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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. – Electrical and Electronics Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Computer Techniques in Power Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Explain the following with examples :

i) Oriented Graph ii) Tree iii) Basic loops iv) Singular Matrix. 8

b. Define Primitive network. For the data given in table pertaining to passive elements obtain,

i) Primitive incidence matrix ii) Primitive admittance matrix. 6

Element	Self impedance Z_{pu}	Mutual impedance Z_{pu}
1	0.4	0.1 with element 1
2	0.5	
3	0.8	

c. Explain the significance of primitive network with necessary equations and associated representations. 6

2 a. For the network shown in Fig. 2(a) consider elements (1, 2, 3) as the branch and node 4 as reference. Obtain;

(i) Bus incidence matrix A

(ii) Branch path incidence matrix K and there from show that $A_b K^t = U$. 10

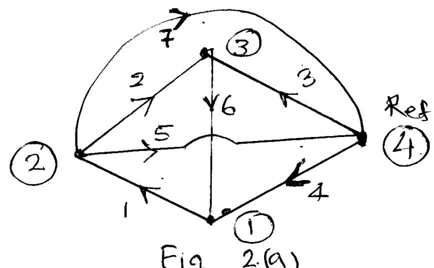

Fig 2(a)

b. For the network shown in Fig. 2(b) draw the oriented graph and obtain the bus incidence matrix, loop incidence matrix and augmented loop incidence matrix. 10

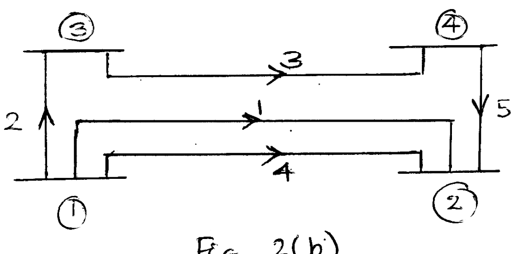

Fig 2(b)

UNIT - II

3 a. Derive an expression for the bus admittance matrix *Y*-bus using singular transformation method. 8

b. Use the singular transformation approach to obtain the Y_{bus} for the data given in Table 3(b). 12

Table 3(b)

Element No.	Bus Code	Self Admittance
1	0 - 1	1.4
2	1 - 2	1.6
3	2 - 3	2.4
4	3 - 0	2.0
5	2 - 0	1.8

4 a. Form the bus admittance matrix by method of inspection for the system shown in Fig. 4(a). Assume $a_1 = 0.92$ and $a_2 = 0.95$. 10

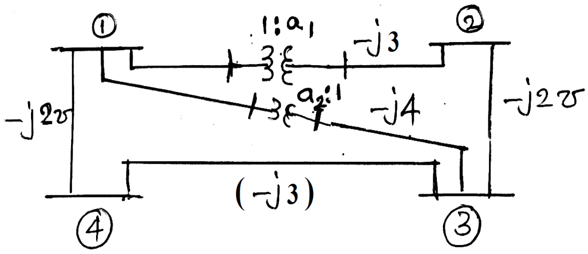

Fig 4(a)

Bus Code	A_{dm}
1 - 2	-j3
1 - 3	-j4
1 - 4	-j2
2 - 3	-j2
3 - 4	-j3

b. For the network shown in Fig. 4(b), determine the Z_{Bus} using Z-Bus building algorithm with node 1 as reference. The self impedance of the elements are marked on the diagram and are in pu. 10

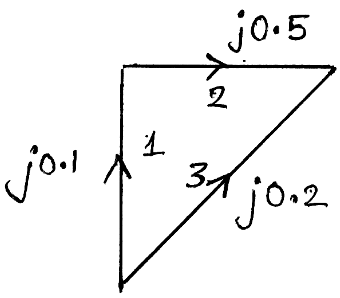

Fig 4(b)

UNIT - III

5 a. What do you understand by the terms "Load flow analysis"? List and explain how buses are classified in a power system to perform load flow analysis or power flow analysis. 8

b. List the advantages of Bus admittance matrix in the study of load flow analysis. 4

c. With an example, explain how load flow analysis is conducted using Newton Raphson method? 8

6 a. What are the assumptions made in Fast Decoupled Load Flow (FDLF) method? Where does FDLF find its applications? 6

b. For the sample power system shown in Fig. 6(b) determine the bus voltages at the end of the first iteration using Gauss Seidel (GS) method. Assume flat voltage start. (as PQ is not given write voltage equations). 8

