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10EE71

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain with an example: i) Oriented graph; ii) Tree; iii) Basic cutset. **(05 Marks)**

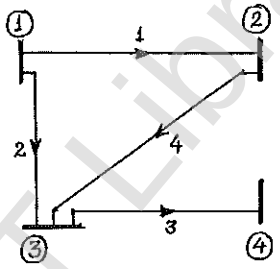
b. What is primitive network? The data relating to passive elements is given in table Q.1(b). Obtain: i) Primitive impedance matrix, z; ii) Primitive admittance matrix, y. **(05 Marks)**

Table Q.1(b)

Element No.	Self Impedance, $Z_{pq,pq}$		Mutual Impedance, $Z_{pq,rs}$	
	Bus code (p-q)	Impedance in pu	Bus code (r-s)	Impedance in pu
1	1 – 2	j0.45	-	-
2	2 – 3	j0.30	1 – 2	j0.15
3	1 – 3	j0.60	1 – 3	j0.25

c. For the power system shown in Fig.Q.1(c), obtain incidence matrixes A, B and K and verify the identity $B_f = A_f K^t$. Choose bus-1 as reference and element 4 as link. **(10 Marks)**

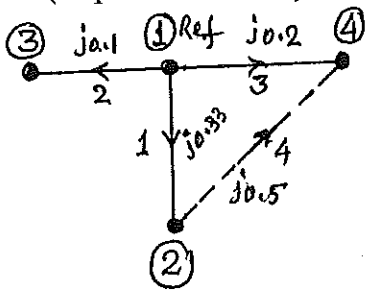
Fig.Q.1(c)



2 a. With usual notations, prove that $Y_{bus} = A^t[y]A$ using singular transformation. **(06 Marks)**

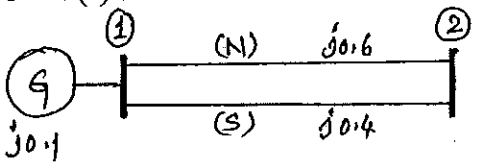
b. With the help of singular transformation method, determine the bus admittance matrix Y_{bus} for the power system whose oriented graph is shown in Fig.Q.2(b). Element no. and self-impedance of the elements in pu are marked on the diagram. Neglect mutual coupling. Verify the same using ROI method (Inspection method). **(08 Marks)**

Fig.Q.2(b)



c. Form Z_{bus} using step by step building algorithm of the system shown in Fig.Q.2(c). Take element connected between 1 – 2 (s) as LINK. **(06 Marks)**

Fig.Q.2(c)



3 a. Explain the classification of different types of buses considered during power system load flow analysis. Discuss the need of slack bus in such an analysis. **(08 Marks)**

b. For a typical four buses and five lines power system, determine the bus voltages at the end of first iteration using GS method. The system data is given in Table Q3(b). Assume acceleration factor of 1.6.

Table Q3(b)

LINE DATA		BUS DATA				
Bus code	Admittance in pu	Bus No.	P	Q	V	Remarks
1 – 2	2 – J8	1	-	-	1.06∠0	SLACK
1 – 3	1 – J4	2	0.5	0.2	1 + J0	PQ
2 – 3	0.66 – J2.664	3	0.4	0.3	1+ J0	PQ
2 – 4	1 – J4	4	0.3	0.1	1 + J0	PQ
3 – 4	2 – J8					

(12 Marks)

4 a. Discuss clearly the significance and properties of Jacobian matrix as applied to load flow analysis. **(06 Marks)**

b. Write the generalized flow chart for GS method. **(08 Marks)**

c. Explain the step by step procedure of fast decoupled load flow analysis. **(06 Marks)**

PART – B

5 a. Derive an expression for economical load schedule for an n-plant system neglecting the transmission losses and hence show that plant incremental cost is given by:

$$\lambda = \frac{P_D + \sum_{i=1}^{n} \frac{b_i}{2c_i}}{\sum_{i=1}^{n} \frac{1}{2c_i}}$$

where, P_D is load demand in MW b_i and c_i are coefficients of cost function. **(10 Marks)**

b. The incremental fuel costs in Rs. per MWh for a plant consisting of two units are

$\frac{dF_1}{dP_{G1}} = 0.1\ P_{G1} + 20$, $\frac{dF_2}{dP_{G2}} = 0.12 P_{G2} + 15$.

Assume that both units are operating at all times. Determine:

i) The most economical division of load between the generators for a constant load of 300MW.

ii) The saving in Rs. per day obtained compared to equal load sharing between the two units. **(10 Marks)**

6 a. What are transmission line loss coefficients? Derive an expression for transmission loss as a function of plant generation for a two plant system. **(10 Marks)**

b. Discuss the problem formulation and solution procedure of optimal scheduling for hydro-thermal plants. **(10 Marks)**

7 A 50 Hz, 500 MVA, 400 kV generator (with transformer) is connected to a 400kV infinite bus bar through an interconnector. The generator has H = 2.5 MJ/MVA, voltage behind transient reactance is 450 kV and is loaded 460 MW. The transfer reactance's between generator and bus bar under various conditions are:

Pre fault: 0.5 pu

During fault: 1.0 pu

Post fault : 0.75 pu

Calculate the swing curve using intervals of 0.05 sec and assuming that the fault is cleared at 7.5 cycles. **(20 Marks)**

8 a. Illustrate clearly the method of solving swing equation using Runge-Kutta approach for transient analysis of a power system. **(10 Marks)**

b. Explain the representation of loads in a power system during transient stability period. **(10 Marks)**

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