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06EE71

Seventh Semester B.E. Degree Examination, Dec.2017/Jan.2018

Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With an example, define element, node, true branch, link, basic cutset and basic loop. Establish the relationship between links, elements and nodes. **(10 Marks)**

b. For a six node (0, 1, 2, 3, 4, 5) nine element system with elements {1, 2, 3, 4, 5} as tree branches, the bus incidence matrix is shown below with bus '0' as reference: (i) Construct the oriented graph, (ii) Branch path incidence matrix, (iii) Basic loop incidence matrix.

Bus / e	1	2	3	4	5
1	-1				
2			-1		
3				-1	
4		-1	1		
5				1	-1
6			1	-1	
7	-1	1			
8		1		-1	
9	1				-1

(10 Marks)

2 a. What is meant by primitive network? Derive the matrix expression for forming the bus admittance matrix from the primitive admittance matrix through a singular transformation. **(07 Marks)**

b. From Y_{BUS} by inspection for the power system shown in Fig.Q2(b).

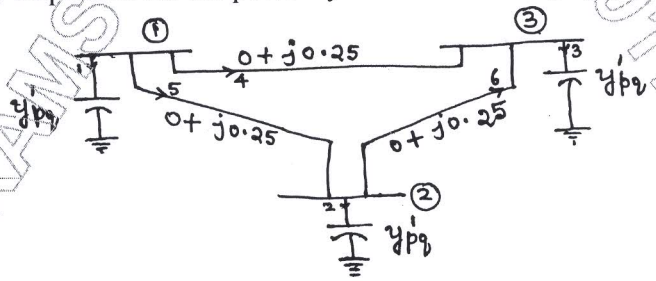

Fig.Q2(b)

Line charging elements 1, 2 and 3.

Line charging admittance $y'_{pq} = 0 + j0.1$ p.u.

All transmission lines (elements 4, 5 and 6) are having a line impedance of $Z_{pqpq} = 0 + j0.25$ p.u. **(03 Marks)**

c. Explain step by step procedure for Z_{bus} algorithm when a branch is added to the existing partial network. **(10 Marks)**

3 a. Draw the flow chart of Gauss-Siedal method of load flow analysis. **(10 Marks)**

b. For a 3 bus power system elements of Y_{BUS} are given as, $Y_{11} = 3 - j9$, $Y_{12} = -2.5 + j1.0$, $Y_{13} = -1 + j6$, $Y_{22} = 4.5 - j20$, $Y_{23} = -1 + j6$ and $Y_{33} = 4 - j8$. The net real and reactive power injections at bus 2 and 3 are $P_2 = Q_2 = 1.6$ p.u.; $P_3 = Q_3 = -0.7$ p.u. Consider Bus 1 as slack bus with a voltage $E_1 = 1.04\underline{|0}$. Assume flat start for initial values of voltages at buses 2 and 3. Determine the voltage at bus 3 at the end of first iteration using Gauss-Siedal method. Use an acceleration factor of 1.6. **(10 Marks)**

4 a. Obtain the elements of the Jacobians J_1, J_2, J_3 and J_4 of Newton-Raphson method of load flow in polar coordinates. **(12 Marks)**

b. Explain fast decoupled load flow method clearly bring-out the assumptions in obtaining simplification. **(08 Marks)**

PART – B

5 a. Explain equal incremental cost criterion for economic generation scheduling neglecting transmission losses. Also write the algorithm for the iterative method for obtaining economic loading of generators. **(10 Marks)**

b. The incremental fuel costs of two plants are given by

$$\frac{dC_1}{dP_1} = 0.008P_1 + 8 \qquad \frac{dC_2}{dP_2} = 0.0096P_2 + 6.4$$

Incremental costs are expressed in Rs/MWh. The maximum and minimum loadings on each generating units are 625 MW and 125 MW respectively. Determine economic operating schedule for supplying a load of 1000 MW. Also determine the saving in the fuel cost in Rs/hr when the load 1000 MW is equally shared between the two units. **(10 Marks)**

6 a. What are B-coefficients? For the system shown in Fig.Q.6(a), obtain the loss coefficients and the power loss. Take $I_1 = 1 + J0$ pu and $I_2 = 0.8 + J0$ pu, voltage at bus-3 as $1 + J0$ pu. Line impedances are $Z_a = 0.02 + J0.15$pu, $Z_b = Z_c = 0.03 + J0.25$pu. **(10 Marks)**

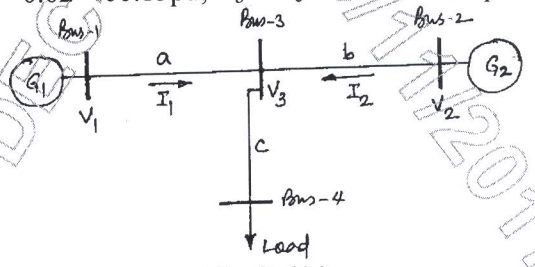

Fig.Q.6(a)

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

7 a. Explain with flow chart, modified Euler's method of determining transient stability of power system. **(10 Marks)**

b. Explain the numerical solution of Swing equation by 4th order Runge-Kutta method. **(10 Marks)**

8 Write short notes on any four of the following:

a. Types of buses in load flow studies

b. Augmented cutset incidence matrix $[\hat{B}]$

c. Mathematical formulation for optimal scheduling of hydrothermal system

d. Comparison of Gauss-Seidal and N-R methods of load flow analysis

e. Representation of generator and loads for transient stability studies. **(20 Marks)**

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