U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. | **Semester: VII**
Branch: Electrical and Electronics Engineering | **Duration: 3 hrs.**
Course Code: 19EE7PCPS2 | **Max Marks: 100**
Course: Power Systems-II

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

		UNIT - I	CO	PO	Marks
1	a)	Derive the standard expression $Ybus = A^T[Y]A$ using singular transformation method.	CO2	PO2	**08**
	b)	For a given network shown in Fig 1(b), Obtain Y_{bus} using inspection method. All generators are having a series reactance of j0.02 pu. A shunt capacitor is connected at bus 4 with an admittance value of j0.05 pu.	CO3	PO2	**12**

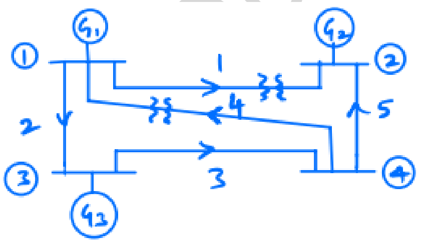


Fig 1(b)

Element No.	Buses (i-j)	Zpq-pq (pu)	(line charging) Ysh (pu)	Off nomial turns ratio
1	1-2	0.02+j0.08	--	0.95
2	1-3	0.02+j0.06	j0.02	-
3	3-4	0.01+j0.05	j0.01	-
4	4-1	0.02+j0.04	--	0.90
5	2-4	0.01+j0.03	j0.03	--

OR

			CO	PO	Marks
2	a)	Form $Ybus$ by singular transformation method for the system shown below. Take bus 1 as reference.	CO2	PO2	**12**

Element No.	**Bus code (p-q)**	**Impedance (Z) in p.u**
1	1-2	j0.15
2	1-3	j0.30
3	2-3	j0.45
4	2-4	j0.30

	b)	How a transformer with off-nominal turns ratio is modelled in power systems?	*CO1*	*PO1*	**08**

UNIT - II

3	a)	What is load flow problem? Explain in detail the different types of buses in a power system. Discuss the significance of slack bus in the load flow studies.	*CO2*	*PO2*	**10**
	b)	The following is the system data for a load flow solution. The line admittance and bus data are given below. Find the voltages at the end of 1^{st} iteration using Gauss-Siedel method by taking α as 1.6.	*CO3*	*PO3*	**10**

Line	Admittance	Bus code	P	Q	V	Remarks
1-2	2-j8	1	-	-	1.06	Slack
1-3	1-j4	2	0.5	0.2	1+j0	PQ
2-3	0.666-j2.664	3	0.4	0.3	1+j0	PQ
2-4	1-j4	4	0.3	0.1	1+j0	PQ
3-4	2-j8	-	-	-	-	-

OR

4	a)	Derive the load flow equations for G.S. Method. List the data essential for the power flow.	*CO2*	*PO2*	**10**
	b)	For the network shown in the Fig. 4(b), obtain the complex bus-bar voltages at the end of first iteration using Gauss-Siedal method. Bus-1 is a Slack bus with $V_1 = 1.0\angle 0^0$ pu. Take $P_2+jQ_2 = -5.96+j1.46$ pu, $P_3 = 6.02$ pu and $\lvert V_3 \rvert = 1.02$ pu. Assume $V_3^0 = 1.02\angle 0^0$ pu and $V_2^0 = 1\angle 0^0$ pu. Given data are in impedance form.	*CO3*	*PO3*	**10**

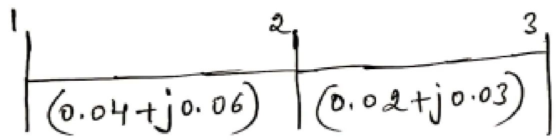


Fig 4(b)

UNIT - III

5	a)	Obtain the expressions of Jacobian of Newton Raphson's power flow model.	*CO2*	*PO2*	**08**
	b)	Obtain voltages at the end of first iteration using FDLF method for Fig. 5(b). Consider base MVA as 100.	*CO2*	*PO3*	**12**

Bus data	Pg (MW)	Qg (MVAr)	Pd (MW)	Qd (MVAr)	Voltage (pu)
1	--	--	--	--	1.05
2	--	--	40	25	--
3	40	?	20	10	1.04

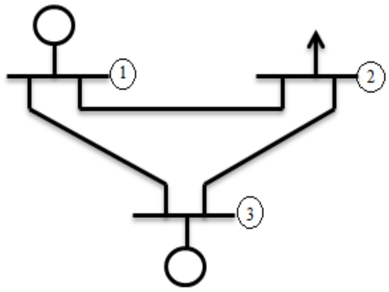


Fig. 5(b)

