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

IV B.Tech I Semester Regular Examinations, November 2012
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. Define and explain the following with suitable examples:
   (a) Cut-set and a basic cut-set
   (b) Tree and branchs
   (c) Basic loop and open loops. [16]

2. Form the Z_{bus} for the given network connections and remove the element-2, form the Z_{bus} using removal of element formulae (take bus 4 as reference): [16]

	Self		Mutual	
Element	Bus code	Impedance	Bus code	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. 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]

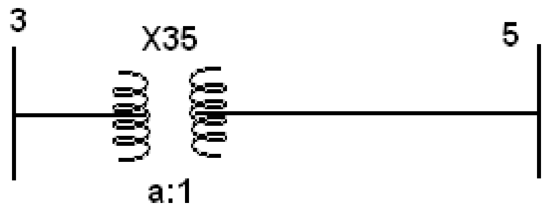

Figure 3

4. Discuss computational aspects of N-R (Polar form) and N-R (Rectangular form). [16]

5. (a) A 40 MVA, 20 KV/400 KV single phase transformer has the following impedances. $Z_p = 0.9 + j1.8$ ohms and $Z_s = 128+j288$ ohms.
   Find:
   i. pu impedance of the transformer referred to HV
   ii. pu impedance of the transformer referred to LV. [16]

(b) Draw pu impedance diagram of the network shown in figure 5.

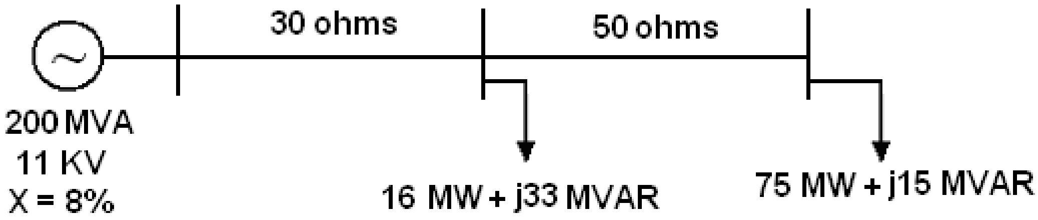

Figure 5

6. (a) P_{abc} is 3 phase power in a circuit and P_{012} is power in the same circuit in terms of symmetrical components. Show that $_{abc} = _{012}$.

   (b) The line currents in a 3 phase supply to an un balanced load are respectively $I_a = 10 + j20$; $I_b = 12 - j10$; $I_c = -3 - j5$ Amp. phase sequence is abc. Determine the sequence components of currents. [8+8]

7. A generator supplies 1.0 pu power to an infinite bus as shown in figure 7. The terminal voltage and infinite bus voltage are 1.0 pu. All the reactances are on a common base. Determine steady state stability limit: [16]

   (a) when both lines are in

   (b) when one line is switched off.

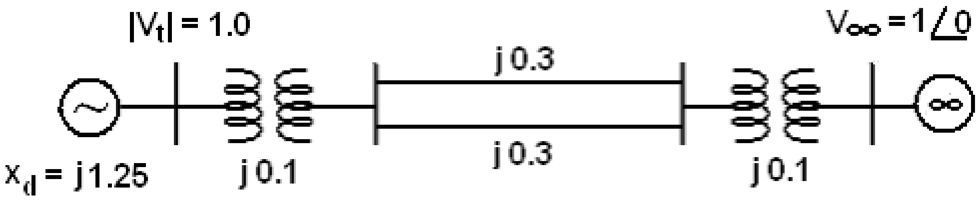

Figure 7

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

   (b) A single machine supplies power to an infinite bus over a double circuit line. Discuss transient stability of the system when one of the circuit is suddenly switched off. [8+8]

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Set No. 2

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Answer any FIVE Questions
All Questions carry equal marks
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1. Define and explain the following with suitable examples:
   (a) Cut-set and a basic cut-set
   (b) Tree and branchs
   (c) Basic loop and open loops. [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. What are the necessities of loud flow studies. Derive the basic loud flow equation. [16]

