Code No: RR320203 **Set No. 1**

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MODELLING OF POWER SYSTEM COMPONENTS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Obtain the oriented graph of the network whose fundamental cut set matrix is given below.
   (b) Define primitive network and network. Show the representation of a network component both impedance form and admittance form and give the performance equations both in impedance and admittance form. [8+8]

Elements	Branches				Links		
BASIC CUT SETS	1	3	5	6	2	4	7
A	1	0	0	0	0	-1	-1
B	0	1	0	0	1	1	1
C	0	0	1	0	1	1	0
D	0	0	0	1	0	0	-1

2. (a) For the network shown below, draw its graph and mark also a tree. Give the total number of edges (i.e. elements), nodes, buses and branches for this graph. Write also its nodal equations and determine the elements of Y_{Bus} matrix directly by inspection.
   (b) For the same network, write the loop equations and hence determine the elements of Z_{loop} matrix directly by inspection. Values shown are currents & admittances Figure 2. [12+4]

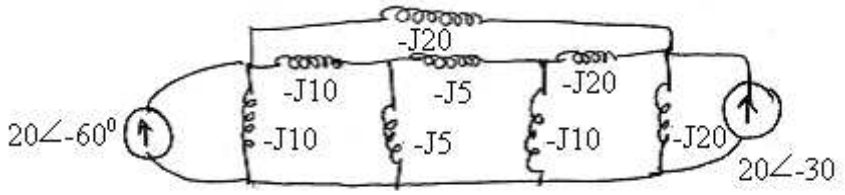

Figure 2

3. Describe the procedure of modification of existing Zbus by adding branch from new bus (p) to ref node, from new bus (p) to existing bus (k), from existing bus (k) to ref node and between existing buses (j) and (k). [16]

4. (a) Write a detail note on tap-changing and regulating transformer.
   (b) Explain the necessity of transformer modelling for power system studies. [10+6]

5. Develop the expressions for formation of three phase Z_{BUS} for the element which is added between two existing buses in a partial network. [16]

6. A synchronous generator is connected to an infinite bus through a transmission line. Neglecting the resistances draw the phasor diagram and derive the
   (a) Relation between active power and power angle.
   (b) Relation between reactive power and power angle. [8+8]

7. (a) Explain the functions of various blocks of speed governing system.
   (b) Explain the turbine model and hence discuss transfer functions of reheat and non-reheat models. [8+8]

8. Explain the functional blocks of Automatic voltage regulator. [16]

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Code No: RR320203 **Set No. 2**

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MODELLING OF POWER SYSTEM COMPONENTS
(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 is the element node incidence matrix $\hat{A}$? And what are the elements of this matrix? What is the dimension of this matrix $\hat{A}$?
   (b) What is bus-incidence matrix A? and what is the dimension of this matrix?
   (c) For the figure 1 shown, write down A, $\hat{A}$, B, $\hat{B}$, matrices. (Take 1-2-3-4 as tree) [3+3+10]

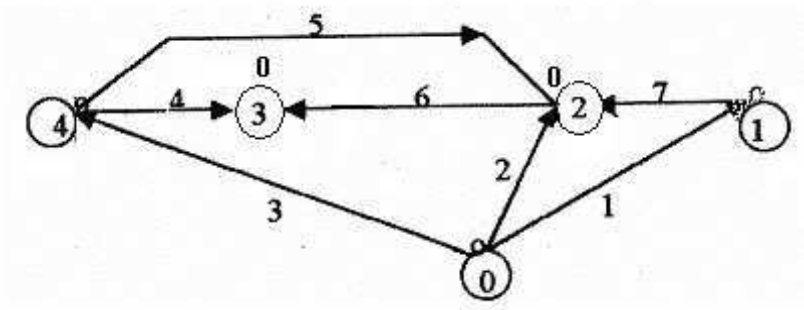

figure 1

2. Derive the expressions for Bus admittance and impedance matrices by singular transformation. [16]

3. Describe the procedure of modification of Zbus by adding mutually coupled branch from existing buses (p) and (k). [16]

4. (a) What is nominal and off-nominal transformer tap settings? Derive the relationships between primary inputs and secondary outputs of a transformer on nominal ratio using admittances in matrix form.
   (b) What is phase shifting transformer? Bring out its significance in power system. Draw basic equivalent circuit of phase shifting transformer with nominal tap ratio and solve this circuit for terminal currents bringing out their relationship with input and output voltages. [8+8]

