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10EE71

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019

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 neat sketches, explain the following:
i) Oriented graph
ii) Basic cut sets
iii) Tree branch path incidence matrix. **(06 Marks)**

b. The bus incidence matrix of 8 elements and 5 nodes is given below. Reconstruct the graph of the network.

n \ b	1	2	3	4	5	6	7	8
A	-1	0	0	0	1	0	1	0
B	0	-1	0	0	-1	1	0	1
C	0	0	-1	1	0	-1	0	0
D	0	0	0	-1	0	0	-1	-1

(06 Marks)

c. For the network shown in Fig.Q1(c), obtain the matrices A, B and C. Assume G as reference bus and AB, DF as links.

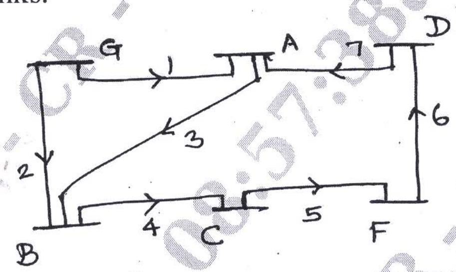

Fig.Q1(c) **(08 Marks)**

2 a. For the data given below, obtain the YBUS using singular transformation. Take bus 4 as reference bus.

Line	Bus (p – q)	Z_{pu}	Bus (r – s)	Z_{pu}
1	1-2	0.2		
2	2-3	0.3	1-2	0.05
3	3-4	0.4		
4	4-1	0.5		

(10 Marks)

b. Form the Z_{BUS} for the power system shown in Fig.Q2(b). Select node 1 as reference bus. The line reactances are marked in p.u.

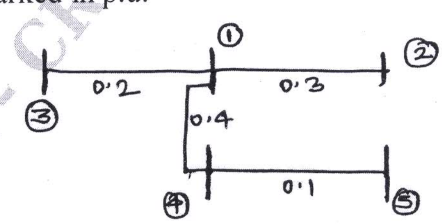

Fig.Q2(b) **(10 Marks)**

3 a. What is the importance of load flow in power system? Enumerate the data required to carry load flow analysis. **(08 Marks)**

b. Following is a system flow data of load flow solution:

Bus code	Admittance
1-2	2 – jB
1-3	1 – j4
2-3	0.666 – j2.664
2-4	1 – j4
3-4	2 - jB

The schedule of active and reactive power are as follows:

Bus code	P	Q	V	Remarks
1	-	-	1.06	Slack
2	0.5	0	1.04+j0	PV
3	0.4	0.3	-	PQ
4	0.3	0.1	-	PQ

The reactive power constraint at bus 2 is $0.1 \le Q_2 \le 1.0$ pu. Determine the voltage at the end of first iteration using Gauss-Seidel iterative method. Assume acceleration factor $\alpha = 1.4$. **(12 Marks)**

4 a. Explain the fast decoupled load model with stating all the assumptions made. **(08 Marks)**

b. In the system shown in Fig.Q4(a), bus 1 is slack bus with a voltage of $V = 1.0\angle 0^\circ$ pu and at load bus P = 125 MW, Q = 60 MVAv. The line impedance are (0.15 + j0.19) pu on the base of 100 MVA, using Newton-Raphson method obtain |V| and δ upto first iteration.

Fig.Q4(a) **(12 Marks)**

PART – B

5 a. What is the need of economic operation of power systems? Explain four types of performance curves used for economic generation scheduling. **(10 Marks)**

b. The fuel cost functions for the three plants in Rs./hr are given by

$F_1 = 0.004\ PG_1^2 + 5.3\ PG_1 + 500$

$F_2 = 0.006\ PG_2^2 + 5.5\ PG_2 + 400$

$F_3 = 0.009\ PG_3^2 + 5.8\ PG_3 + 200$

where PG_1, PG_2, PG_3 are in MW. Find the optimal dispatch and total cost, when the total load is 975 MW, with the following generator limits

$100\text{ MW} \le PG_1 \le 450\text{ MW}$; $100\text{ MW} \le PG_2 \le 350\text{ MW}$; $100\text{ MW} \le PG_3 \le 225\text{ MW}$. **(10 Marks)**

6 a. What are B-coefficients? Obtain the expressions for the transmission loss coefficients for a 3 bus system. **(10 Marks)**

b. A power system having two plants 1 and 2 corrected to the busses 1 and 2 respectively as shown below. There are two loads and four branches. The ref bus with a voltage of $1.0\angle 0^\circ$ pu is shown in the diagram. The branch currents and impedances are:

$I_a = (2 - j0.5)$ pu $I_b = (1.6 - j0.4)$ pu

$I_c = (1 - j0.25)$ pu $I_d = (3.6 - j0.9)$ pu

$Z_a = (0.015 + j0.06)$ pu $= Z_b$ $Z_c = (0.01 + j0.04)$ pu $= Z_d$

Calculate the loss coefficients of the system in pu, if the base MVA is 100 MVA. **(10 Marks)**

7 a. With the help of a flow chart, explain the method of finding the transient stability of a given power system using Runge Kutta method. **(10 Marks)**

b. Consider a system having the following parameters. p_m = 3.0 pu, $\gamma_1 p_m$ = 1.2 pu, $\gamma_2 p_m$ = 2.0 pu, H = 3.0, f = 60 Hz, Δt = 0.02 sec, p_e = 1.5 pu. Determine the rotor angle and angular frequency at the end of 0.02 second using modified Euler's methods. **(10 Marks)**

8 a. Explain the following:
i) Network performance equations
ii) Load models employed for stability studies **(10 Marks)**

b. Explain various methods employed for improving the transient stability. **(10 Marks)**

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