U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**

Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

Course Code: 23EE5PCPS1/22EE5PCPSA **Max Marks: 100**

Course: Power System -1

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	Develop an expression for: i. Change the base impedance from one set of base values to another set. (03M) ii. Show that the p.u. equivalent impedance of a two winding transformer is the same whether the calculations are made from H.V. side or the L.V. side. (03M)	CO1	PO1	**06**
1	b	What are the advantages of p.u. systems?	CO1	PO1	**04**
1	c	Draw the p.u. reactance diagram for the system shown in Fig. 1.c below. Choose a base of 22 kV, 100 MVA in the generator circuit. The Three phase load of 57 MVA, 0.6 pf lagging at 10.45 kV. Line 1 and 2 has reactance of 48.4 & 65.3 ohms respectively.	CO1	PO2	**10**
		OR			
2	a	i. What is the need for base value? ii. Write the equation for converting the p.u. impedance expressed in one base to another.	CO1	PO1	**10**

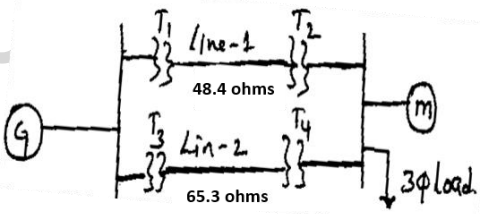
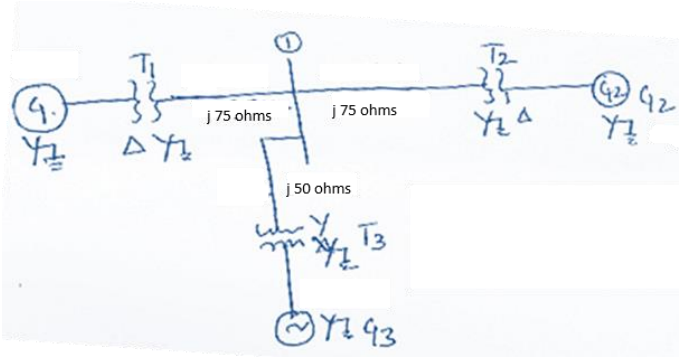
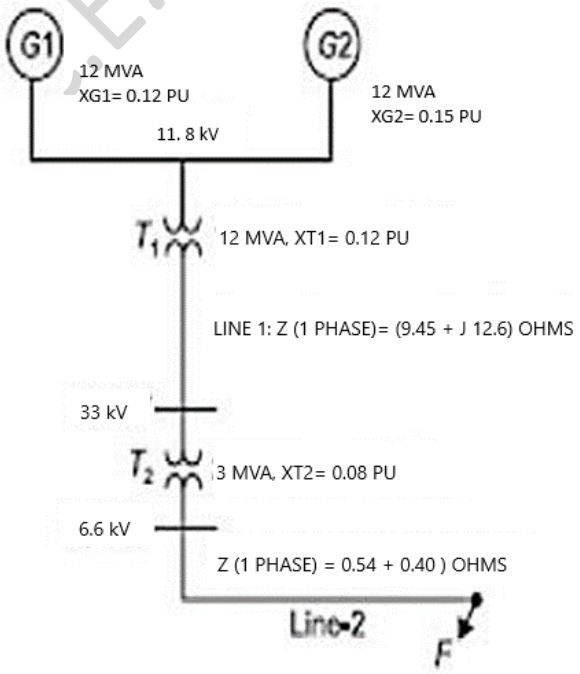
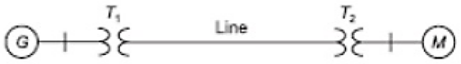
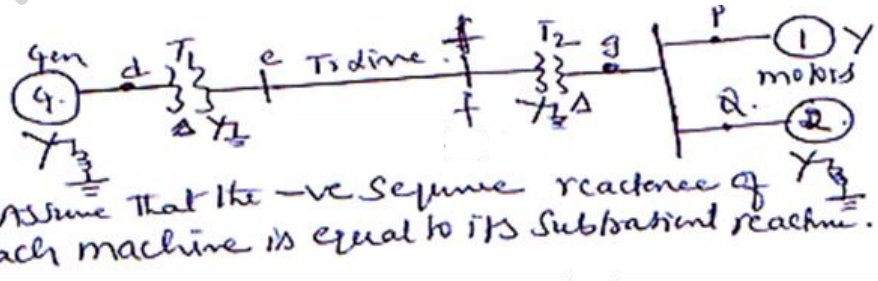
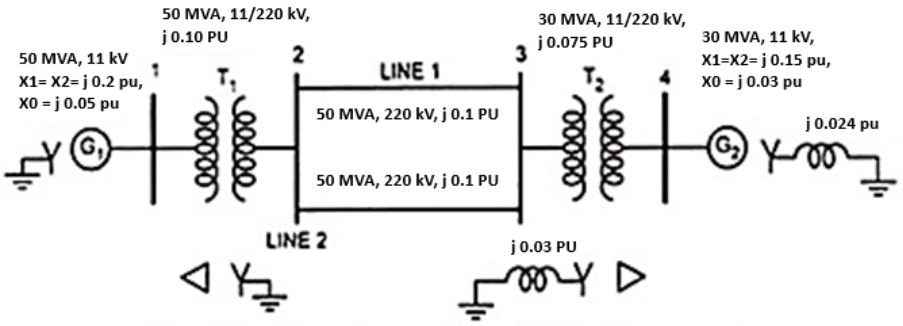


