CBCS SCHEME

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18EE71

Seventh Semester B.E. Degree Examination, June/July 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. Define (i) Graph (ii) Tree (iii) Loop , with an example. **(06 Marks)**

b. For the sample power system shown in Fig.Q1(b), obtain $\hat{A}$, A, K, B, $\hat{B}$, C and $\hat{C}$. Take link elements as 4 and 5 and bus 1 as reference. Verify $A_\ell k^t = B_\ell$; $C_b = -B_\ell^t$.

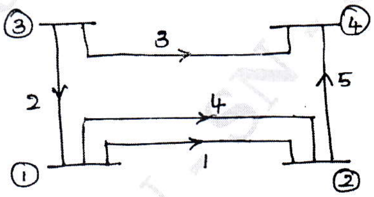

Fig.Q1(b) **(14 Marks)**

OR

2 a. Prove that $Y_{BUS} = A^t[y]A$ with usual notations. **(08 Marks)**

b. Obtain Y_{BUS} using singular transformation method for the system shown in Fig.Q2(b). Verify the obtained Y_{BUS} by inspection method.

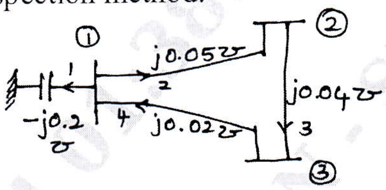

Fig.Q2(b) **(12 Marks)**

Module-2

3 a. Write a note on :

(i) Load Flow Analysis (ii) Classification of Buses **(10 Marks)**

b. Consider a three-bus system. The specifications at various buses are given in the table. Each line impedances $Z_L = j0.25$ pu. Neglect shunt admittances of all lines.

Busi	Type	$\lvert V_i \rvert$ pu	S_i	Injected Powers	
				P_i	Q_i
1	Slack	1	0	-	-
2	PQ	?	?	-0.5	-0.4
3	PV	0.9	?	0.5	-

Find V_2, S_2 and S_3 at the end of first iteration using Gauss-Siedel method. **(10 Marks)**

OR

4 a. Write the importance of acceleration factor during analysis. **(04 Marks)**

b. Briefly discuss on operating constraints. **(04 Marks)**

c. For the sample system shown, the data is shown in the Fig.Q4(c). All the buses other than the slack are PQ type. Assuming a flat voltage start, find the voltages and bus angles at the 3 buses at the end of the first GS iteration. Line data in impedance form.

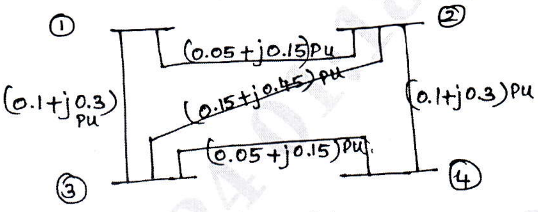

Fig.Q4(c) **(12 Marks)**

Module-3

5 a. Write a flow charts for the solution of the load flow by NR method. **(06 Marks)**

b. Obtain the voltages at all buses for the system shown in Fig.Q5(b) at the end of first iteration by NR method.

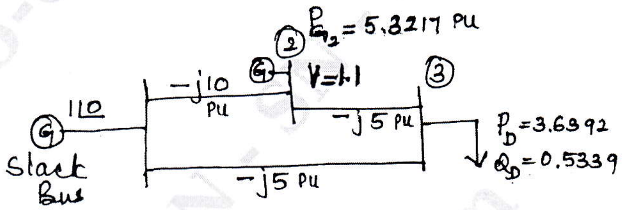

Fig.Q5(b)

The line data mentioned are in admittances. **(14 Marks)**

OR

6 a. Write an algorithm for the solution of load flow by FDLF method. Mention the assumptions made to get faster solution by FDLF. **(10 Marks)**

b. Compare Gauss-Siedel, Newton Raphson and Fast Decoupled Load Flow methods. **(10 Marks)**

Module-4

7 a. Deduce an expression for economic dispatch including transmission losses. **(06 Marks)**

b. Incremental fuel costs in rupees per MWh for a plant consisting of two units are,

$$dC_1 \mid dP_{G1} = 0.2\ PG_1 + 40$$
$$dC_2 \mid dP_{G2} = 0.4\ PG_2 + 30$$

and the generate limits are as follows:

$$30\ MW \leq P_{G1} \leq 175\ MW$$
$$20\ MW \leq P_{G2} \leq 125\ MW$$

Assume that both units are operating at all times. How will the load be shared between the two units as the system load varies over the full range of load values? What are the corresponding values of the plant incremental costs? **(10 Marks)**

c. Write a note on Input-Output curve and heat rate curve. **(04 Marks)**

OR

8 a. Derive an expression for transmission loss as a function of plant generation for a two plant system. **(08 Marks)**

b. Write a Dynamic Programming flowchart/algorithm for unit commitment problem. **(04 Marks)**

c. For the given sample system shown in Fig.Q8(c) the branch currents and impedances are ;

$I_a = 2 - j0.5$ pu ; $Z_a = 0.015 + j0.06$ pu
$I_b = 1.6 - j0.4$ pu ; $Z_b = 0.015 + j0.06$ pu
$I_c = 1 - j0.25$ pu ; $Z_c = 0.01 + j0.04$ pu
$I_d = 3.6 - j0.9$ pu ; $Z_d = 0.01 + j0.04$ pu

Calculate the loss formula co-efficients of the system in pu. The reference bus voltage is $1.0\angle 0^\circ$.

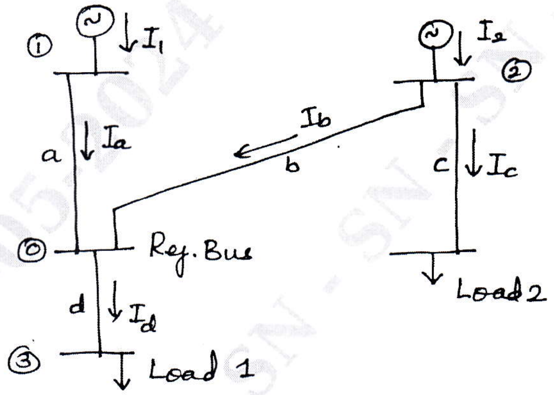

Fig.Q8(c) **(08 Marks)**

Module-5

9 a. Derive the generalized algorithm for finding the elements of bus impedance matrix when a branch is added to the partial network. **(10 Marks)**

b. Form Z_{BUS} using building algorithm for the power system shown in Fig.Q9(b). Add the elements in the order specified on the figure. Self impedance of elements are marked on the figure and take bus-1 as reference bus.

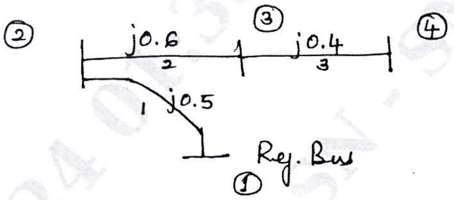

Fig.Q9(b) **(10 Marks)**

OR

10 a. With the necessary equations, explain the solution of swing equation by point by point method along with graphical representation. **(10 Marks)**

b. Explain in detail the steps involved in numerical solution of swing equation by Range-Kutta method. **(10 Marks)**

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