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: V**

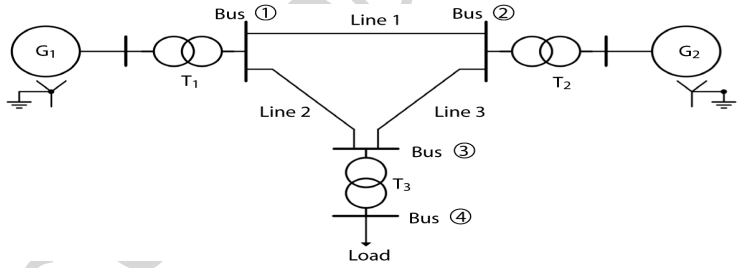
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

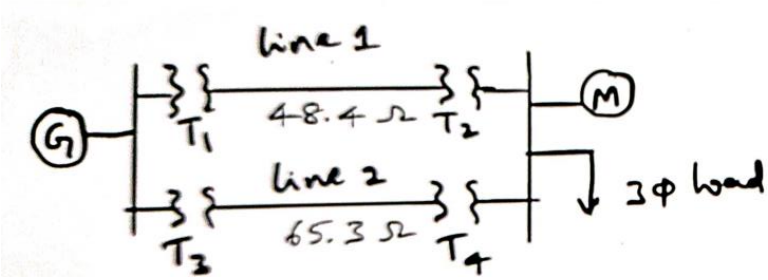
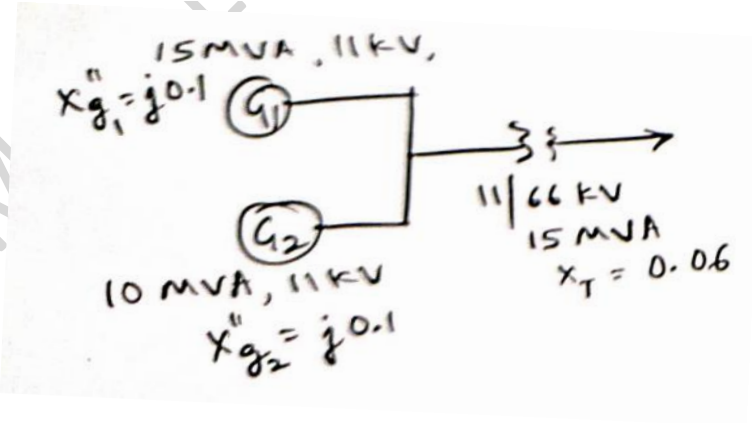
Course Code: 23EE5PCPS1 / 22EE5PCPSA **Max Marks: 100**

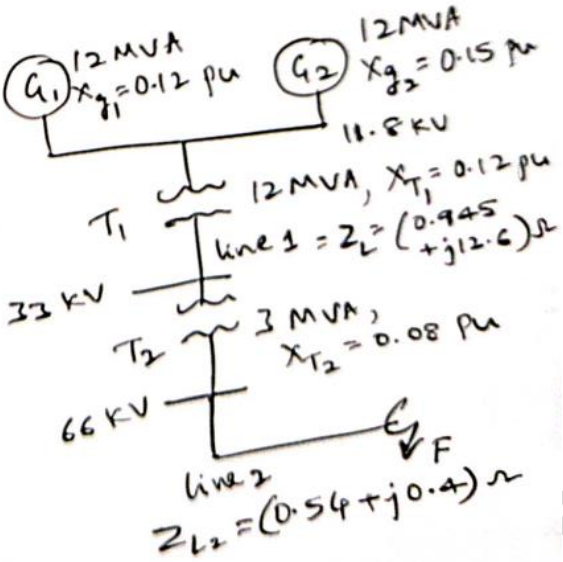
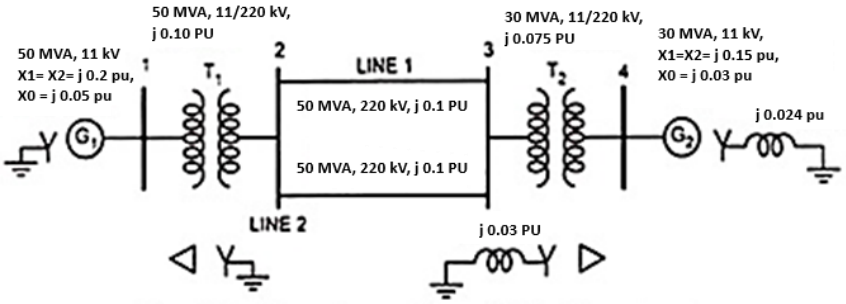
Course: Power System -1

