B.E. Electrical (Electronics & Power) Engineering Eighth Semester

EP801 - Computer Applications In Power System

P. Pages : 3 **GUG/W/18/2009**

Time : Three Hours * 1 5 3 9 * Max. Marks : 80

Notes : 1. Answer **five** questions as per internal choice.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.
4. Use of non-programmable electronic calculator is permitted.

1. a) Bus incidence matrix for a power system is given below - **10**

Element \ Node	①	②	③
1	0	–1	0
2	0	0	–1
A = 3	–1	1	0
4	–1	0	0
5	0	–1	1
6	0	–1	1

Select 1, 2, 3 as tree.

i) Form basic cutset incidence matrix.

ii) Form basic loop incidence matrix

iii) Show that $A_b \cdot k^t = U_b$

b) Derive expression for loop impedance matrix using singular transformation. **6**

OR

2. a) Oriented graph of a power system is shown in fig. 2 (a). Select 1, 2, 3 as tree and show that **12**

i) $A_b \cdot k^t = U_b$

ii) $B_\ell \cdot A_b = A_\ell$

iii) $C_b = B_\ell{}^t$

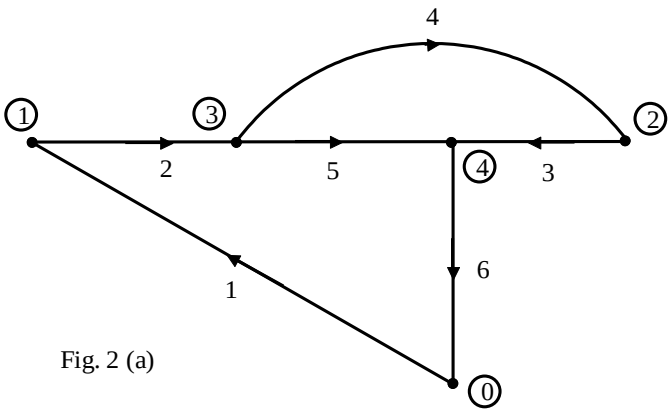

Fig. 2 (a)

b) Explain representation of power system element in impedance and admittance form. **4**

3. a) Show that the symmetrical component transformation matrix is unitary. **4**

b) The information of interconnection of the elements of a power system is described in Table 3 (b). Neglect line charging admittance and assume that there is no mutual coupling. **12**

Select node ⓪ as reference and elements 1, 2, 3 as tree. Form bus impedance matrix (Z_{bus}) using algorithm method.

Table 3 (b)

Element No.	Connected		Self impedance (pu)
	From bus	To bus	
1	0	2	0.40
2	2	3	0.25
3	1	2	0.50
4	0	3	0.25
5	0	1	0.20

OR

4. a) Explain the algorithm for formation of three phase bus impedance matrix. Consider that there is no mutual coupling. **8**

b) The bus impedance matrix (Z_{bus}) for a three bus power system is given below - **8**

$$Z_{bus} = \begin{matrix} & ② & ③ \\ ② & 0.242 & 0.044 \\ ③ & 0.044 & 0.099 \end{matrix}$$

Modify this Z_{bus} matrix, if a new element with self impedance of 0.4 pu is added between bus ② and bus ③

5. a) State the advantages and disadvantages of Newton-Raphson method used for load flow analysis. **4**

b) With the help of flow chart and necessary equations explain Gauss-Seidel method used for load flow analysis (including P-V buses) **12**

OR

6. a) Derive the elements of Jacobian matrix used in Newton-Raphson method of load flow analysis. **8**

b) Explain acceleration of convergence in Gauss-Seidel method of load flow analysis. **4**

c) Explain, how the buses are classified in load flow analysis ? **4**

7. a) What is the need of short circuit studies. **4**

b) For a line-to-line fault at bus 'p' in a power system, derive expression for - **12**
i) Fault current
ii) Voltage at faulted bus
iii) Voltage at healthy buses

OR

8. a) State the assumptions made in short circuit analysis of large power system. **6**

b) Find three phase fault impedance matrix $\left(Z_F^{abc}\right)$ in case of three phase to ground fault. **10**
Consider that fault impedance (in each phase) is Z_f and the ground impedance is Z_g.
Also transform Z_F^{abc} in symmetrical component form.

9. a) With the help of flow chart and necessary equations, explain Runge-Kutta fourth order method for transient stability analysis. **12**

b) State the assumptions made in transient stability analysis. **4**

OR

10. a) Derive swing equation for a machine connected to infinite bus through transmission network. **4**

b) A single machine connected to infinite bus has H = 3.0, $x_d' = 0.25\,pu$ and line reactance = 0.1 pu. Initially bus voltage (generator bus) is 1.4 pu and generator was delivering 75 MW. At t = 0 second three phase short circuit occurred at generator bus. Find variation of rotor angle with respect to time up to t = 0.15 second, taking time step of 0.05 second. Given that base MVA = 100 and infinite bus voltage is 1<0 pu. Use Euler's modified method. **12**

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