4. Derive N-R (Polar form) equations and N-R (Rectangular form) equations and explain difference between these methods. [16]

5. (a) Prove that Base impedance = $\frac{KV^2_{LL(Base)}}{MVA_{3-\phi(Base)}}$
   (b) Obtain pu impedance diagram of the power system of figure 5b. Choose base quantities in generagor circuit.
   Generator: 20 MVA, 11 KV, X''= 0.1 pu
   Transformer: 25 MVA, 11/33 KV, X = 0.1 pu
   Load: 10 MVA, 33 KV, 0.8 pf lag. [16]

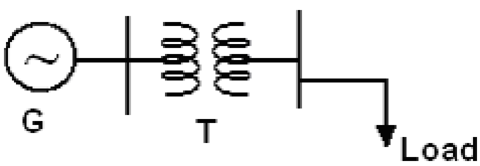

Figure 5b

6. For the system shown in figure 6. A LLG fault occurs at point F. Find fault current. [16]

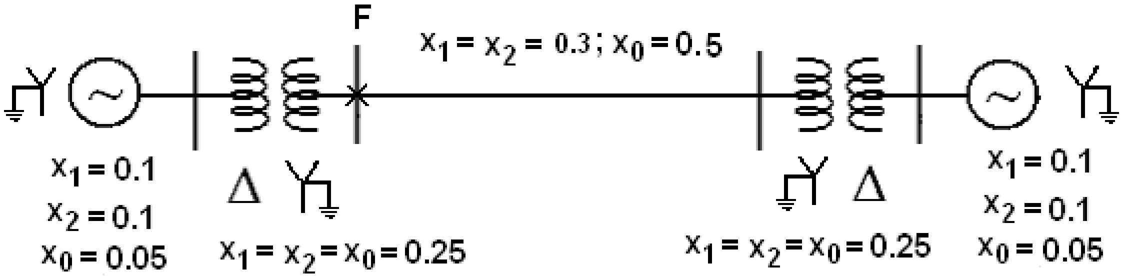

Figure 6

7. A 275 KV transmission line has following line constants.
   A = 0.85 $\angle 5^0$, B = 200 $\angle 75^0$
   The line delivers 150 MW with $|V_S| = |V_R| = 275KV$. Determine synchronizing power coefficient. [16]

8. (a) Derive equal area criterion of stability of single machine connected to infinite bus.
   (b) Power station A has four identical sets each rated 80 MVA and each having an inertia constant 7 MJ/MVA. The stations are located close together to be regarded as a single equivalent machine for stability studies. Find inertia constant of the equivalent machine on 100 MVA base. [8+8]

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Set No. 3

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Time: 3 hours Max Marks: 80

Answer any FIVE Questions
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1. Prove $Z_{br}=AZ_{bus}A^t$ using non-singular transformation. [16]

2. Using the building algorithm construct Z_{bus} for the system below, choose Bus-4 as reference. [16]

	Self		Mutual	
Element	Bus code	Impedance	Bus code	Impedence
1	1-2	0.5		
2	1-3	0.4		
3	1-4	0.3		
4	2-3	0.2	1-3	0.1
5	3-4	0.3		

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]

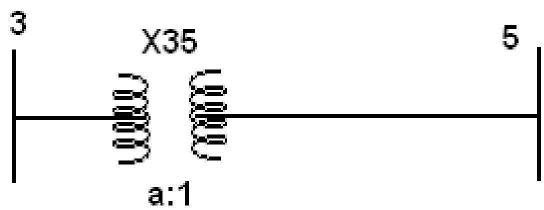

Figure 3

4. Derive necessary equations for N-R (polar form) method of load flow analysis.[16]

5. (a) A 3 phase fault through fault impedance $Z_f = 0.08$ occurs at point F on the system shown in figure 5. The system is operating at noload and rated voltage. Determine bus voltages and line currents during the fault.
   (b) State the assumptions made in short circuit analysis. [10+6]

