

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

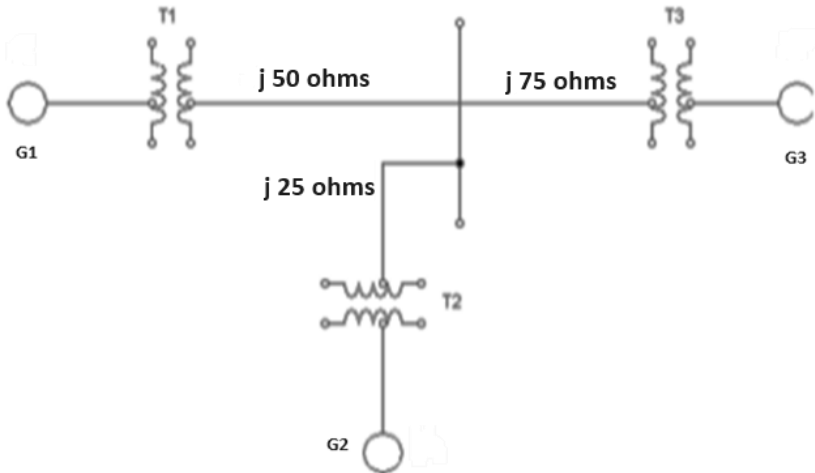
Duration: 3 hrs.

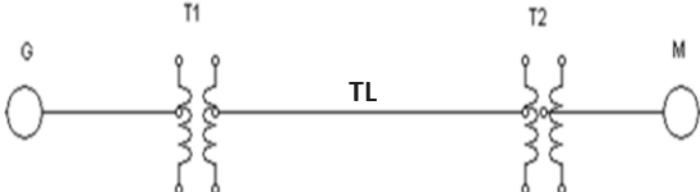
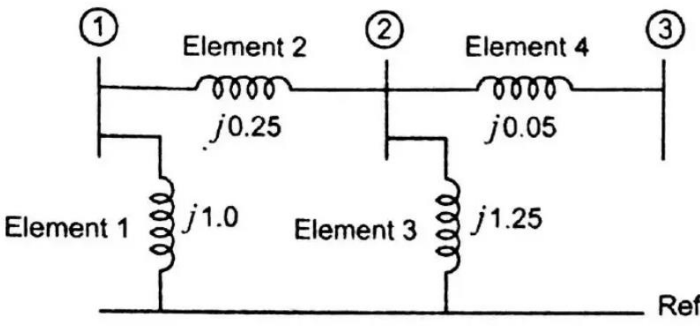
Course Code: 19EE6PCPS1

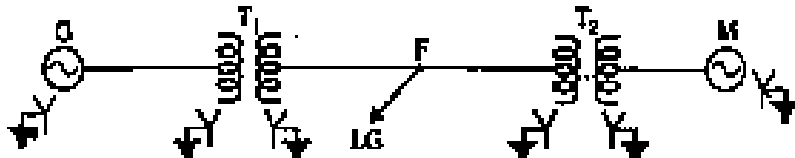
Max Marks: 100

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)	Show that per unit impedance referred to either side of a single-phase transformer is the same.	CO1	PO1	08
		b)	<p>The single line diagram of an unloaded power system is shown in Fig 1.b The generator transformer ratings are as follows.</p> <p>G1=50 MVA, 11 kV, $X''=25\%$ G2=50 MVA, 18 kV, $X''=25\%$ G3=50 MVA, 20 kV, $X''=21\%$ T1=25 MVA, 220/13.8 kV (Δ/Y), $X=15\%$ T2=3 single phase units each rated 30 MVA, 127/18 kV(Y/Δ), $X=15\%$ T3=25 MVA, 220/20 kV(Y/Δ), $X=15\%$ Draw the reactance diagram using a base of 100 MVA and 11 kV on the generator1.</p>  <p>Fig 1.b</p>	CO1	PO2	12
			OR			
	2	a)	Define per unit value. Mention the advantages of per unit system.	CO1	PO1	08

