Code No: M0222/R07 **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Define the terms:
   (a) Element node incidence matrix
   (b) Bus incidence matrix
   (c) Branch path incidence matrix
   (d) Basic cut-set incidence matrix. [16]

2. Form the Z_{bus} for the given network connections (take bus 1 as reference). [16]

	Self		Mutual	
Element	Buscode	Impedance	Buscode	Impedence
1	1-2	0.6		
2	1-2	0.4	1-2 (1)	0.2
3	1-3	0.5		
4	2-4	0.2		
5	2-4	0.4	2-4 (4)	0.1
6	3-4	0.5		

3. Explain the treatment of PV buses in Gauss-Seidel load flow method. What is the effect of Q-limit enforcement on rate of convergence of the method? [16]

4. Explain step by step algorithm of N-R (Rectangular form) including P-V Busses. [16]

5. (a) What are the advantages of p.u system.
   (b) For the network shown in figure 5b draw p.u impedance diagram. [10+6]

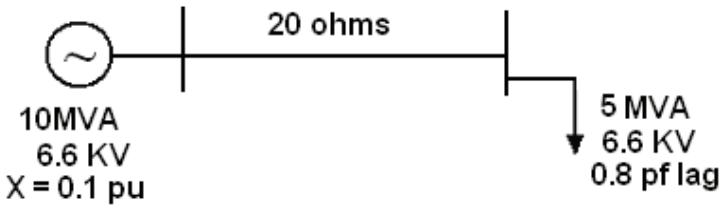

Figure 5b

6. (a) The voltages across a 3 phase unbalanced load are V_{ab} = 300 V$\angle$0; V_{bc} = 300 $\angle$-90^0; V_{ca} = 800 $\angle$143^0 respectively. Determine the sequence components of voltages.

(b) Symmetrical components of unbalanced 3 phase currents are $I_0 = 3 \angle -30^0$; $I_1 = 5 \angle 90^0$; and $I_2 = 4 \angle 30^0$. Obtain original unbalanced phasors. [8+8]

7. A 50 Hz generator supplies 1.0 pu power to an infinite bus as shown in figure 7c. Determine:

   (a) Steady state stability limit

   (b) Accelerating power if load is increased so that $\Delta\delta = 10^0$

   (c) If the accelerating power is constant for 0.05 secs find the rotor angle at the end of this interval. Inertia constant, H for the generator is 4 MJ / MVA.[16]

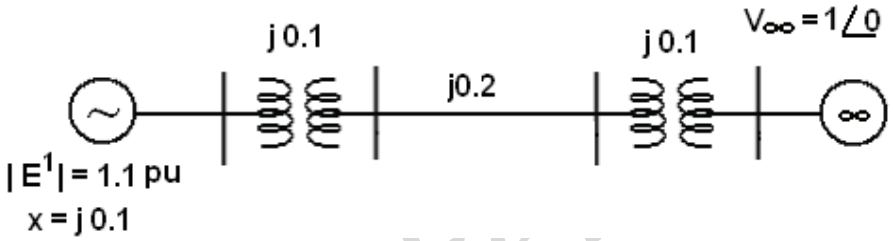

Figure 7c

8. (a) Derive swing equation of a single machine connected to infinite bus.

   (b) A synchronous generator is feeding 250 MW to a 50 Hz large network over a double circuit line. The maximum steady state power that can be transmitted over line with both circuits in operation is 500 MW and is 350 MW with any one of the circuit. A solid 3 phase fault at network-end of one the line causes it to trip. Find critical clearing angle before which circuit breakers have to trip. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: M0222/R07 **Set No. 2**

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Form the network matrices Y_{br} and Z_{loop} using singular transformation for the network connections given below: [16]

element	p-r
1	1-2 (1)
2	1-2(2)
3	1-3
4	2-4
5	3-5

Self		Mutual	
Bus code	Impedence	Bus code	Impedence
1-2	0.6	1-2(1)	0.1
1-3	0.5	1-2(1)	0.2
3-4	0.5		
1-2(2)	0.4		
2-4	0.2		

2. Write the algorithm for formation of Z_{bus} for a link case and also form Z_{bus} for the network: [16]

Element	Bus code	Impedance
1	1-2	0.4
2	1-2	0.2
3	1-3	0.4
4	2-3	0.4

3. Explain the Gauss-Seidel iteration method applied to load flow studies? What is the difference between Gauss and Gauss-Seidel method? [16]

4. Explain significance of slack bus? How voltage controlled bus is handled in N-R (polar form). [16]

5. (a) Justify the assumption that load currents and line charging currents are negligible in short circuit analysis.
   (b) What is short circuit capacity and derive an expression for SCcapacity?[10+6]

