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10EE71

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.***

PART – A

1 a. Define the following with example:
(i) Oriented graph (ii) Tree (iii) Primitive network (iv) Cotree. **(08 Marks)**

b. The bus incidence matrix of a power system network is shown below. Construct the oriented graph of the system. **(06 Marks)**

$$A = \begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 & 1 \\ -1 & -1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & -1 \end{bmatrix}$$

c. Derive the expression for Y bus using singular transformation analysis. **(06 Marks)**

2 a. Determine the bus admittance matrix by singular transformation analysis for the power system defined by the line data shown in table-1. **(08 Marks)**

Table-1

Line No.	1	2	3	4	5
Bus Code p – q	0 – 1	1 – 2	2 – 3	3 – 0	2 – 0
Admittance in p.u.	1.4	0.6	2.4	2.0	1.8

b. Obtain the general expressions for Zbus building algorithm when a branch is added to the partial network. **(12 Marks)**

3 a. What are the types of buses in load flow? Discuss with constraints. **(08 Marks)**

b. For the system given, generators are connected to all the buses while loads are connected to bus 2 and 3. Values of real and reactive power are given in table-3. All buses other than slack bus are of PQ type. For case (a). Assume flat voltage start, find the voltage and bus angles at the buses at the end of first Gauss Siedel iteration.

For case (b) bus 2 is a PV bus with $|V_2| = 1.04$ p.u. and $0.2 \le Q_2 \le 1$ is the constraint for reactive power.

Table-2

Line bus to bus	G (p.u.)	B (p.u.)
1 – 2	2.0	-6.0
1 – 3	1.0	-3.0
2 – 3	0.666	-2.0
2 – 4	1.0	-3.0
3 – 4	2.0	-6.0

Table-3

Bus	P_i	Q_i	V_i	Remarks
1	-	-	$1.04\angle 0°$	Slack bus
2	0.5	-0.2	-	PQ bus
3	- 1	0.5	-	PQ bus
4	0.3	-0.1	-	PQ bus

(12 Marks)

4 a. Explain with a flow chart and equation how the load flow analysis is carried out using Newton Raphson method. **(10 Marks)**

b. With assumptions, explain with procedural steps of fast de-coupled load flow method to solve non-linear load flow equations. **(10 Marks)**

PART – B

5 a. Derive the coordination equations for economic load allocation in a thermal power system with the consideration of transmission losses. **(10 Marks)**

b. Three plants of total capacity 425 MW are scheduled for operating to supply a total load of 300 MW. Find the optimal load scheduling, if the plants have the following incremental cost and generation constraints.

$$\frac{dc_1}{dP_1} = 30 + 0.15P_1 \quad (25 < P_1 < 125\,MW) \quad ; \quad \frac{dc_2}{dP_2} = 40 + 0.2P_2 \quad (30 < P_2 < 100\,MW)$$

$$\frac{dc_3}{dP_3} = 15 + 0.18P_3 \quad (50 < P_3 < 200\,MW)$$

(10 Marks)

6 a. Derive expressions for loss coefficients and transmission loss in terms of generation in an interconnected system. **(10 Marks)**

b. With relevant equations discuss the optimal scheduling of hydrothermal system. **(10 Marks)**

7 a. Derive swing equation for transient stability analysis. **(06 Marks)**

b. With the help of algorithm, explain the modified Euler method for transient stability studies. **(08 Marks)**

c. Write a note on Runge-Kutta method to solve stability problems. **(06 Marks)**

8 Discuss on the following :

(i) Modeling of prime movers and loads **(08 Marks)**

(ii) Milne's predictor corrector method **(06 Marks)**

(iii) Penalty factors **(06 Marks)**

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