5. (a) Explain the primitive network three phase representation of a component in impedance form.
   (b) Show that for a stationary element, the phase impedances matrix of a component is diagonalised using symmetrical component transformation.
   (c) Define the bus incidence matrix of a Power system network whose graph is shown in figure 5. [6+6+4]

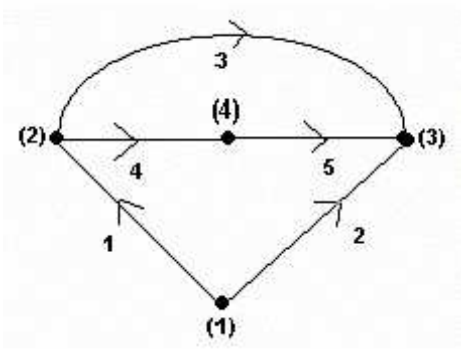

Figure 5

6. A synchronous generator is connected to an infinite bus through a transmission line. Neglecting the resistances draw the phasor diagram and derive the

   (a) Relation between active power and power angle.

   (b) Relation between reactive power and power angle. [8+8]

7. (a) Develop the mathematical model of hydraulic value actuator in speed governing system.

   (b) Two generators rated 200Mw and 400Mw are operating in parallel. The droop characteristics of their governors are 4% and 6% respectively from no-load to full-load. Assuming that the generator are operating at 50Hz, how a load of 500Mw be shared between them. [8+8]

8. (a) Explain about the various performance requirements of excitation system.

   (b) Explain the elements of an excitation system. [8+8]

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Code No: RR320203 **Set No. 3**

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MODELLING OF POWER SYSTEM COMPONENTS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The rows of the bus incidence matrix A are arranged according to a particular tree and the matrix A is partitioned into sub matrices A_b of dimension b × (n-l) and A_L of dimensions L × (n-l) , where the rows of A_b correspond to branches and rows of A_1 correspond to links. Figure 1a. Show the above partitions for the matrix A, for the following sample network. Also form the element node incidence matrix $\hat{A}$.

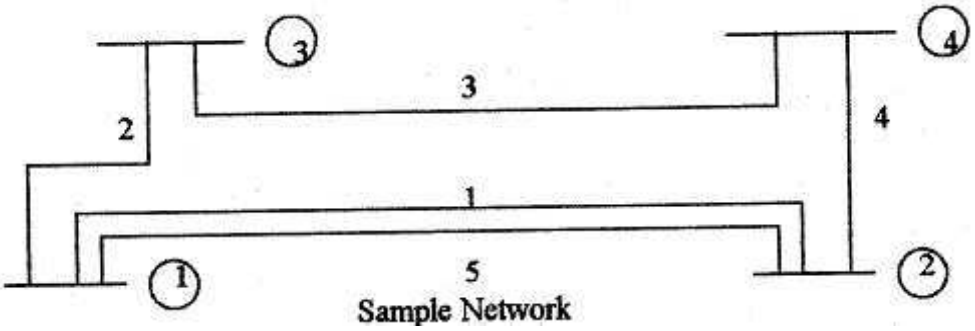

figure 1a

(b) For the oriented connected graph obtain the Bus incidence matrix A, Branch path incidence matrix K and basic cut-set matrix B. Figure 1b. [8+8]

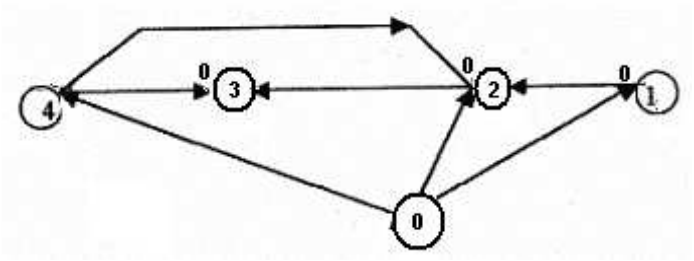

figure 1b

2. (a) For the network shown below, draw its graph and mark also a tree. Give the total number of edges (i.e. elements), nodes, buses and branches for this graph. Write also its nodal equations and determine the elements of Y_{Bus} matrix directly by inspection.