6. A 400 V balanced 3 phase supply is connected to a delta connected resistive load as shown in figure 6. Determine symmetrical components of I_a, I_b, I_c. [16]

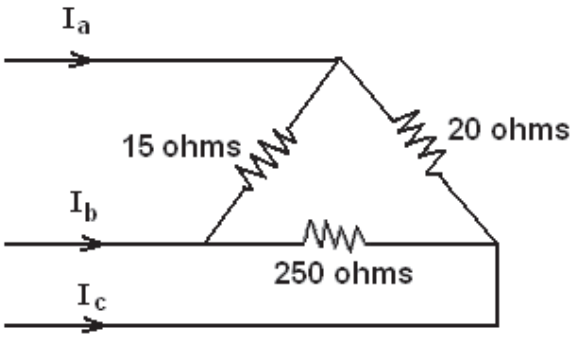

Figure 6

7. A 50 Hz synchronous generator with H = 2.5 MJ / MVA supplies power to infinite bus as shown in figure 7. Derive an expression for power delivered to infinite bus and plot power angle curve. [16]

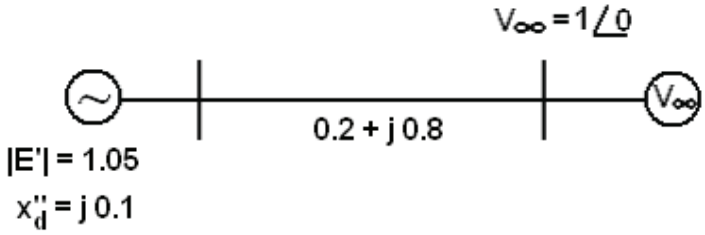

Figure 7

8. (a) What are the assumptions made in deriving swing equation.
   (b) Explain point by point method of determine swing curve. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: M0222/R07 **Set No. 3**

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Form the network matrices Z_{loop} using non-singular transformation for the network connections: [16]

element	p-r
1	1-2 (1)
2	1-2(2)
3	1-3
4	2-4
5	3-5

Self		Mutual	
Bus code	Impedence	Bus code	Impedence
1-2	0.6	1-2(1)	0.1
1-3	0.5	1-2(1)	0.2
3-4	0.5		
1-2(2)	0.4		
2-4	0.2		

2. (a) Derive the necessary equations for modification of Z_{bus} when a new element is connected such that the dimension remains same.
   (b) Explain the algorithm approach of building Z_{bus} using addition of a link method.
   [8+8]

3. The Y_{Bus} of a 5-bus system is (5×5)matrix. The system has an off nominal tap ratio transformer between buses 3 and 5 as shown in figure 3 if the transformer outage takes place, how are the Y_{BUS} elements are modified. [16]

Figure 3

4. (a) Explain physically justifiable assumptions and additional assumptions utilized in FDLF.
   (b) Explain how computational burden can be reduced drastically of ΔV correction variable is replaced by (ΔV/V) in N-R Polar form. [8+8]

5. For the system shown in figure 5. Find short circuit capacity at bus 3. [16]

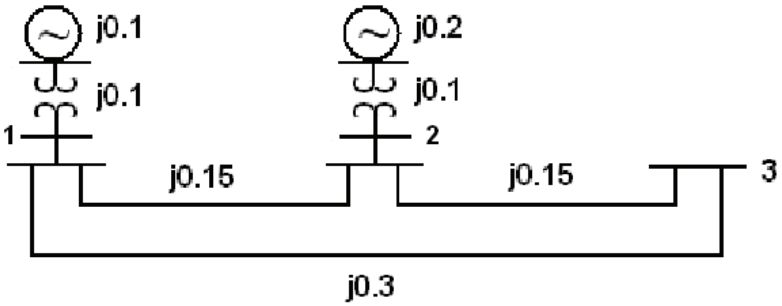

Figure 5

6. A balanced 200 V, 3 phase supply feeds balanced resistive load as shown in figure 6. If the resistance R_{bc} is disconnected. Determine I_a, I_b and I_c and symmetrical components of I_a, I_b and I_c. [16]

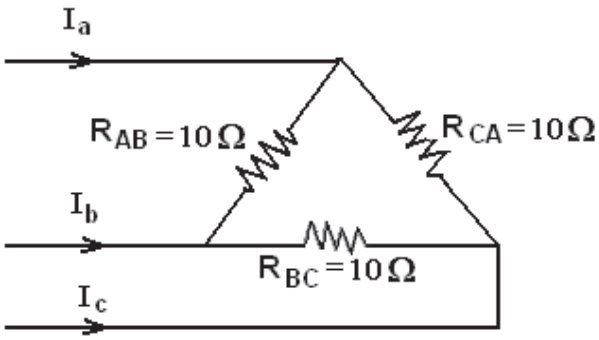

Figure 6

7. (a) A 50 Hz transmission line 500 km long with constants given below ties up two large areas
R = 0.11 ohm / Km, L = 1.45 mH / Km, C = 0.009 micro farads / Km.
Find steady state stability limit if $|V_S| = |V_R| = 200KV$.

