U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. | **Semester: VI**
Branch: Electrical and Electronics Engineering | **Duration: 3 hrs.**
Course Code: 22EE6PCCAP | **Max Marks: 100**
Course: Computer Applications in Power Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

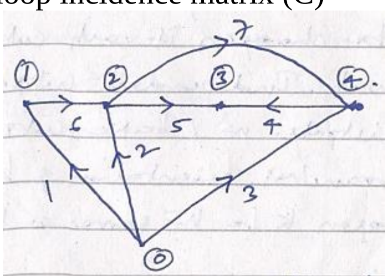
<table>
<tr><th></th><th></th><th>UNIT - I</th><th>CO</th><th>PO</th><th>Marks</th></tr>
<tr><td>1</td><td>a)</td><td>Explain the following terms in network topology with an example
i. Tree ii. Basic loops iii. Basic cut-sets</td><td>CO1</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td>b)</td><td>Derive an expression for formation of bus admittance matrix (Y_{BUS}) by singular transformation.</td><td>CO1</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td>c)</td><td>For the data shown in Table 1. (c), Obtain Ybus by inspection method.
<table>
<tr><th>Line</th><th>Buses</th><th>Z in pu</th><th>Turns ratio (a)</th></tr>
<tr><td>1</td><td>1-2</td><td>j 0.2</td><td>--</td></tr>
<tr><td>2</td><td>2-3</td><td>j 0.6</td><td>0.95</td></tr>
<tr><td>3</td><td>1-3</td><td>j 0.4</td><td>--</td></tr>
</table>
Table 1. (c)</td><td>CO1</td><td>PO2</td><td>08</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>a)</td><td>How a off-nominal transformer is modelled in formation of Ybus.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td>b)</td><td>The oriented connected graph of a system is shown in Fig. 2. (b) Take ground as reference. Determine the following:
i. Bus incidence matrix (A)
ii. Branch-path incidence matrix (K)
iii. Basic cut-set incidence matrix (B)
iv. Basic loop incidence matrix (C)


Fig. 2. (b)</td><td>CO1</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>UNIT - II</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>a)</td><td>Obtain the generalized algorithm expression for bus impedance matrix elements when a link is added to the partial network.</td><td>CO2</td><td>PO1</td><td>10</td></tr>
</table>

b) For the data given in Table 3. (b), obtain Ybus by singular transformation method. Consider Bus 1 as reference bus. *CO2* *PO2* **10**

Element Number	Buses	Z (pu)	Mutual Z (pu)
1	1-2	j 0.2	
2	2-3	j 0.4	j 0.1 (1)
3	1-3	j 0.6	j 0.1 (1)

Table 3. (b)

OR

4 a) Derive an expression for formation of bus admittance matrix (YBUS) by singular transformation. *CO2* *PO1* **08**

b) The three-bus network is shown in Fig.4. (b) Determine the bus impedance matrix using **Z** building algorithm. *CO2* *PO2* **12**

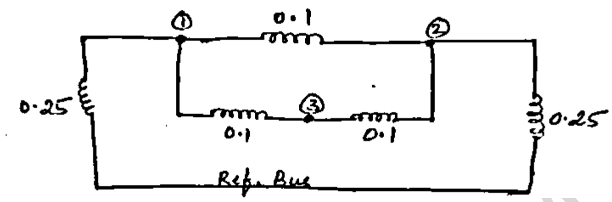


Fig. 4. (b)

UNIT - III

5 a) With the help of a flow chart, explain the Gauss-Seidel method of load flow analysis. *CO3* *PO2* **10**

b) The following is the transmission line data for a load flow study: *CO3* *PO3* **10**

Transmission Line		Impedance (pu)
From	**To**	
1	2	0.05 + j 0.15
1	3	0.10 + j 0.30
2	3	0.15 + j 0.45
2	4	0.10 + j 0.30
3	4	0.05 + j 0.15

The schedule of active (P) and reactive (Q) powers are as follows:

Bus No.	P (pu)	Q (pu)	$|V|$ (pu)
1	--	--	$1.04 \angle 0^0$
2	0.5	- 0.2	--
3	- 1.0	0.5	--
4	0.3	- 0.1	--

Determine the bus voltages at the end of first iteration by applying Gauss-Seidel iteration method. Consider α = 1.2.

