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

Autonomous Institute Affiliated to VTU

July / August 2024 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)	Derive the expression for the per unit impedance of a machine on new base when it is expressed on the machine ratings.	CO 1	PO1	**06**
	b)	Draw the per unit reactance diagram of the power system shown in fig1(b). Choose a common base of 30 MVA, 13.8 kV in the generator circuit.	CO 1	PO2	**08**
	c)	Describe per unit quantity. Show that the per unit impedance of the transformer is same when referred to either sides of it.	CO1	PO1	**06**
		UNIT - II			
2	a)	Explain the modification of Z_{BUS} when a branch is added to its partial network.	CO1	PO1	**10**

	Generator	Motor	Transformers
MVA	30	M_1-20, M_2-10	35
kV	13.8	12.8	13.2/115
X	15%	20%	10%

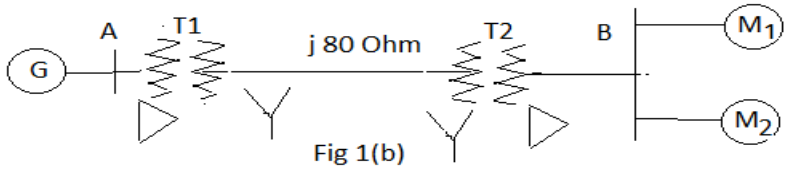

Fig 1(b)

		b)	Two generators are connected in parallel to LV side of a Y- Δ transformer. Symmetrical three phase fault is occurred at the HV side of the transformer when it is operating at 66 kV. Find the sub transient fault currents of each generator. The ratings of the machines are given in table-I. Select bases of 75MVA & 69kV on HV side of the transformer. Machine | MVA | KV | % Reactance Xd'' Generstor-1 | 50 | 13.8 | 25 Generstor-2 | 25 | 13.8 | 25 Transformer | 75 | 13.8 Δ- 69 Y | 10 Table-I	*CO 1*	*PO2*	**10**
			OR			
	3	a)	A symmetrical short circuit is occurred at the terminals of an unloaded 3-phase generator. Draw the current oscillogram & mark the important regions on it. Obtain the expressions for sub-transient, transient & steady state reactances.	*CO 2*	*PO1*	**10**
		b)	For the power system having structure as shown in table_3(b), construct the bus Impedances matrix by Z_{BUS} building algorithm method. Add the elements in the order of line numbers, taking 0-bus as reference node. Line number | Connecting buses | Impedances in per units 1 | 0- 1 | j 0.10 2 | 0- 2 | j 0.15 3 | 1- 3 | j 0.40 4 | 1- 2 | j 0.60 5 | 2- 3 | j 0.40 Table:- 3(b)	*CO 2*	*PO2*	**10**
			UNIT - III			
	4	a)	Develop the expressions for resolving the unbalanced phasors to its symmetrical components.	*CO2*	*PO1*	**06**
		b)	Derive the expression for 3-phase complex power in terms of symmetrical components.	*CO2*	*PO1*	**06**
		c)	A delta connected load is supplied by a 3-φ supply. When one of the supply lines (say Line-C) is opened, the current in other lines are 10 amps. Determine the sequence components of line currents in all phases. Comment on the result.	*CO2*	*PO2*	**08**

			UNIT - IV			
	5	a)	For a double line (L-L) fault occurs at the terminals of an unloaded generator, derive the expression for fault current and hence arrive at inter-connection of sequence networks. Judge the fault current if the generator neutral is unconnected.	*CO3*	*PO2*	**10**
		b)	An 800 V, star connected neutral grounded generator operating on no load & at rated voltage, having the fault currents corresponding to respective faults are given below. Three phase fault- 240 A, Line to ground fault – 500A, Line to Line fault- 300 A. Estimate the fault current for a double line to ground fault. Neglect the resistances.	*CO3*	*PO2*	**10**
			UNIT - V			
	6	a)	Define stability and stability limits. How are they classified?	*CO4*	*PO1*	**06**
		b)	A 2-pole 50-Hz, 11-kV, turbo alternator has a rating of 100-MWwith a power factor of 0.85-lag. The rotor has a Moment of Inertia of 10,000-Kg.mt^2. Calculate the inertia constants H & M.	*CO3*	*PO2*	**06**
		c)	A salient pole alternator has X_d = 0.7 & X_q = 0.4 pu. The machine is operating at normal voltage, full load & 0.8 power factor lag. To what value its terminal voltage could rise, if the load is disconnected. Neglect Ra.	*CO3*	*PO2*	**08**
			OR			
	7	a)	Derive swing equation with usual notations.	*CO4*	*PO1*	**06**
		b)	State and explain equal area criterion of stability evaluation. Derive the necessary expression.	*CO3*	*PO1*	**06**
		c)	Evaluate the steady state power limit of a two machine system consisting of a synchronous generator with an equivalent reactance of 0.5 pu connected to an infinite bus through a reactance of 1 pu. The terminal voltage is held at 1.2 pu and the voltage of the infinite bus is 1pu.	*CO3*	*PO2*	**08**

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