   (b) A generator supplies power to an infinite bus via line as shown in figure 7b. The machine delivers 1.0 pu power and both terminal voltage of the generator and infinite bus are 1.0 pu. All the reactances are on a common base. Determine power angle equation. [8+8]

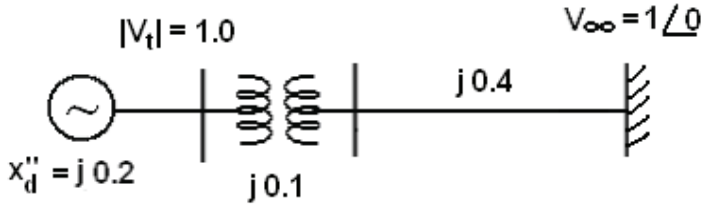

Figure 7b

8. A 50 Hz, 500 MVA, 400 KV generator (including transformer) is connected to a 400 KV infinite bus bar through on inter connector. The generator has H = 2.5

MJ/MVA. Voltage behind transient reactance 420 KV and supplies 460 MW. The transfer reactance between generator and bus bar under various conditions are Prefault = 0.5 pu; During fault = 1.0 pu; Post fault = 0.75 pu.
Calculate swing curve using $\Delta T = 0.05$ sec, with fault cleared at 0.1 secs. The period of study is 0.2 secs. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: M0222/R07 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Form the network matrices Z_{loop} using non-singular transformation for the network connections: [16]

element	p-r
1	1-2 (1)
2	1-2(2)
3	1-3
4	2-4
5	3-5

Self		Mutual	
Bus code	Impedence	Bus code	Impedence
1-2	0.6	1-2(1)	0.1
1-3	0.5	1-2(1)	0.2
3-4	0.5		
1-2(2)	0.4		
2-4	0.2		

2. (a) Derive the necessary equations for modification of Z_{bus} when a new element is connected such that the dimension remains same.
   (b) Explain the algorithm approach of building Z_{bus} using addition of a link method.
   [8+8]

3. The $\underline{Y_{Bus}}$ of a 5-bus system is (5×5)matrix. The system has an off nominal tap ratio transformer between buses 3 and 5 as shown in figure 3 if the transformer outage takes place, how are the Y_{BUS} elements are modified. [16]

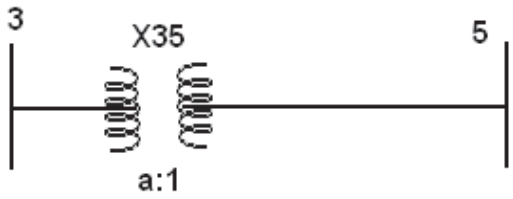

Figure 3

4. Explain how P-V bus is handled in N-R (Rectangular form) method. [16]

5. (a) Justify the assumption that load currents and line charging currents are negligible in short circuit analysis.

(b) What is short circuit capacity and derive an expression for SCcapacity?[10+6]

6. A generator having solidly grounded neutral and rated 50 MVA, 30 KV has positive, negative and zero sequence reactances of 0.25, 0.15 and 0.05 pu. What reactance must be placed in the neutral to limit LLG fault current that for a 3 phase fault. [16]

7. A 50 Hz synchronous generator with H = 2.5 MJ / MVA supplies power to infinite bus as shown in figure 7. Derive an expression for power delivered to infinite bus and plot power angle curve. [16]

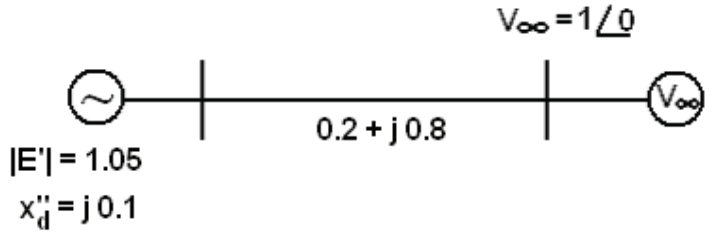

Figure 7

8. (a) Explain the methods of improving transient stability.

(b) A 50 Hz synchronous generator with inertia constant H = 4 MT/MVA and x'_d equal to 0.15 pu feeds 1.0 pu power to an infinite bus at 0.8 pf lagging. Via a network with an equivalent reactance of 0.3 pu. A 3 phase fault is sustained for 100 milli seconds at the terminals. Plot swing curve through t = 0.25 secs. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