Code No: R32022 **R10** **Set No: 1**

III B.Tech. II Semester Regular/Supplementary Examinations, May/June -2014

POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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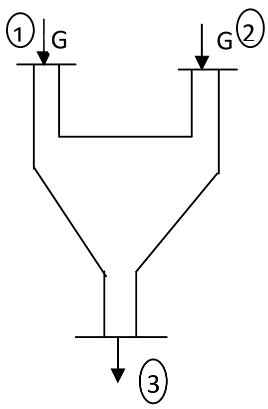
1. a) What is per unit system? Why it is required in power system calculations?
   b) Explain how base quantities can be selected and derive the formula for base impedance
   c) By choosing the rating of transformer as base value, convert all electrical quantities of the following transformer in p.u values. Transformer is rated as 100KVA, 200/200V, single phase has equivalent impedance referred to H.V side as (1+j1)ohms and exciting current referred to L.V side is 3Amps

2. a) Define the following terms with suitable examples
   i)Tree ii)Branches iii)Links iv)co-tree v)Loop
   b) Describe load flow solution with P-V buses using Gauss-Seidel Method

3. Using data given below, obtain V3 using N-R method after first iteration

Bus code	series impedance
1-2	0.08+j0.24
1-3	0.02+j0.06
2-3	0.06+j0.18

Bus code	Assumed bus voltage	Generation (MW)	Generation(MVAR)	Load (MW)	Load (MVAR)
1	1.05+j0	0	0	0	0
2	1.0+j0	20	0	50	20
3	1.0+j0	0	0	60	25



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4. Describe the procedure of modification of exciting Zbus by adding branch from new bus(p) to reference node, from new bus(p) to exciting bus(k), from exciting bus(k) to reference node and between exciting buses (j) and (k)

5. a) Two generators are connected to a common bus bar, at which an outgoing feeder is connected. The generator ratings are 15MVA,30% and 20MVA,50% respectively. The percentage reactance of each alternator is based on its own capacity. The bus bar voltage is 12KV. Find the short circuit current that will flow into a complete three phase S.C at the beginning of the outgoing feeder.
   b) What are the different symmetrical faults and compare their properties.

6. a) What are symmetrical components. Why are they used in power system fault analysis, explain in detail.
   b) Obtain the symmetrical components of a set of unbalanced currents Ia=1.6<250 degrees, Ib=1.0<180 degrees and Ic=0.9 < 132 degrees. And also find out the neutral current.

7. a) What are the different unsymmetrical faults and compare their characteristics.
   b) A 30MVA, 11KV, three phase synchronous generator has a direct sub transient reactance of 0.25pu. The negative and zero sequence reactance are 0.35pu and 0.1pu respectively. The neutral of generator is solidly grounded. Determine the sub transient current in the generator and line to line voltages for sub transient conditions, when a single line to ground fault occurs at the generator terminals with the generator operating unloaded at rated voltage.

8. a) Give the list of methods to improve transient state stability limits.
   b) Explain point by point method for solving swing equation.

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Code No: R32022 **R10** **Set No: 2**

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POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
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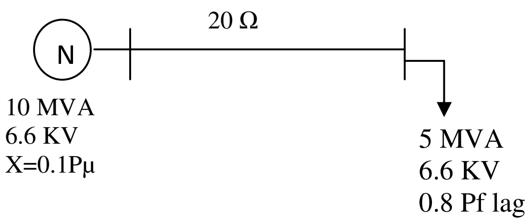
1. a)Derive the formula for base impedance
   b) Why do you use a single line diagram for power system representation? What are the assumptions that are being made while drawing a single line diagram?
   c) For the network shown in figure draw per unit impedance diagram.



2. a) Explain the following terms
   (i) Basic loops (ii) Cut-set (iii) Basic cut set (iv) Loop
   By taking an oriented connected graph. What is the relation between basic loop and link and basic cut-set and the number of basic cut-sets and the number of branches?
   b) Derive static load flow equations

3. Explain with a flow chart, the computational procedure for load flow solution using fast decoupled method deriving necessary equations

4. How do you modify Zbus by adding mutually coupled Zbus between exciting bus(p) to new bus(q) ? Describe the algorithm by giving suitable example.

5. a) A generating station has four bus bar sections. Each section is connected to tie bar through 20% reactors rated at 200MVA. Generators of total capacity 100MVA and 20% reactance are connected to each bus bar section. Calculate the MVA fed to a fault under short circuit condition on two of the bus bars
   b) Explain how the short circuit current control is achieved in power system.

6. a) Bring out the relationship between symmetrical components and unbalanced phasors
   b) Resolve the sequence currents into unbalanced currents. Given Iro=8+j5.33Amps Ir1=0.845+j15.11Amps, Ir2=3.155+j3.56Amps

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7. a) Derive the expression for the fault current and the terminal voltages for a line to ground fault which occurs at the terminals of an unloaded three phase alternator. Assume that the alternator neutral is grounded through reactance xn.
   b) A three phase, 11KV, 25MVA generator with X0=0.05pu, X1=0.2pu is grounded through a reactance of 0.3ohms. Calculate the fault current for a single line to ground fault. Also calculate the terminal voltage of the faulted phase w.r.t ground.

8. a) What is steady state stability? Explain it w.r.t power angle curve?
   b) Define synchronizing power coefficient and explain its significance.