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

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)		Derive an expression for the following: i. How will you change the base impedance from one set of base values to another set? (03M) ii. Per unit value of a quantity on either side of transformer is same. (03M) iii. Advantage the per unit value of a quantity. (04M)	*CO1*	*PO1*	**10**
	b)		Draw the per unit reactance diagram for the system shown in Fig 1. b below. Choose a common base of 50 MVA, 110 kV.  Fig. 1.b Items / MVA / kV (LL) n / X Generator-1 / 48 MVA / 20 kV / 20% Generator-2 / 25 MVA / 13.8 kV / 15% Transformer-1(T1) / 50 MVA / 20/110 kV / 8% Transformer-2(T2) / 30 MVA / 13.8/110 kV / 6% Transformer-3(T3) / 50 MVA / 11/110 kV / 10% Transmission line-1: 40 Ω; Transmission line-2: 32 Ω Transmission line-3: 30 Ω, Three phase load 60 MVA, 0.75pf lagging.	*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. iii. What are the approximations made in reactance diagram?	*CO1*	*PO1*	**10**

		b)	Draw the per unit reactance diagram for the system shown in Fig. 2 b below. Choose a base of 13.8 kV, 100 MVA in the generator circuit.  Fig. 2 b Data Items / MVA / KV / X Generator / 90 MVA / 13.8 kV / 18% Transformer-1(T1) / 50 MVA / 13.8/220 kV / 10% Transformer-2(T2) / 40 MVA / 220/11 kV / 10% Transformer-3(T3) / 40 MVA / 13.8/132 kV / 10% Transformer-4(T4) / 40 MVA / 132/11 kV / 10% Motor / 80 MVA / 10.45 kV / 20% Three phase load 57 MVA, 0.8 pf lagging 10.45 kV	*CO1*	*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.	*CO2*	*PO2*	**10**
		b)	Two generators G1 and G2 are rated 15MVA, 11 kV and 10 MVA, 11 kV respectively. The generators are connected to a transformer as shown in Fig. 3 b. Calculate the sub transient current in each generator when a three-phase fault occurs on the high voltage side of the transformer.  Fig. 3 b.	*CO2*	*PO2*	**10**
			OR			
	4	a)	Analyze and develop expression for the maximum momentary current of the short circuit during symmetrical fault on a transmission line including waveforms.	*CO2*	*PO2*	**10**

		b)	A radial power system network is shown in Fig. 4 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.  Fig. 4 b	*CO2*	*PO2*	**10**
			UNIT - III			
5		a)	Analyze and develop the expression for: i). Prove that a balanced set of three phase voltages will have only positive sequence components of voltages only. (05M). ii). Complex power in terms of symmetrical components. (05M).	*CO2*	*PO2*	**10**
		b)	The line current in three - phase four wire system: $I_a = 100\angle 30^\circ$; $I_b = 50\angle 300^\circ$ and $I_c = 30\angle 180^\circ$ Evaluate the symmetrical components and the neutral current.	*CO2*	*PO2*	**05**
		c)	Draw the different configuration of transformer for zero sequence networks.	*CO2*	*PO2*	**05**
			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*	*PO2*	**10**
		b)	For the power system shown in Fig 6 b. with the data given, draw the zero sequence, positive sequence and negative sequence networks. Let base values be 50 MVA and 11 kV on generator side.  Fig 6 b	*CO2*	*PO2*	**10**

			UNIT - IV			
	7	a)	Analyze and develop 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 30 MVA, 13.2 kV synchronous generator has a solidly grounded neutral. Its positive, negative and zero sequence impedances are 0.30, 0.40 and 0.05 p.u respectively. Evaluate the following: a. What value of reactance must be placed in the generator neutral so that the fault current for a line to ground fault of zero fault impedance shall not exceed the rated line current? b. What value of resistance in the neutral will serve the same purpose? c. What value of reactance must be placed in the neutral of the generator to restrict the fault current to ground to rated line current for a double line to ground fault?	*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 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 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 0.5pu 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**

****