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Course Code

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Seventh Semester B.E. Degree Examinations, February 2025

POWER SYSTEM ANALYSIS-2

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any, may be suitably assumed

Q. No Question Marks (RBTL:CO:PI)

Module-1

1. a. Formulate following incidence matrices for the system data shown in Fig. Q1(a). 08 (3 : 1 : 2.1.2)
Q1(a).
(i) [A] (ii) [B] (iii) [C] (iv) [K].

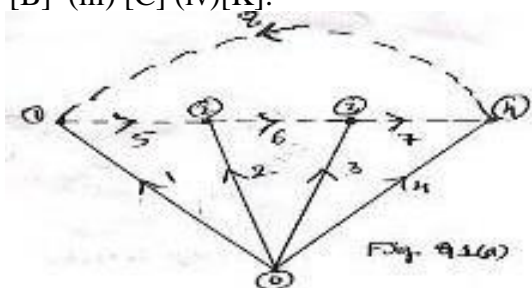


Fig. Q1(a)

- b. Define a primitive network. Give the representation of primitive network in impedance and admittance form. Obtain the performance equations in both the cases. 06 (2 : 1 : 1.2.1)
- c. Formulate Bus admittance matrix for the system data obtained from Fig. Q1(c) by singular transformation analysis. 06 (3 : 1 : 2.1.2)

Element No	1	2	3	4	5	6
Reactance in PU	0.1	0.2	0.5	0.25	0.5	0.1

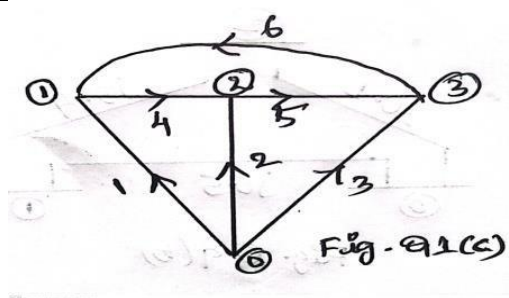


Fig. Q1(c)

(OR)

2. a. Formulate following incidence matrices for the system data shown in Fig. Q2 (a). Select node 1 as reference node. 08 (3 : 1 : 2.1.2)
Q2 (a). Select node 1 as reference node.
(i) [A] (ii) [B] (iii) [C] (iv) [K].

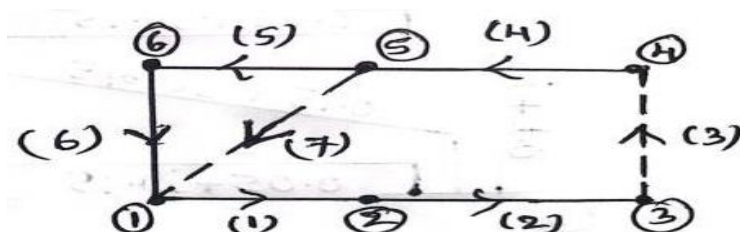


Fig. Q2(a)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

- b. Derive an expression of Bus admittance matrix by singular transformation method. 06 (2 : 1 : 1.4.1)
- c. Formulate Bus admittance matrix for the system data shown in Fig. Q2(c) by singular transformation analysis. 06 (3 : 1 : 2.1.2)

	Reactance in PU
Generator	$0.1+j0.1$
Line	$0.1+j0.2$

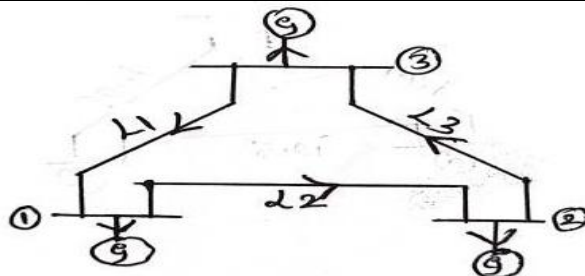


Fig. Q2(c)

Module-2

3. a. For the following given data and network shown in the Fig. Q3 (a) find out the voltage magnitude and angles at the end of 1st Gauss Seidel Iterative Method. Also find the Real and reactive power at slack bus. 10 (3 : 2 : 2.1.2)