Line data	Line (p-q)	Zpq	Ysh
1	1-2	0.25+j0.04	J0.05
2	2-3	0.15+j0.03	J0.05
3	1-3	0.30+j0.05	J0.05

OR

6	a)	With flow chart and assumptions, explain FDLF method of load flow analysis.	*CO2*	*PO2*	**10**
	b)	For a power system shown in Fig 6(b) obtain Jacobian elements using NR method of load flow analysis.	*CO2*	*PO3*	**10**

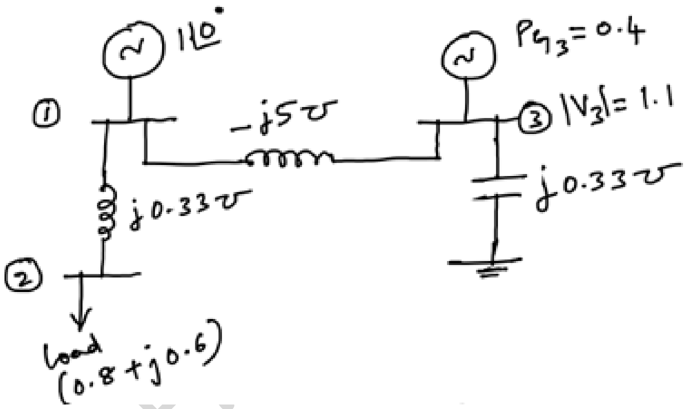
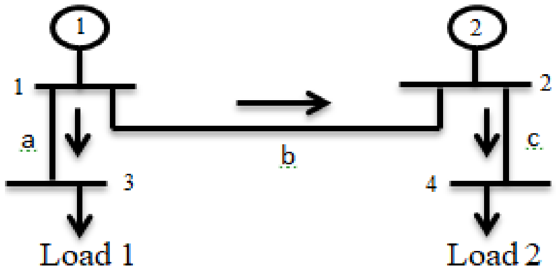
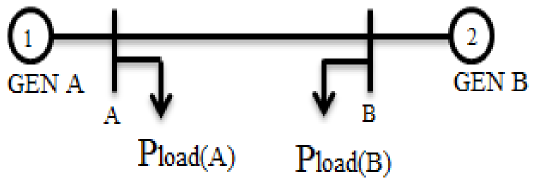


Fig 6(b)

UNIT - IV

7	a)	Define: (i) Penalty factor (ii) Incremental fuel rate	*CO4*	*PO1*	**04**
	b)	The fuel cost of two units are given by, $C_1 = 1.5+20P_{G1}+0.1P_{G1}^2$ Rs/hr, $C_2 = 1.9+30P_{G2}+0.1P_{G2}^2$ Rs/hr. If the total demand is 200 MW, find the economic load scheduling of the two units.	*CO4*	*PO2*	**06**
	c)	Compute the loss co-efficient for the network shown in Fig.7(c) $I_a = 1.6 - j0.4\ pu \quad Z_a = 0.15\angle 85^0\ pu$ $I_b = 1.8 - j0.45\ pu \quad Z_b = 0.15\angle 78^0\ pu$ $I_c = 2 - j0.5\ pu \quad Z_c = 0.25\angle 85^0\ pu$ $consider\ v_1 = 1.2\angle 0^0\ pu$	*CO4*	*PO3*	**10**

			 Fig.7(c)			
			OR			
	8	a)	Derive an expression of B-Coefficients for two generating plants.	*CO4*	*PO1*	**10**
		b)	A two-bus system, without generator limits, has been considered which is shown in Fig. 8(b), where $P_{load\ (A)} = 450\ MW, P_{load\ (B)} = 125\ MW\ and$ $P_{loss} = 0.08(P_{G(A)}) + 10$ $(IFC)_A = 0.06\ P_{G(A)} + 4.0\ Rs/MWh$ $(IFC)_B = 0.07\ P_{G(b)} + 6.0\ Rs/MWh$ Find optimal generator scheduling and power loss in the system.  Fig. 8(b)	*CO4*	*PO3*	**10**
			UNIT - V			
	9	a)	For an isolated power system, consider the following system data Rating of the generator: 250 MW Nominal operating load: 125 MW Inertia constant: 5.0 Sec Speed regulation of the governor: 2.5 % Nominal frequency: 60 Hz. Find a) Gain constant and time constant of ALFC. b) Static frequency change for the uncontrolled case when the load is increased to 150 MW. c) System frequency during change of load. Consider linear change.	*CO2*	*PO3*	**10**
		b)	Explain operating states of power systems with block diagram.	*CO1*	*PO1*	**10**
			OR			
	10	a)	Explain digital system configuration with block diagram.	*CO1*	*PO1*	**10**
		b)	Develop a mathematical model of speed governor system, with block diagram.	*CO2*	*PO1*	**10**

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