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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

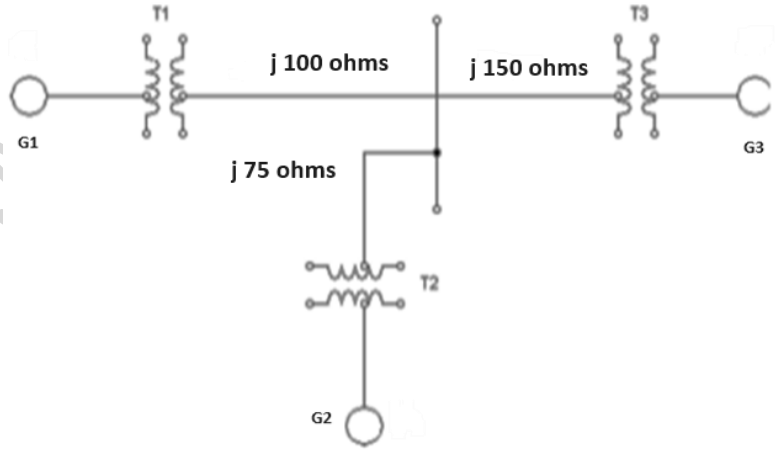
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

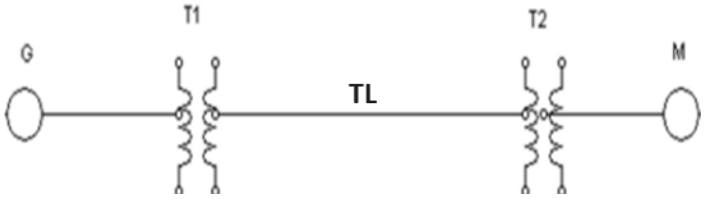
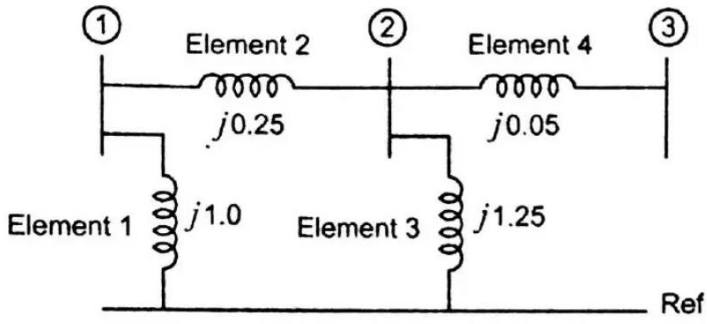
Course Code: 19EE6PCPS1 **Max Marks: 100**

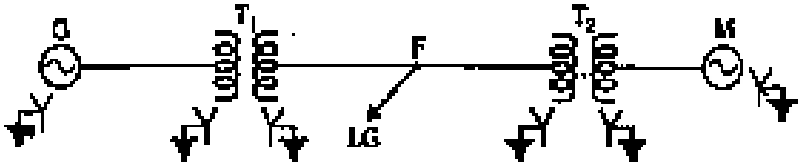
Course: Power Systems - I

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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Define per unit quantity? Enumerate the advantages of per unit computation.	*CO1*	*PO1*	**08**
	b)	The single line diagram of an unloaded power system is shown in Fig 1.b The generator transformer ratings are as follows. G1=20 MVA, 11 kV, X''=25% G2=30 MVA, 18 kV, X''=25% G3=30 MVA, 20 kV, X''=21% T1=25 MVA, 220/13.8 kV (Δ/Y), X=15% T2=3 single phase units each rated 10 MVA, 127/18 kV(Y/Δ), X=15% T3=15 MVA, 220/20 kV(Y/Δ), X=15% Draw the reactance diagram using a base of 50 MVA and 11 kV on the generator1.  Fig 1.b	*CO1*	*PO2*	**12**
		OR			
2	a)	Explain the procedure to form reactance diagram from single line diagram.	*CO1*	*PO1*	**08**

