PU.S.N.										

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

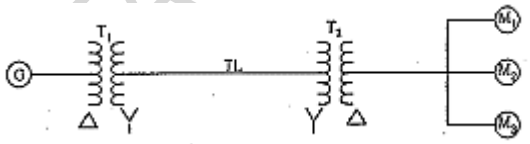
Autonomous Institute Affiliated to VTU

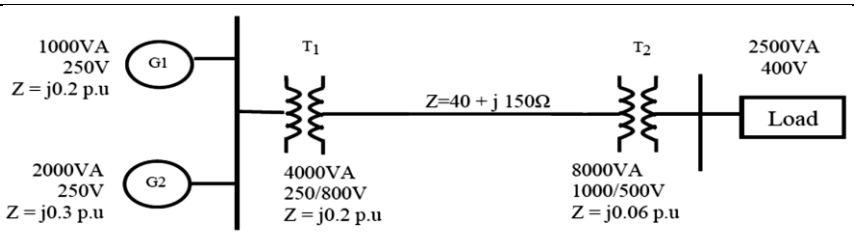
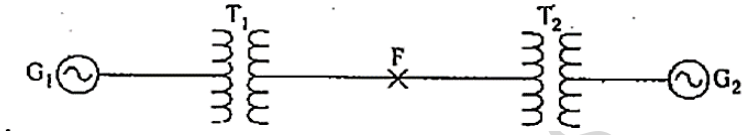
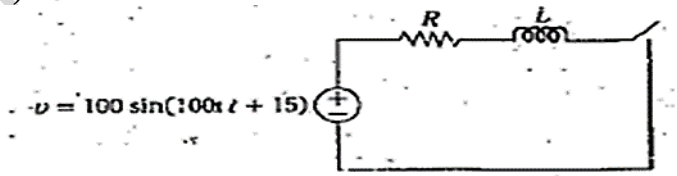
June 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE5PCPSA **Max Marks: 100**
Course: Power System Analysis

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)	What is meant by PU quantity in a 3-phase system? Explain how to find the PU quantities of voltage, current & impedance	*CO1*	*PO1*	**06**
	b)	A 100 MVA,33 kV,3-phase generator has a sub transient reactance of 15%. Generator is connected to the motors through transmission line and transformer as shown in fig1, the motors have a rated output of 30 MVA, 20 MVA, 50 MVA with 20% sub-reactance each. the three-phase transformer rated 100 MVA ,32 kV delta/100 kV star with leakage reactance of 50 Ω, selecting the generator rating as base value. draw the pu reactance diagram  fig1	*CO1*	*PO2*	**08**
	c)	Show that the per unit equivalent impedance of a two winding transformer is same whether the calculations is made from the HV side or from the LV side.	*CO1*	*PO1*	**06**
		OR			
2	a)	Explain (i) Single line diagram (ii) Impedance diagram and (iii) Reactance diagrams with examples.	*CO1*	*PO1*	**10**
	b)	Draw impedance diagram for this system where the per unit impedance of the components are represented on a common 5000 VA base and common system base voltage of 250 V.	*CO1*	*PO2*	**10**

						
			UNIT – II			
3	a)		Justify why fault analysis is important in power system with an example, list out the assumptions involved while calculating the symmetrical faults.	*CO2*	*PO1*	**06**
	b)		Generator G_1 and G_2 are identical and rated 11KV, 20MVA and have a transient reactance of 0.25 pu at own MVA base. The transformer T1 and T2 are also identical and are rated 11KV and 66KV, 5MVA and have a reactance of 0.06 pu to their own MVA base. the tie-line is 50KM long: each conductor has a reactance of 0.848Ω/KM, the three-phase fault is assumed at F,20KM from generator G1 as shown in fig3, evaluate short circuit current  Fig 2	*CO2*	*PO2*	**08**
	c)		With the help of waveform at the time of three phase symmetrical fault on synchronous generator, define steady state, transient and sub transient reactance	*CO2*	*PO1*	**06**
			OR			
4	a)		Explain clearly, how circuit breakers are rated?	*CO2*	*PO1*	**06**
	b)		A transmission line of inductance L=0.1H and resistance R=5Ω is suddenly short circuited at t=0, at the far end of line as shown in fig3 if the source voltage is v=100sin(100πt+15) obtain the following 1)Expression for the short circuit current, i(t) 2)Value of maximum momentary current 3)Instant of short circuit so that the DC-offset current is zero 4)Instant at which DC-offset current is maximum  Fig3	*CO2*	*PO2*	**08**
	c)		Describe the transients occurring in a transmission line on the occurrence of a short circuit	*CO2*	*PO1*	**06**
			UNIT - III			
5	a)		Derive the expression for symmetrical components in terms of phase voltages	*CO2*	*PO1*	**06**
	b)		Balanced star connected load takes 30A from a balanced 3-phase,4 wire supply. if the fuses in two lines are removed, find the	*CO2*	*PO1*	**08**