Bus No	Type	Generation		Load		Bus voltage	
		P_{GP}	Q_{GP}	P_{DP}	Q_{DP}	V	δ
1	Slack	-	-	-	-	1.06	0
2	P-Q	2.0	1.0	1.0	0.5	-	-
3	P-Q	3.5	2.0	2.5	1.0	-	-

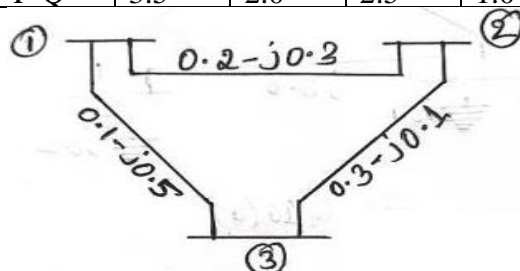


Fig. Q3(a)

- b. Illustrate the steps following in Gauss-Seidel iterative method of load flow analysis. 10 (2 : 2 : 1.2.1)

(OR)

4. a. For the following given data and network shown in Fig. Q4 (a), find out the voltage magnitude and angles at the end of 1st Gauss Seidel iterative method. Also find the real and reactive power at slack bus. 10 (3 : 2 : 2.1.2)

Bus No	$P_i(\text{pu})$	$Q_i(\text{pu})$	$V_i(\text{pu})$	Remarks
1	-	-	$1.06 \angle 0$	Slack bus
2	0.5	-0.2	-	P-Q bus
3	-1	0.5	-	P-Q bus
4	0.3	-0.1	-	P-Q bus

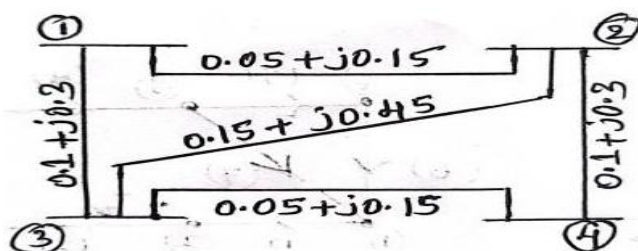


Fig. Q4(a)

- b. For the following given data and network shown in the Fig. Q 4(b), find out the voltage magnitude and angles at the end of 1st Gauss Seidel Iterative Method. Also find the currents in each branch and total loss in the system. 10 (3 : 2 : 2.1.2)

Bus No	Pi(pu)	Qi(pu)	Vi(pu)	Remarks
1	-	-	1.04 \angle 0	Slack bus
2	1.0	0.5	-	P-Q bus
3	1.0	1.0	-	P-Q bus

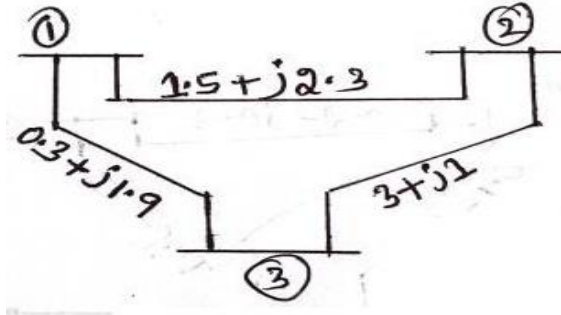


Fig. Q4(b)

Module-3

5. a. Compare G-S, N-R, LDF & FDLF methods of load flow analysis. 10 (2 : 3 : 1.2.1)
b. Write an algorithm for N-R Iterative method of load flow analysis. 10 (2 : 3 : 1.2.1)
(OR)
6. a. Derive an expressions for diagonal elements of NR Jacobian submatrices in polar form. 12 (2 : 3 : 1.2.1)
b. With suitable assumptions, Derive an expression for fast decoupled load flow method. 08 (2 : 3 : 1.2.1)