		b)	Draw the reactance diagram for the power system shown in Fig 2.b .Use a base of 50 MVA, 230 kV in 30 Ω line. The ratings of the generator, motor and transformers are Generator = 20 MVA, 20 kV, X=20% Motor = 35 MVA, 13.2 kV, X=25% T1 = 25 MVA, 18/230 kV (Y/Y), X=10% T2 = 45 MVA, 230/13.8 kV (Y/Δ), X=15% Transmission Line = j30 ohms.  Fig 2.b	*CO1*	*PO2*	**12**
			UNIT - II			
	3	a)	Explain the modification of Zbus when a branch is added to its partial network. Ignore mutual coupling.	*CO2*	*PO2*	**10**
		b)	Two generators are connected in parallel to the low-voltage (L.V) side of a three phase Δ-Y transformer. The ratings of the machines are Generator G1: 50 MVA, 13.8kV, Xd"=25% Generator G2: 25MVA, 13.8kV, Xd"=25% Transformer T: 75MVA, 13.8 Δ -69 Y kV, X=10% Before the fault occurs, the voltage on the high voltage (HV) side of the transformer is 66 kV. The transformer is unloaded, and there is no circulating current between the generators. Find the sub transient current in each generator when a three phase fault occurs on the high voltage side of the transformer.	*CO2*	*PO2*	**10**
			OR			
	4	a)	Explain Symmetrical short circuit of a synchronous Generator (on No load condition)	*CO2*	*PO2*	**10**
		b)	For the network shown below, Form Zbus by building algorithm method. 	*CO2*	*PO2*	**10**

			UNIT - III			
	5	a)	Derive an expression for phase voltages in terms of symmetrical components.	*CO2*	*PO2*	**10**
		b)	In a three phase, three wire system, the line currents are Ia=100∠0° A and Ib=100∠-100° A. Determine the sequence components of line currents.	*CO2*	*PO2*	**10**
			OR			
	6	a)	Derive an expression for symmetrical components in terms of phase voltages.	*CO2*	*PO2*	**10**
		b)	The positive and negative sequence components of phase voltages of a three phase system are Va1=230∠30° V and Va2=60∠60°V. Determine the positive and negative sequence components of line voltages and hence the line voltages.	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Derive an expression for fault current, line current for line to line fault on unloaded generator through impedance. Draw the inter connection of sequence network.	*CO2*	*PO1*	**10**
		b)	A three phase generator with an open circuit voltage of 400 V is subjected to an LG fault through a fault impedance of j2 Ω. Determine the fault current if Z1=j4 Ω, Z2=j2 Ω and Z0=j1 Ω.	*CO2*	*PO2*	**10**
			OR			
	8	a)	Analyze and develop an expression for fault current, line current for line to double line to ground fault on unloaded generator through impedance. Draw the inter connection of sequence network.	*CO2*	*PO1*	**10**
		b)	A synchronous motor is receiving 10MW of power at 0.8 pf lag at 6 kV. An LG fault takes place at the middle point of the transmission line as shown in Fig 8. b. Find the fault current. The ratings of the generator motor and transformer are as under. Generator: 20MVA, 11kV, X1=0.2p.u; X2=0.1p.u; X0=0.1p.u. Transformer T1: 18MVA, 11.5Y-34.5Y kV, X=0.1p.u. Transmission line: X1=X2=5Ω; X0=10Ω. Transformer T2: 15MVA, 6.9Y-34.5Y kV, X=0.1p.u. Motor: 15MVA, 6.9kV, X1=0.2p.u; X2=X0=0.1p.u.  Fig 8. b.	*CO2*	*PO2*	**10**
			UNIT - V			
	9	a)	Analyze and develop the relation for Power-angle equation of a salient pole Synchronous machine connected to an infinite bus and also draw the power angle curve.	*CO3*	*PO2*	**10**

		b)	Evaluate the SSSL of a system consisting of a generator of equivalent reactance 0.5 pu connected to an infinite bus through a series reactance of 1.0 pu. The terminal voltage of the generator is held at 1.2 pu and voltage of the infinite bus is 1.0 pu.	*CO3*	*PO2*	**10**
			OR			
	10	a)	Analyze and develop an expression for Application of Equal Area Criterion with the case of Sudden change in input.	*CO3*	*PO2*	**10**
		b)	Define the following: i. Stability. ii. Transient stability. iii. Steady state stability limit. iv. Swing curve. v. Power angle.	*CO3*	*PO2*	**10**

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