Line data table

From Bus To Bus	R in pu	X in pu
1 - 2	0.05	0.15
1 - 3	0.10	0.30
2 - 3	0.15	0.45
2 - 4	0.10	0.30
3 - 4	0.05	0.15

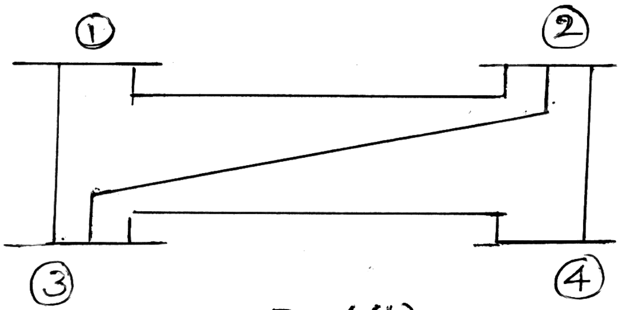

Fig 6(b)

c. Compare Gauss-Seidel and Newton-Raphson method of solving load flow methods. 6

UNIT - IV

7 a. Derive and explain the method of incremental cost for the economic operation of generators, consider the transmission losses. 6

b. What are B-coefficients? Obtain expression for the transmission line coefficients. 8

c. Two units each of 200 MW each supply a constant load of 300 MW. The fuel costs are given by the equations, 6

$IC_1 = 0.1\ P_{G1} + 20;\ \ IC_2 = 0.12\ P_{G2} + 15$

P_G is MW and the cost is in Rs/hour. Determine the most economical division of load between the two units. What is the savings realized per day as compared to equal sharing of the total load between the two units?

Contd...4

8 a. For the two bus system shown in Fig. 8(a), if 90 MW is transmitted from plant 1 to the load with a transmission loss of 8.1 MW, determine the generation of each plant and the power received by the load when the system λ = Rs.25/MWh. The incremental fuel costs are given below; 10

$$\frac{dc_1}{dP_{G1}} = 0.01P_{G1} + 16Rs/MWh \qquad \frac{dc_2}{dP_{G2}} = 0.04P_{G2} + 20Rs/MWh$$

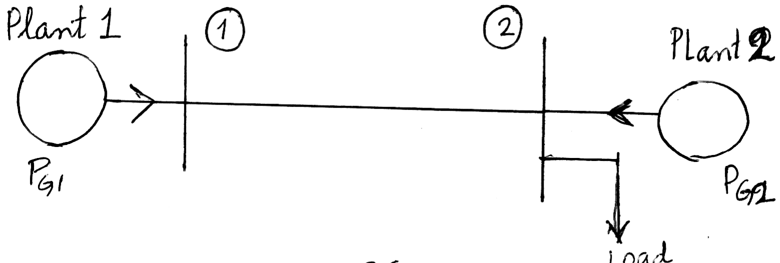

Fig 8(a)

b. Compute the loss coefficients for the network shown in Fig. 8(b) using the data given, 10

I_a = (1.0 – j0.15)pu z_a = (0.02 + j0.15) pu

I_b = (0.5 – j0.10) pu z_b = (0.03 + j0.15) pu

I_c = (0.2 – j0.05) pu z_c = (0.02 + j 0.25) pu

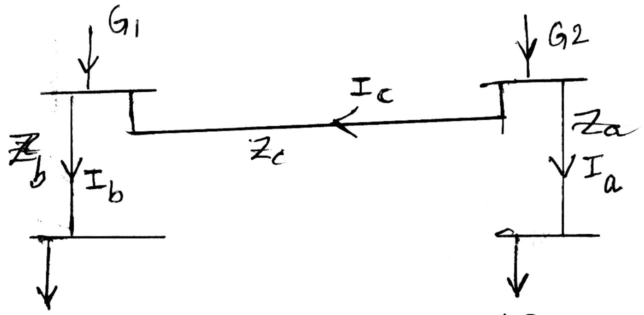

Fig 8(b)

UNIT - V

9 a. With relevant equations, describe the approach to find the solution of swing equation using modified Euler's method for stability analysis. 10

b. Write the equations to obtain the solution of swing equation and explain the step-by-step method or point-by-point method. 10

10 a. Explain the Runge Kutta method. 10

b. Explain with necessary expressions, the various synchronous machine modules employed in transient stability studies. 10

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