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Code No: R32022 **R10** **Set No: 3**

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POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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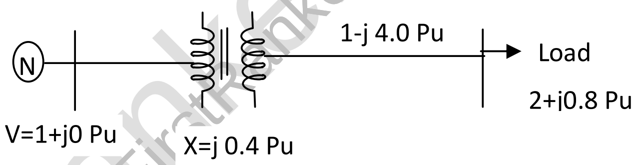
1. a) What is per unit system? What are its advantages?
   b) Obtain p.u impedance diagram of the power system as given below. Choose base quantities in generator circuit
   Generator: 20MVA, 11KV, X"=0.1pu
   Transformer: 25MVA, 11/33KV, X=0.1pu Load: 10MVA, 33KV, 0.8 pf lag

2. Form the Y-bus for the given network

Element	positive sequence reactance
1-2	j1.0
2-3	j0.4
2-4	j0.2
3-4	j0.2
3-1	j0.8
4-5	j0.08

3. For the system shown in figure, find the voltage at the receiving end bus at the end of first iteration. Load is 2+j0.8pu. Voltage at sending end(slack) is 1+j0pu. Line admittance is 1.0-j4.0pu. Transformer reactance is j0.4pu. Use the decoupled load flow method. Assume Vr=1<0degrees



4. Write the algorithm for the formation of bus impedance matrix for a branch case and form the Zbus for the given network connections.

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

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5. a) The plant capacity of three phase generating station consists of two 10MVA generators of reactance 14% each. These are connected to a common bus bar from which loads are taken through two 3MVA, 11/33KV step up transformers each having 5% reactance. Determine the MVA rating of the C.B's, when a three phase symmetrical fault occurs at HV side of two transformers. The reactances given are based on the MVA of each equipment.
   b) What are the harmful effects of short circuit faults on power system.

6. Three resistors of 5ohms, 10ohms and 20ohms are connected in Delta across the three phases of a balanced 100V supply. What are the sequence currents in the resistors and in supply lines?

7. a) Derive the expression for the fault current and the terminal voltages for a line to ground fault occurs at the terminals of an unloaded three phase alternator. Assume that the alternator neutral is solidly grounded.
   b) A 20MVA, 11KV, three phase 50Hz generator has its neutral earthed through a 5% reactor. It is in parallel with another identical generator having isolated neutral. Each generator has a positive sequence reactance of 20%, negative sequence reactance of 10% and zero sequence reactance of 15%. If a line to ground short circuit occurs in the common bus bar, determine the fault current

8. a) Define the following terms and give important differences between them
   (i) Steady state stability limit
   (ii) Dynamic state stability limit
   (iii) Transient state stability limit
   b) Give some recent methods for maintaining stability.

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Code No: R32022 **R10** **Set No: 4**

III B.Tech. II Semester Regular/Supplementary Examinations, May/June -2014

POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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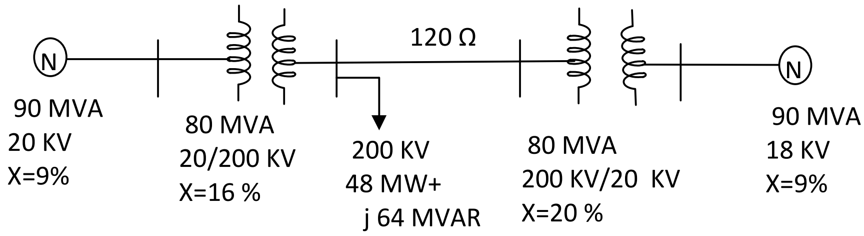
1. Draw the p.u impedance diagram for the system shown in figure. Choose Base MVA as 100MVA and Base KV as 20KV



2. a) Explain the load flow solution using G-S method with the help of a flow chart.
   b) How do you classify system variables in terms of state, input and output variables in power flow studies?

3. Derive the expression for diagonal and off-diagonal elements of Jacobian matrix of N-R(polar form) method

4. Derive expression for a partial network adding a link to form Zbus.

5. a) The section of bus bar A and B are linked by a bus bar reactor rated at 5000KVA with 10% reactance. On bus bar A there are two generators each of 10,000KVA with 10% reactance and on B two generators each of 8000KVA with 12% reactance. Find the steady MVA fed into a dead short circuit between all phases on A and on B with bus bar reactor in the circuit,
   b) Why do we use reactors in power systems? Discuss their advantages.

6. a) Derive the expressions for sequence impedances and draw the sequence impedance diagrams for a three phase synchronous generator whose stator winding neutral is solidly grounded.
   b) A three phase unbalanced system currents are read as Ir=150Amps Iy=0amps and Ib=80Amps. The phase sequence is RYB. Find all the three symmetrical components for the case.

7. a) Derive the expression for fault current and the terminal voltages of a three phase alternator, when there is a line to line fault occurs at the far end of the alternator. Assume that the generator neutral is solidly earthed.
   b) A three phase, 10MVA, 11KV generator with solidly earthed neutral point supplies feeder. The positive, negative and zero sequence impedances of generator and feeder are j1.2, j0.9, j0.4 and j1.0, j1.0, j3.0 respectively. If a fault from one phase to earth occurs on the far end of the feeder, calculate the fault current and line to neutral terminal voltage of the faulted phase.

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8. a) Explain the following terms
   (i) Transfer reactance
   (ii) Inertia constant
   b) Derive the expression for steady state stability limit using ABCD parameters.

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