Figure 5

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Set No. 3

6. For the network shown in fig. B a LL fault occurs at Bus 2 through fault impedance of j0.1. Determine fault current. [16]

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]

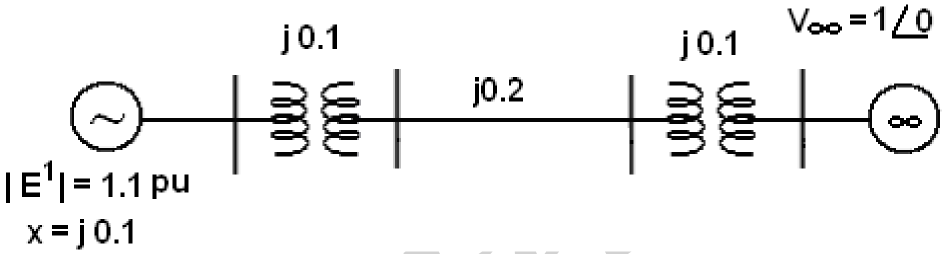

Figure 7c

8. A 50 Hz generator supplies 0.8 pu power to infinite bus via a network as shown in figure 8. A 3 phase fault occurs at point P. If fault is cleared by simultaneous opening of breakers at both ends of the faulted line at 4.5 cycles after fault occurs. Plot swing curve through t = 0.2 secs. Take H = 4 MJ/MVA. [16]

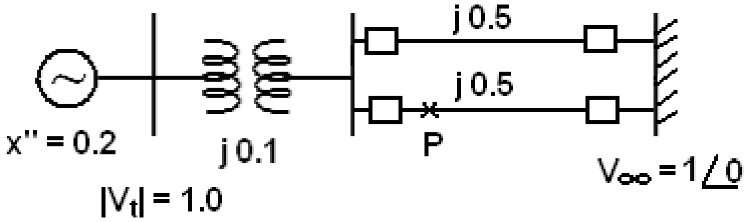

Figure 8

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Code No: M0222/R07

Set No. 4

IV B.Tech I Semester Regular Examinations, November 2012
POWER SYSTEM ANALYSIS
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
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1. For the given network shown in figure 1d connections form:
   (a) Graph
   (b) Tree
   (c) Co-tree
   (d) Cut-set. [16]

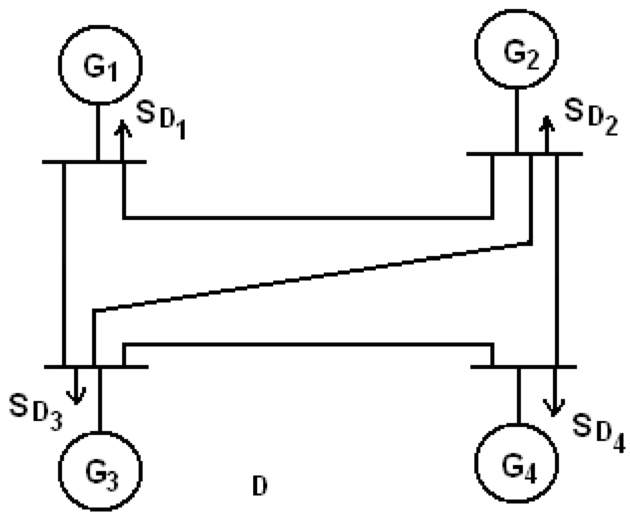

Figure 1d

2. Derive expression for adding a branch to a parallel Z_{bus} with mutual coupling.[16]

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]

