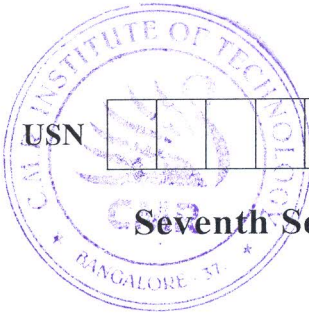


# CBCS SCHEME



17EE71

## Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Power System Analysis – II

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. With usual notations, prove that  $Y_{Bus} = A^{-1}[y]A$  using singular transformation. (06 Marks)  
 b. For the network graph shown in Fig Q1(b), Obtain  $Y_{bus}$  using singular Transformation, self admittances of the elements are mentioned in the graph.

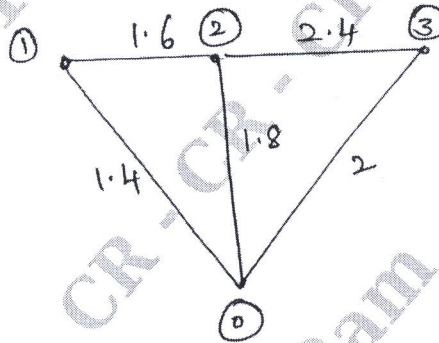


Fig Q1(b)

(06 Marks)

- c. In the power system network shown in Fig Q1(c) the slack bus voltage is  $(1 + j0)$ . The voltage magnitude at bus 2 is maintained at 1.05pu and the Q generation at this bus is limited between 0.0 and 0.5pu. Determine the voltage at the buses by the end of first iteration using G-S method  $Z_{12} = 0.04 + j0.12$   $Z_{23} = 0.02 + j0.03$  pu.

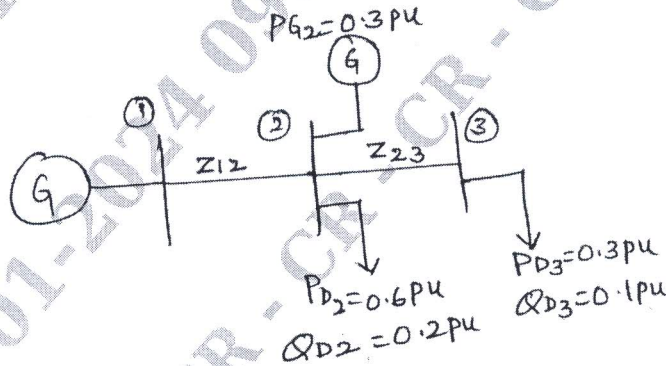


Fig Q1(c)

(08 Marks)

### OR

- 2 a. Explain how buses are classified to carryout load flow analysis. (04 Marks)  
 b. Obtain  $Y_{Bus}$  by singular Transformation method for the system having following data :

Element No.	1	2	3	4	5	6	7
Bus code	0-1	0-2	0-4	3-4	2-3	1-2	2-4
Impedance in pu	j.04	j0.25	j.01	-j0.2	j0.5	j0.3	j0.2

(06 Marks)

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.

- c. The voltage magnitude at bus 2 is to be maintained at 1.03pu with bus 1 as slack bus. Compute voltage at the end of first iteration using G-S technique. Give  $0 < Q_2 < 35$  MVar, Base MVA = 100. Acceleration factor = 1.4, For the system shown in Fig Q2(c), The bus data is as follows :

Bus	Voltage Pu	Generation		Load	
		P <sub>G</sub>	Q <sub>G</sub>	P <sub>D</sub>	Q <sub>D</sub>
1	1.05	-	-	-	-
2	1.03	20	-	50	20
3	1.0	-	-	60	25

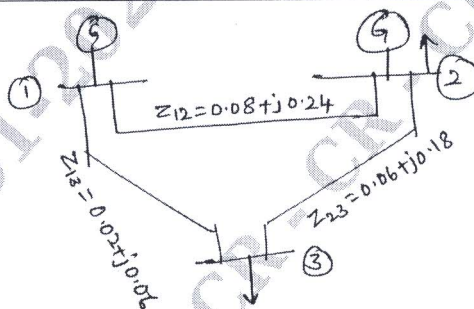


Fig Q2(c)

(10 Marks)