OR

6 a) Explain the classification of different types of buses considered during power system load flow analysis. Discuss the significance of slack bus. *CO3* *PO2* **08**

				CO	PO	Marks
		b)	In the power system shown in Fig. 6 (b), line 1-2 has a series impedance of (0.04 + j 0.12) pu with negligible line charging. The generation and load data are given in the Table 6 (b). Here P and Q are in MW and MVAr respectively.	CO3	PO3	**12**

Bus	Type	Generation		Load	
		P	Q	P	Q
1	Slack	--	--	--	--
2	PV	15	--	30	10

Table 6 (b)

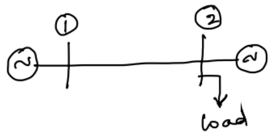


Fig 6 (b)

Slack bus voltage is (1+j0) pu. Voltage at bus 2 is 1.05 pu and the generator at this bus has Q generation limits between 0 and 25 MVAr. Determine its voltage at the end of first iteration, using GS method. Consider base MVA as 50.

UNIT - IV

			CO	PO	Marks
7	a)	Draw the flow-chart of Newton-Raphson method of load flow analysis.	CO4	PO2	**08**
	b)	Line data and Bus data are shown in Table 7. (b), obtain voltage at bus 2 at the end of first iteration using FDLF method.	CO4	PO4	**12**

Line Data		
Element Number	Buses	Z (pu)
1	1-2	0.02+ 0.08 i

Bus Data			
Bus Number	P_i (pu)	Q_i (pu)	Voltage
1	--	--	1.06
2	0.2	0.4	--

Table 7. (b)

OR

			CO	PO	Marks
8	a)	With assumptions and flow chart explain FDLF load flow analysis.	CO4	PO2	08
	b)	For a power system shown in Fig 8 (b) obtain Jacobian elements.	CO4	PO4	12

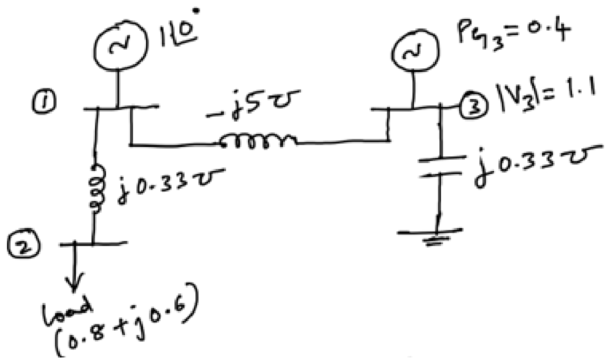
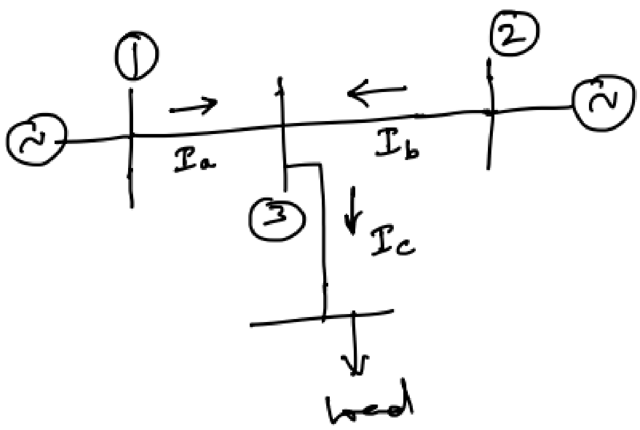


Fig 8(b)

			UNIT – V			
	9	a)	Deduce an expression for transmission loss and its B-coefficients in terms of plant generation capacities for two units delivering a load	*CO5*	*PO2*	**10**
		b)	The operating fuel cost function of three generator units are given as: $\boldsymbol{C_1 = 0.004\,P_1^2 + 7.2\,P_1 + 350}$ **₹/hr** $\boldsymbol{C_2 = 0.0025\,P_2^2 + 7.3\,P_2 + 500}$ **₹/hr** $\boldsymbol{C_3 = 0.003\,P_3^2 + 6.74\,P_3 + 600}$ **₹/hr** The demand is 450 MW. The load is equally shared by three generator units. Determine the following: i. Economic operating schedule ii. Corresponding total cost of generation iii. Saving obtained	*CO5*	*PO3*	**10**
			OR			
	10	a)	Deduce the condition for optimal load dispatch considering transmission losses in a system.	*CO5*	*PO2*	**10**
		b)	Obtain B coefficients for the system shown in Fig 10 (b). (take up to 3 decimals) $I_a = 1\angle 0^0\ pu \qquad Z_a = 0.16\angle 80°\ pu$ $I_b = 0.8\angle 0^0\ pu \qquad Z_b = 0.12\angle 75°\ pu$ $I_c = 1\angle 0^0\ pu \qquad Z_c = 0.18\angle 75°\ pu$ Take $V_1 = 1.2\angle 0^0\ pu$  Fig 10 (b)	*CO5*	*PO3*	**10**

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