			symmetrical components of the line currents before and after the fuses are removed.			
		c)	With the help of relevant vector diagrams for voltages & currents, establish the phase shift of symmetrical components in Y-Δ transformer	*CO2*	*PO1*	**06**
			OR			
	6	a)	Determine the sequence components of the voltages Va, Vb and Vc. Given $V_a=200\angle 0^0$, $V_b=200\angle 245^0$, $V_c=200\angle 105^0$.	*CO2*	*PO2*	**08**
		b)	Derive the expression for phase voltages in terms of symmetrical components.	*CO2*	*PO1*	**06**
		c)	Derive an expression for 3- phase complex power in terms of symmetrical components.	*CO2*	*PO1*	**06**
			UNIT – IV			
	7	a)	What are unsymmetrical faults? Explain the various types of unsymmetrical faults and mention their frequencies of occurrence.	*CO2*	*PO1*	**06**
		b)	A 3–phase generator with line-to-line voltages of 400V is subjected to an LLG fault. If Z1=j2 Ω, Z2=j0.5 Ω and Zo=j0.25 Ω. evaluate the fault current and terminal voltages.	*CO2*	*PO2*	**08**
		c)	Derive an expression for the fault current for the LG fault.	*CO2*	*PO1*	**06**
			OR			
	8	a)	Discuss about Double line to ground fault in a power system. Derive equation for the fault current.	*CO2*	*PO3*	**10**
		b)	Three 10 kV, 25 MVA 3 phase star connected generators operate in parallel. The positive, negative and zero sequence reactance's of each being respectively, j 0.2, j 0.15 and j 0.9 pu. The star points of one of the generators is isolated, second generator is solidly grounded and third generator is grounded through 2 Ω resistor. A single line to ground fault occurs at the terminals of one of the generators. Estimate fault current.	*CO2*	*PO2*	**10**
			UNIT – V			
	9	a)	Explain transient stability analysis. Discuss the assumptions and simplifications made during transient stability analysis.	*CO3*	*PO1*	**04**
		b)	A 50 Hz, 6 pole turbo generator, rated 80 MW, working at 0.8 pf and 11kV has inertia of 10 MJ/MVA. a) Calculate the energy stored in the rotor at synchronous speed. b) Find rotor acceleration if the mechanical input is suddenly raised to 75 MW for an electrical load of 60 MW, evaluate the rotor acceleration, neglecting mechanical and electrical loss c) If the above acceleration is maintained for a duration of 6 cycles, calculate the change in torque angle and the rotor speed in RPM at the end of 6 cycles.	*CO3*	*PO2*	**08**

		c)	Develop an expression for power angle equation of a non-salient pole synchronous machine connected to an infinite bus. Draw the power angle curve.	*CO3*	*PO2*	**08**
			OR			
	10	a)	Explain the dynamics of a synchronous machine and derive swing equation. Discuss the important of swing equation in stability studies.	*CO3*	*PO1*	**06**
		b)	A 50Hz generator is delivering 50% of the power that it is capable of delivering through a transmission line to an infinite bus a fault occurs that increases the reactance between the generators and the infinite bus to 500% of the before the fault, when the fault is isolated the maximum power that can be delivered is 75% of the original maximum value. evaluate the critical clearing angle for the condition described.	*CO3*	*PO2*	**08**
		c)	Explain equal area criterion of stability and derive the equation to check the condition for the transient state stability.	*CO3*	*PO1*	**06**

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