+6]
   (b) Fault impedance matrix in sequence component form for a three phase fault at a bus in a power system, for short circuit studies. [4]

5. Derive the expressions for fault current voltages at the bus 'p' where the fault current , voltages at the other buses during fault, Current through the elements when a three-phase- to-ground fault occurs at bus 'p' , using fault impedance Bus Impedance matrices in phase Component form. [16]

6. (a) Define the following terms :

i. Steady state stability limit.
ii. Dynamic state stability limit.
iii. Transient state stability limit .

(b) List the assumptions made in the transient stability solution techniques.

(c) Derive the expression for steady state stability limit using ABCD parameters.

[2+2+2+4+6]

7. (a) Derive and explain theconcept of equal area criterion for stability analysis of a power system.

(b) Discuss why

i. Transient stability limit is lower than steady state stability limit.
ii. The use of automatic reclosing circuit breakers improve system stability.

[8+4+4]

8. (a) What are the steps to between followed for determining multi machine stability?

(b) Write the state variable formulation of swing equations. [8+8]

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