M.Tech. Electrical Power System CBCS Pattern Semester-II

PEPS241 - Computer Application in Power Systems

P. Pages : 3 **GUG/W/23/11025**

Time : Three Hours * 6 1 0 3 * Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Attempt **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Every question has equal weightage.
8. Use of programmable calculator is prohibited.
9. Draw neat and proper diagram/sketches.
10. Don't' use red pen for writing the answers.
11. Don't write any other comments except answers of questions.

1. a) Prove that $Z_{bus} = K^T * Z_{BR} * K$ using non-singular transformation where all abbreviations have their conventional meanings. **7**

b) Explain the necessity of transformer modeling for power system studies. **7**

2. a) Develop the expression for formation of three phases Z_{bus} for the element which is added between two existing buses in a partial network. **7**

b) Using suitable transformation matrix 'T' transform the three phase impedance matrix to its equivalent in 0, 1, 2 sequence quantities. Assume rotating elements. **7**

3. a) For the power system described in fig. 3 (a). **7**

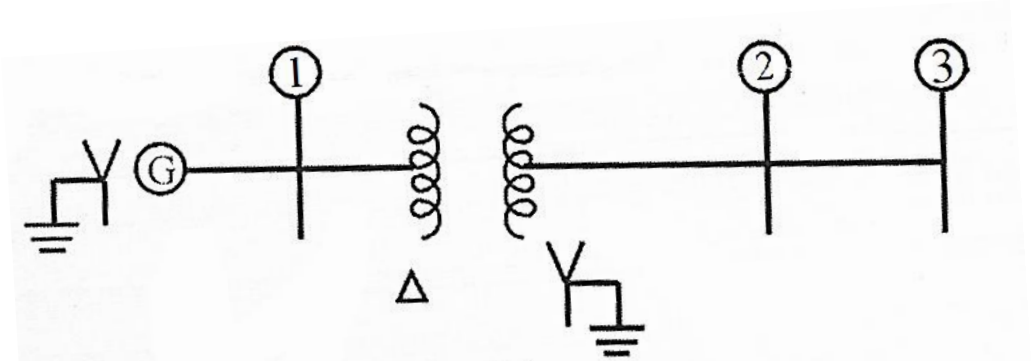


Fig. 3(a)

$G : Z_1 = Z_2 = 0.1 \quad Z_0 = 0.05\,pu$

$T = Z_1 = Z_2 = Z_0 = 0.08\,pu$

$Line : Z_1 = Z_2 = 0.02; \quad Z_0 = 0.4$

Find the fault voltage for double line to ground fault at bus (2) with fault impedance in PU shown in fig. 3 (b).

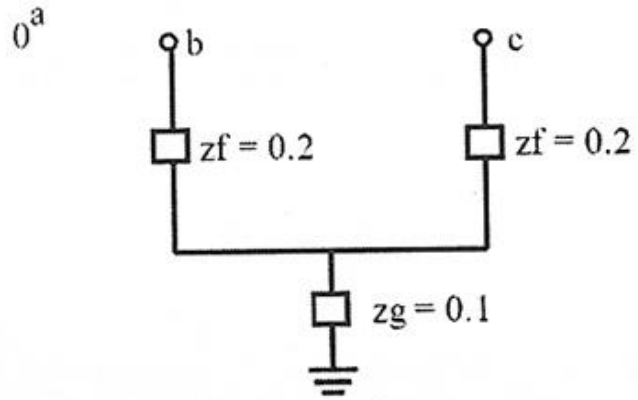
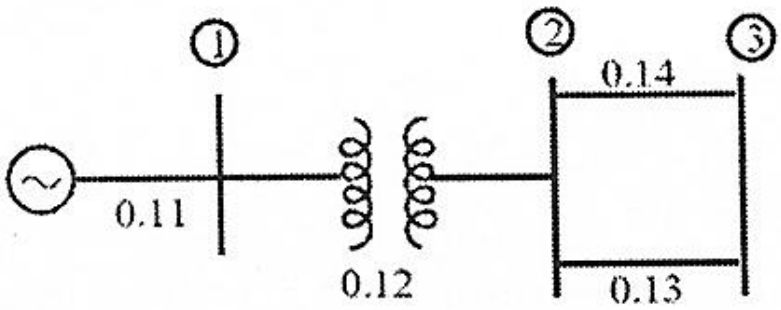


Fig. 3 (b)

b) Derive equation for flux linkage across dqo axes using dqo transformation. **7**

4. a) Consider a 3 phase to ground fault occur on bus 3 of the same power system shown in the fig. **7**
Positive sequence reactance of the elements are shown in fig. Calculate
i) Short circuit current.
ii) Voltage at bus 3 during fault.
iii) Current in phase B of the network element the self-impedance are given in p.u and fault impedance in 0.38 p.u.



b) Represent & Derive an expression for: **7**
i) Faulted Bus voltage.
ii) Fault current.
When 3 phase to Ground fault occurs at bus 'P' in a power system for short circuit studies.

5. a) Derive the swing equation of the machine connected to an infinite bus through transmission network. **7**

b) Develop a flow chart for Modified Euler's method for transient stability studies. **7**

6. a) With the help of a flow chart, discuss the algorithm to be used for transient stability study of power system which employes the modified Euler method. **7**

b) State assumptions made for transient stability studies also explain the necessity of transient stability studies. **7**

7. a) Derive coordinate equation using Lagrange method for the solution of economic schedule. **7**

b) A three-phase, 60Hz synchronous machine is driven at constant synchronous speed by a prime mover. The armature windings are initially open-circuited are field voltage is adjusted so that the armature terminal voltage is at the rated value (i. e. 1.0 PU) The machine has the following per unit reactances and time constants. **7**

$X''_d = 0.15\,pu\ T''_d = 0.035\,sec$

$X_d = 0.40\,puT'_d = 1.0\,sec$

$X_d = 1.20\,pu$

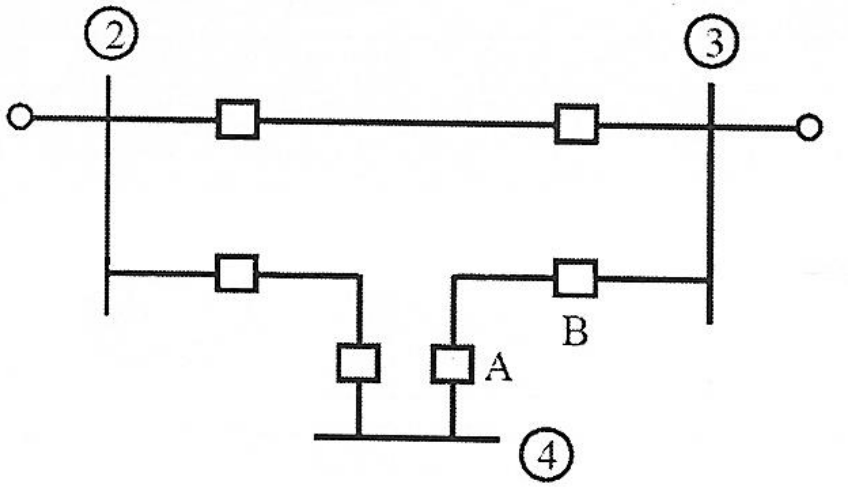
Determine the steady state, transient and subtransient short circuit currents.

8. Using symmetrical components, Calculate the following for three-phase fault at bus 4. **14**

i) Total fault current.

ii) Short circuit currents in all the lines of the network.

iii) Bus voltage during fault.



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