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10EE71

Seventh Semester B.E. Degree Examination, July/August 2021
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define : i) Oriented graph and connected graph ii) Tree and co-tree. **(04 Marks)**

b. For the power system shown in Fig.Q1(b) select ground as reference node verify the following relations : i) $A_b K^T = U$ ii) $B_f = A_f K^T$.

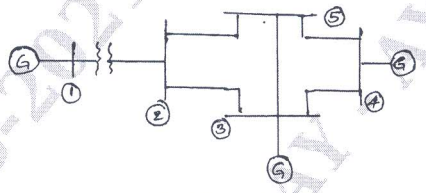

Fig.Q1(b) **(10 Marks)**

c. Bus incidence matrix of a network is shown. Draw the oriented graph and obtain basic loop incidence matrix :

$$[A] = \begin{vmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & -1 & 1 \\ 0 & 1 & -1 & 0 \\ 1 & -1 & 0 & 0 \\ 0 & 1 & 0 & -1 \end{vmatrix}.$$ **(06 Marks)**

2 a. For the network shown in Fig.Q2(a) form Y_{BUS} using singular transformation Bus admittance for the network shown in Table Q2(a).

Element number	Bus code	Self Admittance
1	1 – 4	1.4
2	1 – 2	1.6
3	2 – 3	2.4
4	3 – 4	2.0
5	2 – 4	1.8

Table - 1

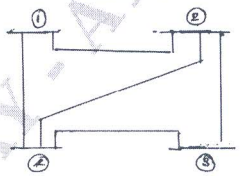

Fig.Q2(a) **(05 Marks)**

b. Derive an expression for off diagonal elements of Z_{BUS} when branch is added to the partial network. **(08 Marks)**

c. For the network shown in Fig.Q2(c), obtain BUS impedance (Z_{BUS}) using at building algorithm.

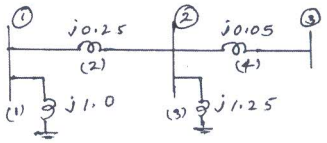

Fig.Q2(c) **(07 Marks)**

3 a. What is load flow analysis? Explain typer of buses for load flow analysis. **(04 Marks)**

b. List various data needed for load flow analysis. **(04 Marks)**

c. Obtain the load flow solution at the end of first iteration of the power system shown in Fig.Q2(a), Bus – 2 is a PV bus whose voltage magnitude is specified as 1.04. Given $0.25 \leq Q_2 \leq 1$ pu. The line data and bus data in given in Table 2 and 3 respectively.

Table – 3 Bus Data

Bus	V_i	P_i	Q_i
1	1.04	–	–
2	1.0	0.5	–0.2
3	1.0	–0.3	–0.1
4	1.0	–1.0	0.5

Table – 2 Line Data

p – q	R_{Pu}	X_{Pu}
1 – 2	0.05	0.15
1 – 4	0.1	0.3
2 – 4	0.15	0.45
2 – 3	0.1	0.3
3 – 4	0.05	0.15

(12 Marks)

4 a. Explain polar form of Newton – Raphson method for load flow analysis. **(08 Marks)**

b. Write algorithm of fast decoupled load flow method. **(06 Marks)**

c. Compare the Gauss-Sidel method with Newton – Raphson method. **(06 Marks)**

5 a. Derive the condition for equal incremental cost criteria when transmission loss in neglected. **(07 Marks)**

b. Fuel cost for plant consisting of three units :

$F_1 = 0.1\ P_1^2 + 40P_1 + 100$ Rs/hr

$F_2 = 0.125P_2^2 + 30P_2 + 150$ Rs/hr

$F_3 = 0.15P_3^2 + 20P_3 + 80$ Rs/hr

Assume that all the 3 units are operating at all time and the total load is 400MW. The minimum and maximum load on each unit are 20 and 150MW respectively. How will 400MW load be shared among 3 units? For optimal operation. **(07 Marks)**

c. For the system whose one line diagram is shown in Fig.Q5(c). Assume $I_1 = 1$Pu, $I_2 = 0.8$Pu. If the voltage at bus – 3 is $V_3 = 1.0$Pu. Find the loss coefficients of transmission line.

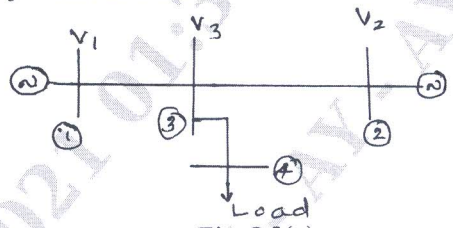

Fig.Q5(c) **(06 Marks)**

6 a. Write algorithm of iterative technique for solution of economic dispatch with losses. **(05 Marks)**

b. On the system consisting of two generator plants. The incremental cost with P_1 and P_2 in MW are $IC_1 = 0.15P_1 + 150$ and $IC_2 = 0.25P_2 + 175$ Rs/MWh. The system is operating on economic dispatch with $P_1 = P_2 = 200$MW and $ITL_2 = 0.2$. Find the penalties factor of plant – 1 and ITL_1. **(05 Marks)**

c. Explain the problem formulation of optimal scheduling of hydrothermal plant. **(10 Marks)**

7 a. Explain point – by – point method for the solution of swing equation. **(10 Marks)**

b. Explain the Runge – Kutta method. **(10 Marks)**

8 a. Explain representation of load. **(05 Marks)**

b. Obtain the network performance equations for transient analysis. **(08 Marks)**

c. Draw the flow chart of modified Euler method for transient calculation. **(07 Marks)**

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