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10EE71

Seventh Semester B.E. Degree Examination, Dec.2014/Jan.2015

Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks: 100

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

PART – A

1 a. Explain with an example the following: i) Oriented graph; ii) Basic cutsets; iii) Basic loops. **(06 Marks)**

b. For the network shown in Fig.Q.1(b) consider elements (1, 2, 3) as tree branches and node-4 as reference and obtain i) Bus incidence matrix, A; ii) Branch-path incidence matrix, K. There from show that $A_b K^T = I$. **(08 Marks)**

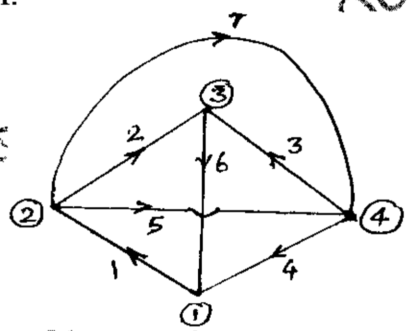

Fig.Q.1(b)

c. Define primitive network. The data relating to passive elements is given in Table 1(c), obtain: i) Primitive impedance matrix; ii) Primitive admittance matrix. **(06 Marks)**

Table 1(c)

Element no.	Self impedance $Z_{pq,pq}$ (pu)	Mutual impedance $Z_{pq,rs}$ (pu)
1	0.4	-
2	0.5	0.1 (with element 1)
3	0.8	

2 a. Derive an expression for bus admittance matrix Y_{bus} using Singular transformation method. **(06 Marks)**

b. The positive sequence impedance data for the sample power system shown in Fig.Q.2(b) is given in Table 2(b). Neglecting resistance form the positive sequence bus admittance matrix Y_{bus} using Singular transformation. Take ground as reference. **(08 Marks)**

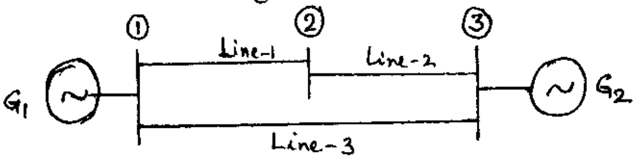

Fig.Q.2(b)

Table 2(b)

Element	G_1	G_2	Line-1	Line-2	Line-3
Positive sequence impedance	0.2	0.25	0 + J0.1	0.02 + J0.2	0.03 + J0.4

c. The bus impedance matrix of a 5 node network with node 5 as reference is given below. Find the topology of the network and parameters of the elements by using Z_{bus} building algorithm. All values are in per unit reactance's. **(06 Marks)**

$$Z_{bus} = J\begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 0 & 2 \\ 0 & 0 & 2 & 0 \\ 0 & 2 & 0 & 3 \end{bmatrix}$$

3 a. Discuss the importance of Load flow analysis in a power system. Enumerate the data required for carrying out load flow studies. **(06 Marks)**

b. For an n-bus power system, obtain the power flow equations in polar form. **(04 Marks)**

c. For the network shown in Fig.Q.3(c), determine the complex voltage at bus-2 at the end of first iteration. Line impedances shown in figure are in p.u. Given that bus-1 is a slack bus $V_1 = 1\angle 0^\circ$ pu, $P_2 + JQ_2 = -5.96 + J1.46$ pu and $|V_3| = 1.02$ pu. Use Gauss-Seidel method. **(10 Marks)**

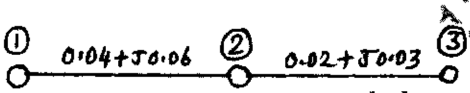

Fig.Q.3(c)

4 a. Using NR method, determine the values of x_1 and x_2 after two iterations. Given that:

$x_2^2 - 4x_1 - 4 = 0$

$2x_2 - x_1 - 2 = 0$ Assume $x_1^{(0)} = -1$, $x_2^{(0)} = 1$ **(08 Marks)**

b. Differentiate between GS method and NR method for load flow studies based on following factors:

i) Computer time requirement per iteration.
ii) Computer memory storage requirement.
iii) Computational efficiency.
iv) Convergence characteristics. **(04 Marks)**

c. Enumerate the step by step procedure for achieving a load flow solution using FDLF analysis. **(08 Marks)**

PART – B

5 a. Derive an expression for transmission loss as a function of plant generation for a two plant system. **(10 Marks)**

b. The fuel input in calories per hour for plant 1 and 2 are given as:

$F_1 = (0.024\ P_1^2 + 8P_1 + 80) \times 10^6$ cal/hr

$F_2 = (0.04\ P_2^2 + 6P_2 + 120) \times 10^6$ cal/hr

The minimum and maximum loads on the units are 10MW and 100MW respectively. Determine the minimum cost of generation per day, if the load curve is as shown in Fig.Q.5(b). Take the cost of fuel as Rs.10 per million caloric. **(10 Marks)**

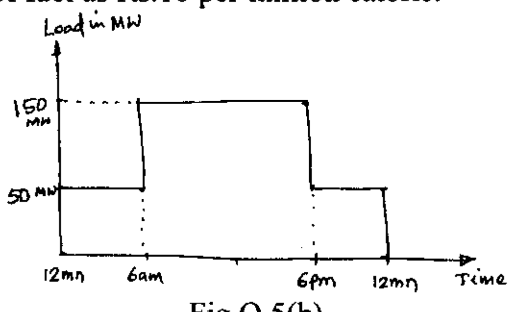

Fig.Q.5(b)

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

b. For the power system shown in Fig.Q.6(b), with bus-1 as reference bus with voltage of (1 + J0) pu. Find the loss coefficients if the branch currents and impedances in pu are:

$I_a = (1 - J0.15)$, $Z_a = (0.02 + J0.15)$

$I_b = (0.5 - J0.1)$, $Z_b = (0.03 + J0.15)$

$I_c = (0.2 + J0.05)$, $Z_c = (0.02 + J0.25)$

If the base is 100MVA, what will be the magnitudes of B-coefficients in reciprocal MW? Also find the transmission loss in pu. **(10 Marks)**

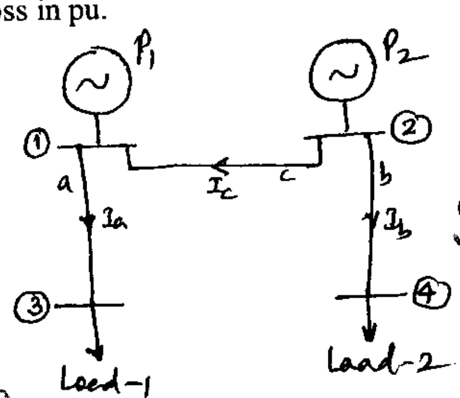

Fig.Q.6(b)

7 a. With the aid of relevant equations used for plotting the swing curve discuss how a suitable protecting scheme can be designed to avoid the system from falling out of step (Point by point method of solution of swing equation). **(10 Marks)**

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

8 a. Providing relevant expressions explain the modified Euler's method for transient stability studies. **(10 Marks)**

b. Illustrate the steps involved in estimating internal voltage angles and machine speeds using Runge-Kutta method during transient period. **(10 Marks)**

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