**Module-2**

- 3 a. Derive the expression for diagonal elements of Jacobian matrix in NR method of load flow analysis. (06 Marks)
- b. For a 3 bus system, the elements of  $Y_{bus}$  are as follows :  
 $Y_{11} = Y_{22} = Y_{33} = 24.23 - j75.95$  pu  
 $Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13 - j40.04$  pu.  
 The bus voltage are  $V_1 = 1.04 + j0$ pu (slack bus)  $V_2 = 1 + j0$ pu (PQ bus) and  $V_3 = 1.04j0$ pu (PV bus). Determine the elements of submatrix  $J_1$  and  $J_4$  of Jacobian matrix in NR load flow education. (08 Marks)
- c. Explain any two methods of control of voltage profile. (06 Marks)

OR

- 4 a. Starting from all the assumptions, deduce the fast decoupled load flow model. (10 Marks)
- b. Explain the algorithm for Newton Raphson load flow. (10 Marks)

**Module-3**

- 5 a. Deduce the condition for optional load dispatch considering transmission losses in a system. (06 Marks)
- b. The fuel input/hour of plant 1 and 2 are given by  
 $F_1 = 0.2 P_1^2 + 40P_1 + 120$ Rs/h  
 $F_2 = 0.25 P_2^2 + 30P_2 + 150$ Rs/h  
 Determine the economic scheduling neglecting the losses for a load of 180mW. Also calculate cost of production of 180mW for the obtained schedule. (06 Marks)
- c. State unit commitment problem. Describe the dynamic programming method for computation of optimal unit commitment. (08 Marks)

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OR

- 6 a. With usual notation, derive the generalized transmission loss formula and B-coefficients. (10 Marks)
- b. Calculate the loss coefficient in pu and MW<sup>-1</sup> on a base of 50MVA for the network shown in Fig Q6(b)
- $I_a = 1.2 - j0.4$ ,  $I_b = 0.4 - j0.2$ ,  $I_c = 0.8 - j0.1$  ;  
 $I_d = 0.8 - j0.2$ ,  $I_e = 1.2 - j0.3$   
 $Z_a = 0.02 + j0.08$ ,  $Z_b = 0.08 + j0.32$ ,  $Z_c = 0.02 + j0.08$   
 $Z_d = 0.03 + j0.12$ ,  $Z_e = 0.03 + j0.12$  ;  $V_{ref} = 1 \angle 0^\circ$

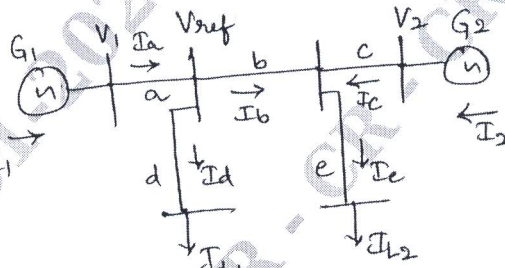


Fig Q6(b) (10 Marks)

**Module-4**

- 7 a. Explain hydrothermal scheduling in brief with the mathematical formula. (06 Marks)
- b. Explain System security static with a block diagram. (06 Marks)
- c. Explain the following : (08 Marks)
- i) Generation shift distribution factor
  - ii) Line outage distribution factor

OR

- 8 a. Explain the following : (06 Marks)
- i) Loss of load probability
  - ii) Frequency and duration of state
- b. Explain with flow chart optimal load flow solution. (06 Marks)
- c. Describe the power system security assessment and modeling for contingency analysis. (08 Marks)

**Module-5**

- 9 a. Explain the Z<sub>bus</sub> building algorithm for addition of a link to the partial network with no mutual coupling. (10 Marks)
- b. Explain the solution of swing equation by Runge-Kutta order 4 methods. (10 Marks)

OR

- 10 a. Explain the solution of swing equation by point – by point method. (10 Marks)
- b. Obtain Z<sub>bus</sub> by building algorithm for the system shown in Fig 10(b). All the impedance are in pu. Add the elements in the order of element numbers.

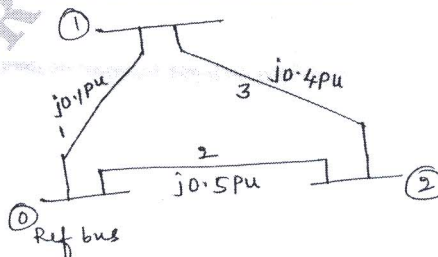


Fig Q10(b) (10 Marks)