(b) For the same network, write the loop equations and hence determine the elements of Z_{loop} matrix directly by inspection. Values shown are currents & admittances Figure 2. [12+4]

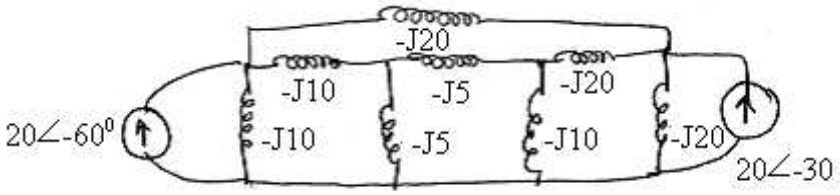

Figure 2

3. Describe the procedure of modification of Zbus by adding mutually coupled branch from existing buses (p) and (k). [16]

4. (a) Write a detail note on tap-changing and regulating transformer.
   (b) Explain the necessity of transformer modelling for power system studies. [10+6]

5. Develop the expressions for formation of three phase Z_{BUS} for the element which is added between two existing buses in a partial network. [16]

6. A synchronous generator is connected to an infinite bus through a transmission line. Neglecting the resistances draw the phasor diagram and derive the
   (a) Relation between active power and power angle.
   (b) Relation between reactive power and power angle. [8+8]

7. (a) Develop the mathematical model of hydraulic value actuator in speed governing system.
   (b) Two generators rated 200Mw and 400Mw are operating in parallel. The droop characteristics of their governors are 4% and 6% respectively from no-load to full-load. Assuming that the generator are operating at 50Hz, how a load of 500Mw be shared between them. [8+8]

8. (a) Explain about the various performance requirements of excitation system.
   (b) Explain the elements of an excitation system. [8+8]

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Code No: RR320203 **Set No. 4**

III B.Tech II Semester Supplimentary Examinations, Apr/May 2008
MODELLING OF POWER SYSTEM COMPONENTS
(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 do you understand by "branch-path incidence matrix K"? And what are the elements of the matrix K? And what is the nature of this matrix? What is the relation between the branch-path incidence matrix K and the submatrix A_b of the bus incidence matrix A, (A_b is of dimensions b × (n-l).
   (b) Taking node 'O' as the reference, write down the branch-path incidence matrix K for the figure 1. (Take 1-2-3-5 as tree). [10+6]

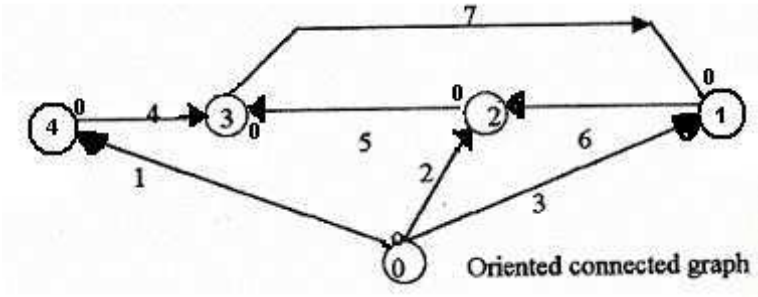

figure 1

2. Derive the expressions for Bus admittance and impedance matrices by singular transformation. [16]

3. Describe the procedure of modification of Zbus by adding mutually coupled branch from existing buses (p) and (k). [16]

4. (a) Write a detail note on tap-changing and regulating transformer.
   (b) Explain the necessity of transformer modelling for power system studies. [10+6]

5. Develop the expressions for formation of Z_{BUS} in three phase network representation for the element which is added between an existing bus and a bus being created. [16]

6. (a) With appropriate assumption derive the swing equation of a single machine connected to an infinite bus system.
   (b) A 2 pole-50 Hz Turbo alternator has a rating of 50 MVA. Its rotor has a moment of inertia 9000 Kg-m^2. Calculate its inertia constant in MJ/MVA and its momentum in MJ sec/elec. degree and in MJ sec/elec. radian. [7+9]

7. (a) Develop the mathematical model of hydraulic value actuator in speed governing system.

(b) Two generators rated 200Mw and 400Mw are operating in parallel. The droop characteristics of their governors are 4% and 6% respectively from no-load to full-load. Assuming that the generator are operating at 50Hz, how a load of 500Mw be shared between them. [8+8]

8. (a) Explain about the various performance requirements of excitation system.

(b) Explain the elements of an excitation system. [8+8]

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