Module-4

7. a. The fuel input in Rs/hr for a plant 1 and 2 are given by: 10 (3 : 4 : 2.1.2)
 $C_1 = (0.1P_1^2 + 20P_1 + 1.5)$ $C_2 = (0.1P_2^2 + 30P_2 + 1.9)$
The minimum and maximum loads on each unit are 10 MW and 125 MW respectively. (i) Determine the optimal generation of 2-units for a total demand of 200 MW and the corresponding cost. (ii) State the inference after arriving at the saving for 2 years realized as compared to equal sharing of total load between the two units.
b. Illustrate the constraints of unit commitment along with the definition. 10 (2 : 4 : 1.2.1)
(OR)

8. a. Calculate the B-coefficients of the system shown in Fig. Q8 (a) in PU. 10 (3 : 4 : 2.1.2)
All are in pu.
 $I_a = 1.2 - j0.4$, $I_b = 0.4 - j0.2$, $I_c = 0.8 - j0.1$, $I_d = 0.8 - j0.2$, $I_e = 1.2 - j0.3$
 $Z_a = 0.02 + j0.08$, $Z_b = 0.08 + j0.32$, $Z_c = 0.02 + j0.08$, $Z_d = 0.03 + j0.12$, $Z_e = 0.03 + j0.12$

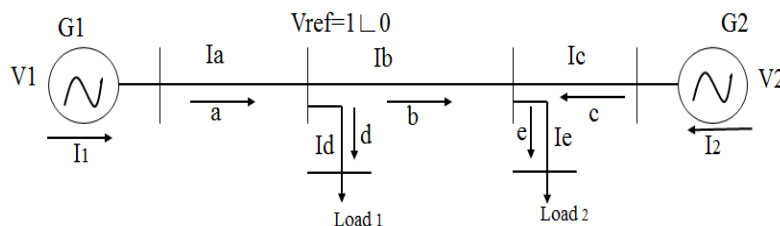


Fig. Q8(a)

- b. Derive an expression for transmission loss for two plant system. 10 (2 : 4 : 1.2.1)

Module-5

9. a. Explain the steps of solving of swing equation by Runge-Kutta method. 10 (2 : 5 : 1.2.1)
- b. Formulate ZBUS by step by step method for the given network shown in Fig. Q9 (b). Take 0 as the reference bus. Add the elements in the order 0-1, 1-2 and 0-2. 10 (3 : 5 : 2.1.2)

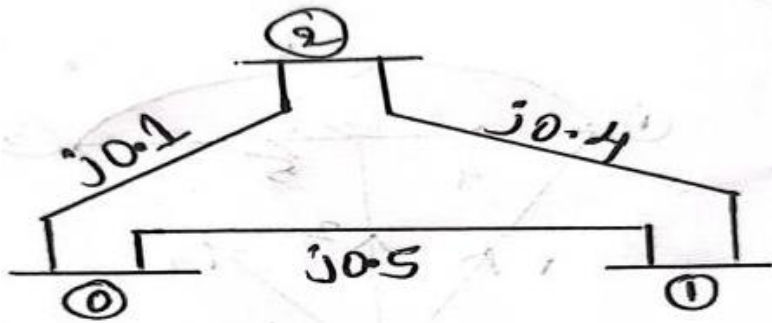


Fig. Q9(b)

(OR)

- 10 a. Formulate ZBUS by step-by-step method for the given network shown below Fig. Q10(a). Select elements 3 and 6 as links. 10 (3 : 5 : 2.1.2)

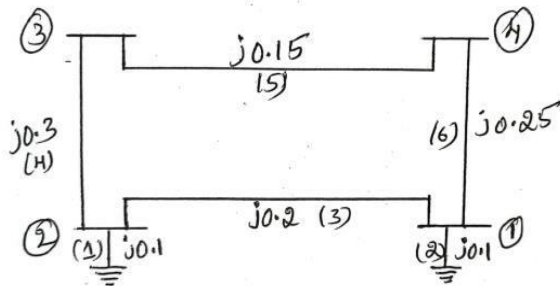


Fig. Q10(a)

- b. Explain the steps of solving of swing equation by point-by-point method. 10 (2 : 5 : 2.1.2)

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