	b)	<p>Draw the reactance diagram for the power system shown in Fig 2.b .Use a base of 100 MVA, 220 kV in 10 Ω line. The ratings of the generator, motor and transformers are</p> <p>Generator = 50 MVA, 20 kV, $X=20\%$ Motor = 35 MVA, 13.2 kV, $X=25\%$ T1 = 25 MVA, 18/220 kV (Y/Y), $X=10\%$ T2 = 45 MVA, 220/13.8 kV (Y/Δ), $X=15\%$ Transmission Line = $j10$ ohms.</p>  <p style="text-align: center;">Fig 2.b</p>	CO1	PO2	12
		UNIT - II			
3	a)	Explain the modification of Zbus when a link is added to its partial network. Ignore mutual coupling.	CO2	PO2	10
	b)	<p>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</p> <p>Generator G1: 100 MVA, 13.8 kV, $X_d''=20\%$ Generator G2: 50 MVA, 13.8 kV, $X_d''=20\%$ Transformer T: 25 MVA, 13.8 Δ -69 Y kV, $X=10\%$</p> <p>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.</p>	CO2	PO2	10
		OR			
4	a)	Explain Symmetrical short circuit of a synchronous Generator (on No load condition)	CO2	PO2	10
	b)	<p>For the network shown below, Form Zbus by building algorithm method.</p> 	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 system, the sequence quantities are $V_{a1}=(0.9+j0.2)$ p.u; $V_{a2}=(0.1+j0.1)$ p.u; $V_{a0}=(0.1+j0.05)$ p.u and $I_{a1}=(0.9-j0.1)$ p.u; $I_{a2}=(0.2-j0.1)$ p.u; $I_{a0}=(0.05-j0.02)$ p.u. Find the three phase complex power in p.u and in MVA on a base of 100MVA. Also compute the active and reactive powers.	CO2	PO2	10
		OR			
6	a)	Derive an expression for three phase complex power in terms of symmetrical components.	CO2	PO2	10
	b)	A balanced delta connected load is connected to a three phase symmetrical supply. The line currents are each 10A in magnitude. If fuse in one of the lines blows out, determine the sequence components of line current.	CO2	PO2	10
		UNIT - IV			
7	a)	Derive an expression for fault current, line current for line to line fault on unloaded generator. Draw the inter connection of sequence network.	CO2	PO1	10
	b)	A three phase generator with an open circuit voltage of 400V is subjected to an LG fault through a fault impedance of $j2\Omega$. Determine the fault current if $Z_1=j4\Omega$, $Z_2=j2\Omega$ and $Z_0=j1\Omega$.	CO2	PO2	10
		OR			
8	a)	Analyze and develop an expression for fault current, line current for line to ground fault on unloaded generator through impedance. Draw the inter connection of sequence network.	CO2	PO1	10
	b)	<p>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.</p> <p>Generator: 20 MVA, 11kV, $X_1=0.2$ p.u; $X_2=0.1$ p.u; $X_0=0.1$ p.u. Transformer T1: 18 MVA, 11.5Y-34.5Y kV, $X=0.1$ p.u. Transmission line: $X_1=X_2=5 \Omega$; $X_0=10 \Omega$. Transformer T2: 15MVA, 6.9Y-34.5 Y kV, $X=0.1$ p.u. Motor: 15MVA, 6.9 kV, $X_1=0.2$p.u; $X_2=X_0=0.1$ p.u.</p>  <p style="text-align: center;">Fig 8. b.</p>	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
		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)	Derive swing equation with usual notation.	CO3	PO2	10
		b)	Define the following: <ul style="list-style-type: none"> i. Stability. ii. Transient stability. iii. Steady state stability limit. iv. Swing curve. v. Power angle. 	CO3	PO2	10
