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

PEPS24x / PEPS241 - Computer Application in Power Systems

P. Pages : 2 **GUG/S/23/11025**

Time : Three Hours * 1 2 5 4 * Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Attempt **any five** questions.
6. Use of programmable calculator is prohibited.
7. Draw neat and proper diagram / sketches.
8. Don't use red pen for writing the answer.
9. 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) Prove that, Branch Admittance matrix $Y_{BR} = B^T[Y]B$ Where all abbreviations have their conventional meanings. **7**

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

b) Write down the performance equation of three phase element in impedance & admittance form. **7**

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

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

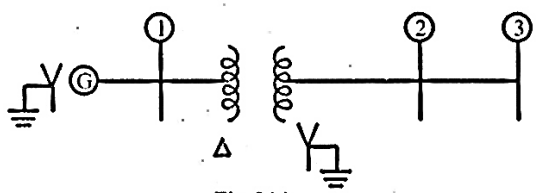


Fig. 3(a)

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

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

Line: $Z_1 = Z_2 = 0.2; Z_0 = 0.4$

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

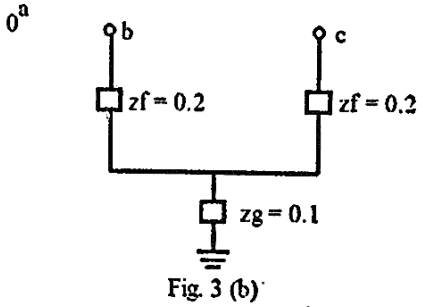


Fig. 3 (b)

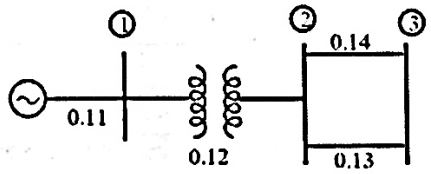
4. a) Consider a 3 phase to ground fault occur on bus 3 of the same power system shown in the fig. **7**

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) Derive the equations for the total fault current in terms of symmetrical components and phase quantities for the following faults at bus P for a general system: **7**

i) Three – phase (Not grounded)

ii) Line – to – Line

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

b) Using the relations between interconnected and primitive network variables prove the following: **7**

a) $A^{b}k^{t} = U$

b) $B^{I} = A^{I}k^{I}$

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

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

7. a) Write a short note on: **7**

i) Economic load dispatch considering losses.

ii) Optimal power flow.

b) A three – phase, 60 Hz 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 reactance's and time constants. **7**

$X''_d = 0.15\,\text{pu}\; T''_d = 0.035\,\text{sec}$

$X_d = 0.40\,\text{pu}\; T'_d = 1.0\,\text{sec}$

$X_d = 1.20\,\text{pu}$

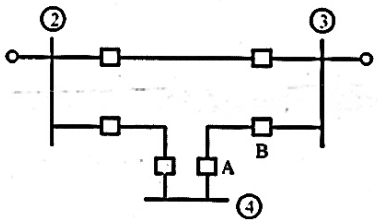
Determine the steady state, transient and subtransient short circuit currents.

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 voltages during fault



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