

## Seventh Semester B.E. Degree Examination, June/July 2015 Computer Techniques in Power System Analysis

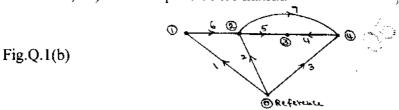
Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

## PART - A

- 1 a. Define subgraph, tree, co-tree as applied to graph theory. Give example for each (06 Marks)
  - b. For the graph shown in Fig.Q.1(b), select tree T(1, 2, 3, 4) and write
    i) Element-node incidence matrix; ii) Branch-path incidence matrix; iii) Basic cut set incidence matrix; iv) Basic loop incidence matrix.

    (14 Marks)



2 a. With the usual notations derive  $Y_{Bus} = A^{t}[y]A_{tot}$ 

(06 Marks)

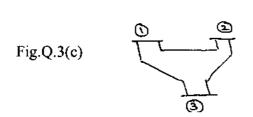
b. In the 3 bus system shown, each line has series impedance of 0.1j pu and negligible shunt admittance. A regulating transformer with turns ratio 1.5 is present at bus (2) in the line 2-3. Assuming ground as reference determine Y<sub>Bus</sub> by direct inspection method. (06 Marks)

The series impedances of the lines are shown in Fig.Q.(c). Taking the elements in the order 0-1, 0-2, 1-2, develop Zhus by building algorithm method. (08 Marks)



- 3 a. What are the advantages of  $Y_{Bus}$  over  $Z_{Bus}$  for load flow analysis? (04 Marks)
  - b. Draw the flow chart for GS method of load flow analysis for the power system with PQ buses. (08 Marks)
  - C. For the 3 bus system shown, the elements of Y<sub>Bus</sub> are as follows:

 $Y_{11} = Y_{22} = Y_{33} = 5.868$ - 23.514j pu and  $Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = -2.934 + 11.767$ j pu. Reactive power limits at bus 3 are;  $0 \le Q_3 \le 1.5$  p.u. Determine whether bus 3 continues as pv bus and there after determine new estimate of voltage at bus 3 using GS method.



Bus power data					
	Bus	P pu	Qpu	Voltage pu	Remark
	1	-	-	1.04	Slack bus
	2	0.5	1	1 + j0	PQ bus
	3	-1.5	-	1.04	pv bus
					(08 Marks)

- 4 a. Write the algorithm for NR method of load flow analysis of power systems having both PQ and PV buses. (10 Marks)
  - b. For a 3 bus system the elements of  $Y_{Bus}$  are as follows:

$$Y_{11} = Y_{22} = Y_{33} = 24.23 \left[ -75.95^{\circ} \right]$$
 pu

$$Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13$$
 |104.04 ° pu

Bus voltages are;

 $V_1 = 1.04 | \underline{0}^{\circ}$  pu (slack bus);  $V_2 = 1 | \underline{0}^{\circ}$  (PQ bus);  $V_3 = 1.04 | \underline{0}^{\circ}$  (pv bus). Determine the elements of sub-matrix  $J_1$  and  $J_4$  of Jacobian matrix  $J_1$  in NR load flow equation in polar form.

PART -- B

- 5 a. Draw and explain the following:
  - i) Input-output curve
  - ii) Cost curve
  - iii) Incremental cost curve
  - iv) Heat rate curve.

(08 Marks)

b. The fuel costs of 2 units are given by

$$F_1 = 1.5 + 20P_1 + 0.1 P_1^2 Rs/hr$$

$$F_2 = 1.9 + 30P_2 + 0.1 P_2^2 \text{ Rs/hr}$$

Where P<sub>1</sub> and P<sub>2</sub> are in MW. Neglecting losses find the optimal scheduling when the total demand is 200MW and the corresponding total cost in Rs./hr. If the total load is shared equally by the generating units find the difference in the total cost in Rs./hr. (12 Marks)

- 6 a. Indicating the assumptions made, derive the equations for general loss formula co-efficients and the transmission loss. (10 Marks)
  - b. For a 2 plant system;  $B_{11} = 0.0015$ ,  $B_{12} = -0.0005$ ,  $B_{22} = 0.0025$ ,  $\frac{dF_1}{dP_1} = 0.01P_1 + 2$ ;

 $\frac{dF_2}{dP_2} = 0.01R + 1.5$ . The objective is to determine the operating scheduling corresponding to

 $\lambda = 26$ . Using iterative method determine at the end of first iteration  $P_1$ ,  $P_2$ , total transmission loss and the total power received. (10 Marks)

- 7 a What is transient stability analysis? What are the assumptions and simplifications made during this study? (08 Marks)
  - b. With the help of neat figures and equations explain point-by-point method of solving swing equation.

    (12 Marks)
- 8 a. Draw the flow chart for transient stability analysis using modified Euler's method. (10 Marks)
  - b. Write the algorithm for Runge-Kutta method of solving swing equation. (10 Marks)

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