Subject: Power System Analysis – 2 **Subject Code: 15EE71**

Model Question Paper

<table>
<tr><th>Q. No.</th><th>Question</th><th>Marks</th></tr>
<tr><td>1. a</td><td>Define a primitive network. Formulate Y_{Bus} by singular transformation method.</td><td>8</td></tr>
<tr><td>b.</td><td>In the power system shown in Fig. Q1(b), line 1-2 has the series impedance of (0.04+j0.12) pu with negligible line charging. The generation and load data is given in the table.
<table>
<tr><td>Bus No.</td><td>Type</td><td colspan="2">Generation (pu)</td><td colspan="2">Load (pu)</td></tr>
<tr><td>1</td><td>Slack</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>2</td><td>PV</td><td>0.3</td><td>-</td><td>0.6</td><td>0.2</td></tr>
</table>
The slack bus voltage is (1+j0). The voltage magnitude at bus 2 is to be maintained at 1.05 pu and the generator at this bus has Q-generation limits between 0 and 0.5 pu. With (1+ j0) pu initial voltage at bus 2, determine its voltage at the end of first iteration, using GS load flow model.

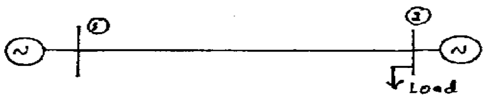


Fig. Q1(b)</td><td>8</td></tr>
<tr><td colspan="3">Or</td></tr>
<tr><td>2. a.</td><td>Develop the Gauss-Seidel load flow model for a power system with a slack bus and (n-1) number of PQ buses. Write the flow chart of the algorithm.</td><td>8</td></tr>
<tr><td>b.</td><td>Determine Y_{Bus} by singular transformation for the system with data as below:
<table>
<tr><td>Element No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Bus Code p-q</td><td>0-1</td><td>0-2</td><td>2-3</td><td>3-0</td><td>2-0</td></tr>
<tr><td>Self-admittance in pu</td><td>1.4</td><td>1.6</td><td>2.4</td><td>2.0</td><td>1.8</td></tr>
</table></td><td>8</td></tr>
<tr><td>3.a</td><td>Derive expressions for diagonal elements of NR jacobian submatrices in polar form.</td><td>8</td></tr>
<tr><td>b.</td><td>In a two bus system shown in Fig. Q3(b), bus 1 is slack bus with $V_1=1.0\angle 0$ pu and bus 2 is a load bus with P = 100 MW, Q = 50 MVar. The line impedance is (0.12+j0.16) pu on a base of 100 MVA. Using NR load flow method compute $|V_2|$ and δ_2 after one iteration.

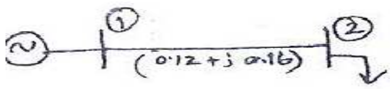
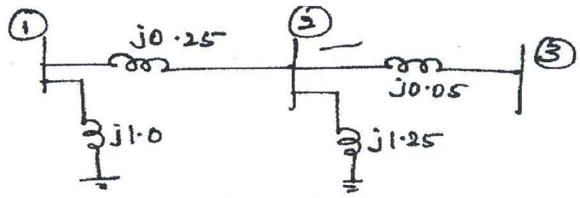


Fig. Q3(b)</td><td>8</td></tr>
<tr><td colspan="3">Or</td></tr>
<tr><td>4.a</td><td>Explain the algorithm with fast decoupled load flow analysis, clearly stating all the assumptions mad.</td><td>8</td></tr>
<tr><td>b.</td><td>Explain how the voltage profile is controlled in an interconnected power system (i) by adjusting generator excitation, (ii) by VAR generators</td><td>8</td></tr>
<tr><td>5.a.</td><td>Draw and explain the following:
i) Input-Output curve
ii) Cost Curve</td><td>8</td></tr>
</table>

	iii) Incremental cost curve iv) Heat rate curve	
b.	The incremental fuel costs in Rs/MWh for a plant consisting of two units are $\frac{dF_1}{dP_{G1}} = 0.1P_{G1} + 20, \frac{dF_2}{dP_{G2}} = 0.12P_{G2} + 15.$ Assume that both units are operating at all times. Determine i) The most economical division of load between the generators for a constant load of 300 MW. ii) The saving in Rs./ day obtained compared to equal load sharing between the	8
Or		
6.a.	Derive the coordination equations for economic load dispatch in a thermal power system with the consideration of transmission losses.	8
b.	Describe dynamic programming method for computation of optimal Unit Commitment.	8
7.a	Write a flow chart for the optimal load flow solution.	8
b.	Explain the state space method used for power system reliability evaluation. Explain Loss Of Load Probability (LOLP)	8
Or		
8.a.	Discuss the optimal scheduling of hydrothermal system.	8
b.	Explain power system security assessment and modelling for contingency analysis	8
9.a.	Derive the generalized algorithm for finding the elements of bus impedance matrix when a link is added.	8
b.	Discuss the steps for determining multimachine stability.	8
Or		
10.a.	Explain point by point method of solving swing equation.	8
b.	Form the Z_{Bus} for the power system shown in Fig. Q10 (b) using Z_{Bus} building algorithm. Select ground node as reference. The line reactances are in pu. 	8

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