



- 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:  
 $Y_{11} = Y_{22} = Y_{33} = 24.23 \angle -75.95^\circ$  pu  
 $Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13 \angle 104.04^\circ$  pu  
 Bus voltages are;  
 $V_1 = 1.04 \angle 0^\circ$  pu (slack bus);  $V_2 = 1 \angle 0^\circ$  (PQ bus);  $V_3 = 1.04 \angle 0^\circ$  (pv bus). Determine the elements of sub-matrix  $J_1$  and  $J_4$  of Jacobian matrix  $J$  in NR load flow equation in polar form. (10 Marks)

## 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  
 $F_2 = 1.9 + 30P_2 + 0.1 P_2^2$  Rs/hr  
 Where  $P_1$  and  $P_2$  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;  $B_{11} = 0.0015$ ,  $B_{12} = -0.0005$ ,  $B_{22} = 0.0025$ ,  $\frac{dF_1}{dP_1} = 0.01P_1 + 2$ ;  
 $\frac{dF_2}{dP_2} = 0.01P_2 + 1.5$ . The objective is to determine the operating scheduling corresponding to  $\lambda = 2.6$ . 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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