CBCS SCHEME

USN

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.*

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.

Module-1

1 a. With usual notations, prove that $Y_{Bus} = A^T[y]A$ 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.

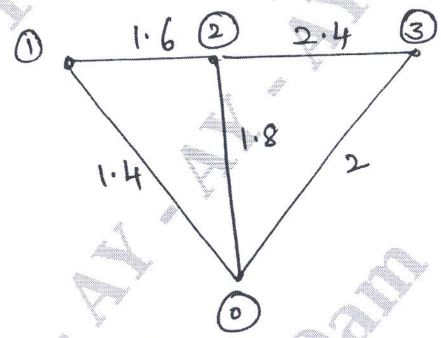

Fig Q1(b) (06 Marks)

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.

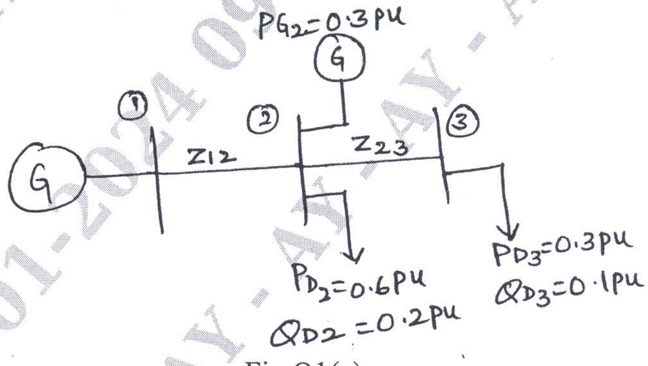

Fig Q1(c) (08 Marks)

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)

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_G	Q_G	P_D	Q_D
1	1.05	-	-	-	-
2	1.03	20	-	50	20
3	1.0	-	-	60	25

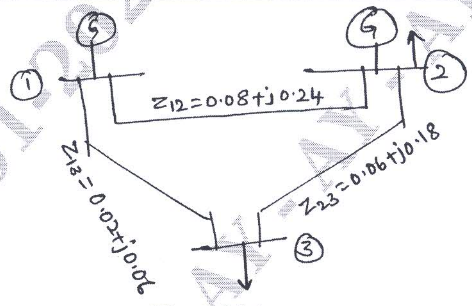

Fig Q2(c) **(10 Marks)**

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 :

$Y_{11} = Y_{22} = Y_{33} = 24.23 \angle -75.95$ pu

$Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13 \angle 104.04$ 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 educations. **(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 land 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

$F_1 = 0.2\ P_1^2 + 40P_1 + 120 \text{Rs/h}$

$F_1 = 0.25 P_2^2 + 30P_2 + 150 \text{Rs/h}$

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)**

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^{-1} on a base of 50MVA for the network shown in Fig Q6(b)

$I_a = 1.2 - j0.4$, $I_b = 04 - j0.2$, $I_c = 0.8 - j0.1$;

$I_d = 0.8 - j0.2$, $I_c = 1.2 - j0.3$

$Z_a = 0.02 + j0.08$, $Z_b = 0.08 + j0.32$, $Z_c = 0.02 + j0.08$

$Z_d = 0.03 + j0.12$, $Z_e = 0.03 + j0.12$; $V_{ref} = 1\underline{|0^\circ}$

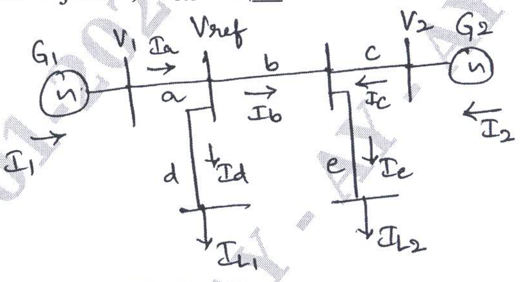

Fig Q6(b) **(10 Marks)**

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 :

i) Generation shift distribution factor

ii) Line outage distribution factor **(08 Marks)**

OR

8 a. Explain the following :

i) Loss of load probability

ii) Frequency and duration of state **(06 Marks)**

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_{bus} 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_{bus} 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.

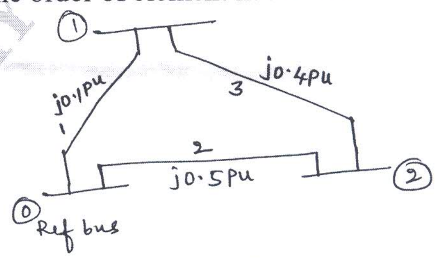

Fig Q10(b) **(10 Marks)**