

CBCS SCHEME

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21EE62

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025 Power System Analysis – 2

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain with an example of the following :
 i) Oriented graph ii) Basic cutsets iii) Basic loops. (06 Marks)
 b. With usual notations prove that $Y_{BUS} = A^T[Y]A$ using singular transformation method. (06 Marks)
 c. For the power system shown in Fig.Q1(c) select ground as reference and a tree for which link elements are 1-2, 1-4, 2-3, 3-4. Obtain basic cutset and basic loop incidence matrices. Verify the relation $C_b = B_l^T$.

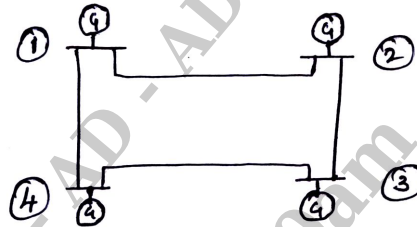


Fig.Q1(c)

(08 Marks)

OR

- 2 a. What is primitive network? Give the representation of a typical component and arrive at their performance equation in impedance and admittance form. (07 Marks)
 b. For a power system shown in Fig.Q2(b) below, obtain Y_{BUS} using singular transformation method by considering Bus(4) as reference bus.

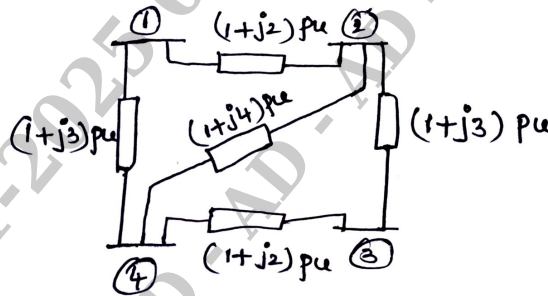


Fig.Q2(b)

(08 Marks)

- c. For the sample network shown in Fig.Q2(c). Obtain bus admittance matrix by using inspection method $[Y_{BUS}]$.

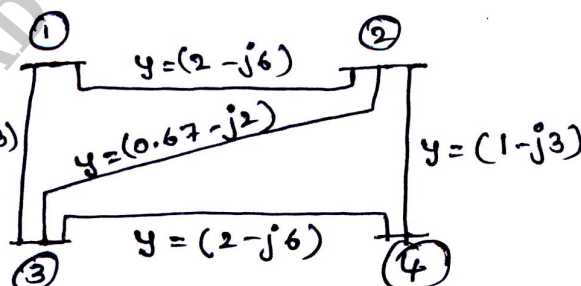


Fig.Q2(c)

(05 Marks)

Module-2

- 3 a. Derive the expressions for power flow-equations used in load flow analysis. (08 Marks)
 b. What are different types of buses, considered during load flow analysis? Explain briefly. (06 Marks)
 c. Why load flow analysis in power system is necessary? Explain. (06 Marks)

OR

- 4 a. Explain the load flow solution procedure of Gauss-Seidel method for a power system having PQ and PV buses with 'Q' limits. (10 Marks)
 b. For the sample power system shown in Fig.Q4(b), all buses except slack bus are PQ buses. Calculate the voltages at end of 1st iteration using Gauss-Seidel load flow [GSLF] method.

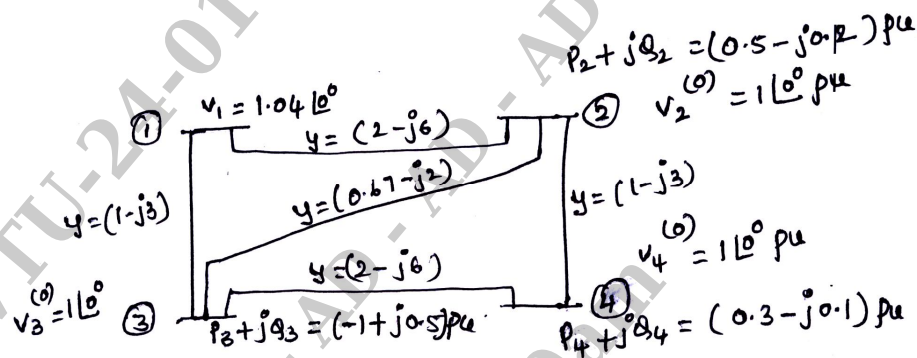


Fig.Q4(b)

(10 Marks)

Module-3

- 5 a. Compare NR and method for load flow analysis. (06 Marks)
 b. Derive the expressions of diagonal elements of Jacobian matrices in NR method of load flow analysis. (08 Marks)
 c. Starting from all the assumptions deduce the Fast Decoupled Load Flow (FDLF) method. (06 Marks)

OR

- 6 a. Explain with flow chart and equation how the load flow analysis is carried out using Newton – Raphson Load Flow [NRLF] method. (10 Marks)
 b. For a 3-bus system, the elements of Y_{BUS} are as follows :

$$Y_{11} = y_{22} = Y_{33} = 24.23 \angle -75.95^\circ \text{ pu} ; Y_{12} = Y_{13} = Y_{21} = Y_{23} = Y_{31} = Y_{32} = 12.13 \angle 104.04^\circ \text{ pu}.$$

The bus voltages are $V_1 = (1.04 + j0) \text{ pu}$ (Slack), $V_2 = (1 + j0) \text{ pu}$ (PQ Bus), $V_3 = (1.04 + j0) \text{ pu}$ (PV bus). Determine the elements of sub matrix J_1 and J_4 of Jacobian matrix in NR load flow method. (10 Marks)

Module-4

- 7 a. Derive the expression for economic dispatch with transmission losses neglected. (06 Marks)
 b. Write a brief note on the performance curves of a thermal power station for economic load dispatch studies. (06 Marks)
 c. A power plant consisting of two units.
 $C_1 = 0.05 p_1^2 + 20P_1 + 800 \text{ Rs/hr}$
 $C_2 = 0.06P_2^2 + 20P_2 + 900 \text{ Rs/hr}$
 Find the total yearly saving in fuel cost in rupees. For optimal scheduling of a load of 150Mw as compared to equal distribution of same load between them. (08 Marks)

OR

- 8 a. What are the transmission line loss co-efficients? Derive an expression for transmission loss as a function of plant generation for a two plant system. (10 Marks)
- b. Explain how dynamic programming is applied to obtain unit commitment. (10 Marks)

Module-5

- 9 a. Obtain the generalized algorithm expression for bus impedance matrix elements when a link is added to the partial network. Also discuss the special cases. (10 Marks)
- b. Explain clearly the point-by-point method of solving swing equation. Mention the assumptions made. (10 Marks)

OR

- 10 a. Obtain Z_{BUS} by building algorithm for the system shown in Fig.Q10(a). all value are in pu. (impedance).

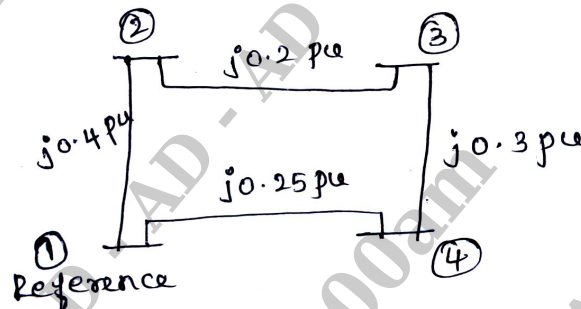


Fig.Q10(a)

- b. Discuss the methodology of using Runge-Kutta technique for transient stability studies of a power system. (10 Marks)