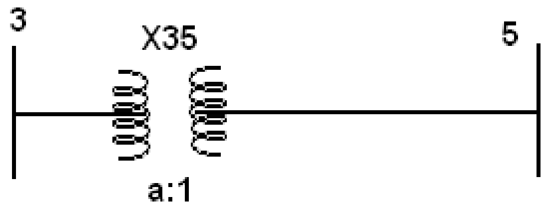

Figure 3

4. (a) Compare N-R (Polar) and N-R (Rectangular form) load flow methods.
   (b) Explain how voltage controlled buses are handled in N-R(Polar)method.[8+8]

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

5. (a) Prove that $Z_{pu(new)} = Z_{pu(old)} \times \frac{(MVA)_{Base(new)}}{(MVA)_{Base(old)}} \times \frac{(KV_{LL})^2_{Base\ old}}{(KV_{LL})^2_{Base\ old}}$

   (b) Obtain pu impedance diagram of the power system of figure 5. Choose base quantities as 15 MVA and 33 KV.

   Generator: 30 MVA, 10.5 KV, $X'' = 1.6$ ohms.
   Transformers T_1 & T_2: 15 MVA, 33/11 KV, X = 15 ohms referred to HV
   Transmission line: 20 ohms / phase
   Load: 40 MW, 6.6 KV, 0.85 lagging p.f. [4+12]

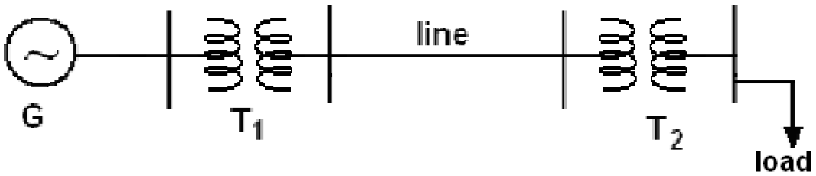

Figure 5

6. For the system shown in figure 6. A a LL fault occurs at point F. Find fault current. [16]

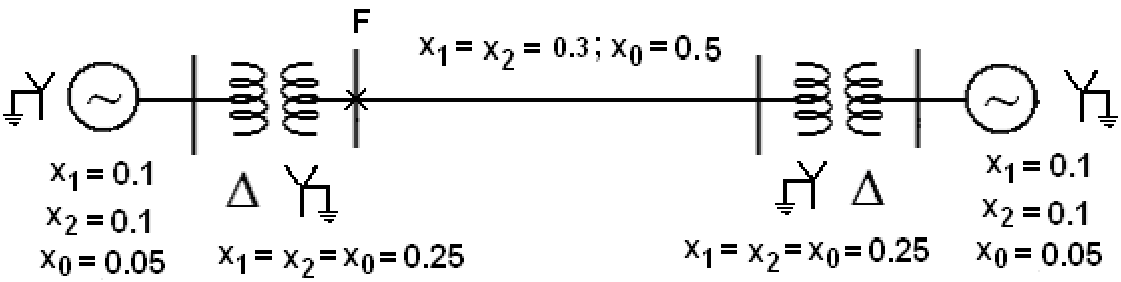

Figure 6

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]

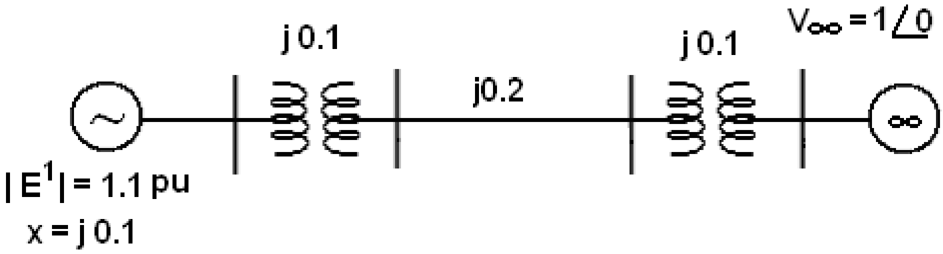

Figure 7c

8. (a) What are the assumptions made in deriving swing equation.

   (b) Explain point by point method of determine swing curve. [6+10]

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