Fig. 1.c

Item	S MVA	V KV	X_{pu} %	Item	S MVA	V KV	X_{pu} %
G	90	22	18	T_1	50	22/220	10
T_2	40	220/11	6	T_3	40	22/110	6.4
T_4	40	110/11	8	M	66.5	66.5	18.5

			iii. What are the approximations made in reactance diagram?			
	2	b	Draw the p.u. reactance diagram for the system shown in Fig. 2.b below. Choose a base of 300 MVA, 20 kV on generator 03 (G3)  Fig. 2.b G_1=200 MVA, 20 kV, X_d=15% G_2=300 MVA, 18 kV, X_d=20% G_3=300 MVA, 20 kV, X_d=20% T_1=300 MVA, 220 Y/22 kV, X_d=10% T_2=Three single phase unit of 100 MVA,130/25 kV, X_d=10% T_2=300 MVA, 220 /22 kV, X_d=10%	*CO2*	*PO2*	**10**
			UNIT - II			
	3	a	Analyze and develop the doubling effect of the short circuit during symmetrical fault on a transmission line including wave forms.	*CO1*	*PO1*	**10**
	3	b	A radial power system network is shown in Fig. 3.b. A three-phase balanced fault occurs at F. Determine the fault current and the line voltage at 11.8 kV bus under fault condition. Choose base values as 12 MVA and 11.8 kV.  Fig. 3. b	*CO2*	*PO2*	**10**

			OR			
	4	a	Analyze and develop an expression for the maximum momentary current during symmetrical fault on a transmission line with waveforms.	*CO2*	*PO2*	**10**
	4	b	A synchronous generator and a synchronous motor each rated 20 MVA, 12.66 kV having 15% reactance are connected through transformers and a line as shown in Fig. 4. b. The transformers are rated 20 MVA, 12.66/66 kV and 66/12.66 kV with leakage reactance of 10% each. The line has a reactance of 8% on base of 20 MVA, 66 kV. The motor is drawing a power of 10 MW at 0.8 leading power factor and a terminal voltage 11 kV when symmetrical three phase fault occurs at the motor terminals. Determine the generator and motor currents. Also determine the fault current.  Fig. 4.b	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a	Evaluate the sequence components of the three voltages: $V_a = 200\angle 0^\circ;\ V_b = 200\angle 245^\circ\ and\ V_c = 200\angle 105^\circ$	*CO2*	*PO2*	**06**
	5	b	Draw different configuration of transformer for zero sequence networks.	*CO2*	*PO1*	**06**
	5	c	A 50 MVA, 11kV, synchronous generator has a sub transient reactance of 20%. The generator supplies two motors over a transmission line with transformers at both ends as shown in Fig. 5.c. The motors have rated inputs of 30 and 15 MVA, both 10 kV, with 25% sub transient reactance. The three phase transformers are both rated 60 MVA, 10.8/121 kV, with leakage reactance of 10% each. Assume zero sequence reactance for the generator and motors is 6% each. Current limiting reactors of 2.5 ohms each are connected in the neutral of the generator and motor number 2. The zero-sequence reactance of the transmission line is 300 ohms. The series reactance of the line is 100 ohms. Draw the positive, negative and zero sequence networks. Assume base MVA =50MVA and base kV =11 kV of Generator.  Fig. 5.c	*CO2*	*PO2*	**08**
			OR			

	6	a	Analyze and develop expression for phase shift symmetrical components in Y-Δ Transformer bank with positive, negative sequences voltage and current vector diagrams.	*CO2*	*PO1*	**10**
	6	b	For the power system shown in Fig. 6.b with the data given, draw the zero sequence, positive sequence and negative sequence networks. Assume base 50 MVA and11 kV on generator side.  Fig. 6. b	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a	Analyze and obtain an expression for fault current, line current for double line to ground fault on unloaded generator through impendence. Draw the inter connection of sequence network.	*CO2*	*PO1*	**10**
	7	b	A 25 MVA, 13.2 kV alternator with solidly grounded neutral has a sub-transient reactance of 0.25 pu. The negative and zero sequence reactance are 0.35 and 0.1 pu, respectively. A single line to ground fault occurs at the terminals of an unloaded alternator. Neglecting resistance, determine the fault current and the line-to-line voltages.	*CO2*	*PO2*	**10**
			OR			
	8	a	Analyze and obtain an expression for fault current, line current for single line to ground fault on unloaded generator through impendence. Draw the inter connection of sequence network.	*CO2*	*PO1*	**10**
	8	b	A 25 MVA, 13.2 kV alternator with solidly grounded neutral has a sub-transient reactance of 0.25 pu. The negative and zero sequence reactance are 0.35 and 0.1 pu, respectively. A line-to-line fault occurs at the terminals of an unloaded alternator. Neglecting resistance, determine the fault current and the line-to-line voltages.	*CO2*	*PO2*	**10**
			UNIT - V			
	9	a	Analyze and develop the relation for power-angle equation of a non-salient pole synchronous machine connected to an infinite bus and also draw the power angle curve.	*CO3*	*PO2*	**10**
	9	b	A salient pole synchronous machine having X_d=0.6 pu and X_q=0.4 pu per phase is operated from an infinite bus voltage 1.0 pu. If the excitation voltage is 1.1 pu. Evaluate the SSSL and angle at which it occurs.	*CO3*	*PO2*	**10**
			OR			
	10	a	Analyze and derive the swing equation and swing curve.	*CO3*	*PO2*	**10**
	10	b	A loss free alternator supplies 50 MW to an infinite bus, the SSSL being 100 MW. Evaluate if the alternator will remain stable if the input to the prime mover of the alternator is abruptly increased by 40 MW.	*CO3*	*PO2*	**10**

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