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06EE71

Seventh Semester B.E. Degree Examination, June/July 2017
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.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. The bus incidence matrix of a 4 bus 7 element system is shown below:

$A^T =$

-1	0	0	0	0	1	0
0	-1	0	0	1	-1	1
0	0	0	-1	-1	0	0
0	0	-1	1	0	0	-1

Obtain, choosing elements { 1, 2, 3, 4 } as a tree, the following :

(i) Oriented graph (ii) Element node incidence matrix
(iii) Basic loop incidence matrix (iv) Augmented loop incidence matrix
(v) Branch path incidence matrix. **(10 Marks)**

b. Write down the performance equation in admittance form of each primitive element of the network shown in Fig.Q1(b) and express in matrix form.

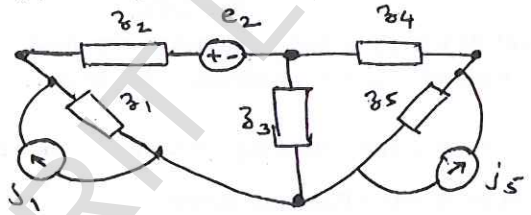

Fig.Q1(b)

$z_1 = 0.1$, $z_2 = 0.2$, $z_3 = 0.5$, $z_4 = 0.25$, $z_5 = 0.1$ **(05 Marks)**

c. Derive an expression for computing Y_{BUS} by singular transformation. **(05 Marks)**

2 a. In a power system with the line data shown in the table, element 1 has a mutual impedance of 0.1 with element 2. Choose bus 1 as reference and obtain the bus admittance matrix by singular transformation. **(08 Marks)**

Line Data

Element No.	Bus code	z_b
1	1 – 2(1)	0.6
2	1 – 3	0.5
3	3 – 4	0.5
4	1 – 2(2)	0.4
5	2 – 4	0.2

b. Derive an expression for modification of the bus impedance matrix when a link element is added between two existing busses. **(06 Marks)**

c. Obtain the Π equivalent circuit of a transformer having off nominal turn ratio. **(06 Marks)**

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3 a. For a system having only P-Q buses explain with the help of a flow chart or algorithm, the solution of load flow equations by Gauss Seidel method. Derive the expression used for updating the voltages in each iteration. How is the algorithm modified when P-V buses are included in the system? **(10 Marks)**

b. In the three bus system shown in Fig.Q3(b), the line impedances are given in p.u. and line charging is neglected. The bus data is given below, with Bus 1 as slack bus and the remaining buses as P-Q buses.

Bus	Generation		Load		|V|
	P(MW)	Q(MVAR)	P(MW)	Q(MVAR)	
1	-	-	0	0	1.05
2	25	15	50	25	1.0
3	0	0	60	30	1.0

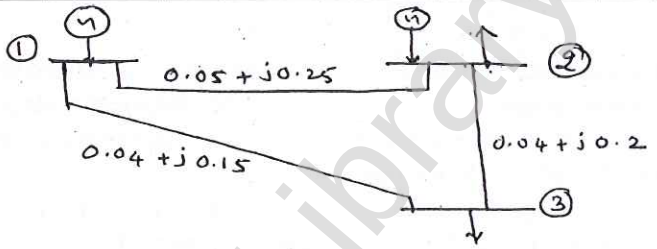

Fig.Q3(b)

Assuming 100 MVA as a base determine the load flow solution after one iteration of Gauss-Seidel method. Take an acceleration factor of 1.4. **(10 Marks)**

4 a. Derive expression for the following elements of the Jacobian matrix for solution of load flow equations by Newton Raphson method : (i) $\frac{\partial P_i}{\partial \delta_i}$ (ii) $\frac{\partial Q_i}{\partial V_j}|V_j|$ **(06 Marks)**

b. Derive the equation for solution of Load flow equation by Fast Decouples load flow method. Clearly state the assumptions used. **(08 Marks)**

c. What are the merits and demerits for solving load flow equations by different methods? **(06 Marks)**

PART – B

5 a. A load of 300 MW is supplied by two 200 MW generators 1 & 2, for which the respective incremental fuel costs are : $\frac{dC_1}{dP_{a_1}} = 0.1P_{a_1} + 20.0$; $\frac{dC_2}{dP_{a_2}} = 0.12P_{a_2} + 15$, where P_{a_1} are in MW and C_i are in Rs/hr. Determine

(i) Economical Division of load between generators

(ii) Savings is Rs/Day thereby obtained compared to equal load sharing between machines. **(10 Marks)**

b. Stating assumptions made, derive a general expression for transmission loss coefficient. **(10 Marks)**

6 a. Derive the exact coordination equations for solving the economic dispatch problem. **(06 Marks)**

b. Write a brief note on optimal scheduling of hydro-thermal system. **(06 Marks)**

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c. A two bus system is shown in Fig.Q6(c). If 100 MW s transmitted from plant 1 to the load, a transmission loss of 10 MW is incurred. Find the required generation for each plant and the power received by the load when the system λ is Rs 25/MWh. The incremental fuel costs of two plants :

$$\frac{dC_1}{dP_{a_1}} = 0.02P_{a_1} + 16.0 \ \text{Rs/MWh} \quad ; \quad \frac{dC_2}{dP_{a_2}} = 0.04P_{a_2} + 20.0 \ \text{Rs/MWh}. \qquad \textbf{(08 Marks)}$$

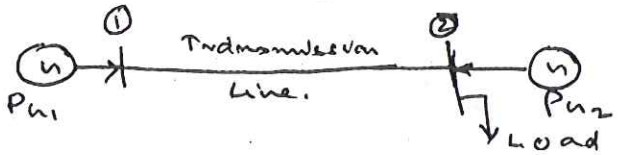

Fig.Q6(c)

7 a. Derive an expression for solving the swing equation by point-by-point method. State any assumptions used. **(10 Marks)**

b. Write down the equations for solving two simultaneous differential equations by Runge – Kutta 4^{th} order method. **(04 Marks)**

c. Explain as to how the swing equation can be solved by Runge-Kutta method. **(06 Marks)**

8 a. Write explanatory notes on the following :

(i) Milne's prediction corrector method

(ii) Modeling of loads and networks for transient stability studies. **(10 Marks)**

b. With the help of a flow chart or algorithm, explain as to how modified Euler method is used for transient stability studies. **(10 Marks)**

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