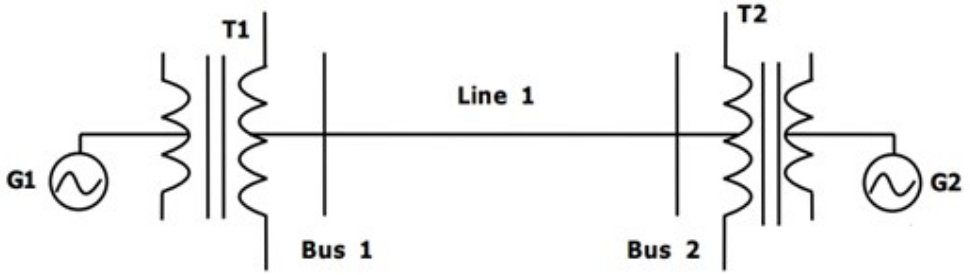
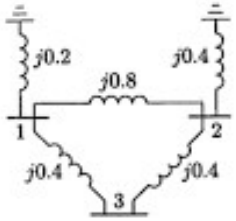
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2023)

CLASS: B.TECH. **SEMESTER: VI**
BRANCH: EEE **SESSION: SP/2023**

SUBJECT: EE355 POWER SYSTEM ANALYSIS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Three generators are rated as follows: Generator 1: 100 MVA, 33 kV, X = 10%; Generator 2: 150 MVA, 32 kV, X = 8%; Generator 3: 110 MVA, 30 kV, X = 12%. Determine the reactance of the generators corresponding to a base value of 200 MVA, 35 kV.	[2]	1	2
Q.1(b)	Define per-unit system of calculation. Prove that the per-unit impedance referred to primary side of the transformer is equal the per-unit impedance referred to its secondary.	[3]	1	1/2
Q.2(a)	Draw the models of generator, transformer, and transmission line as used in power system analysis. Represent them in single-line diagram of a system having one generator connected to a step-up transformer which is connected to a transmission line feeding a load through a step-down transformer.	[2]	1	3
Q.2(b)	For the power system shown in the figure below, the specifications of the components are the following: G_1: 30 kV, 100 MVA, X = 9%, G_2: 25 k, 100 MVA, X = 9%, T_1: 30/220 kV, 90 MVA, X = 12%, T_2: 220/25 kV, 90 MVA, X = 12%, Line1: 220 kV, Z = 30 + j150 Ω.	[3]		
			1	3
	Choose 25kV as the base voltage at the generator 1 side, and 200MVA as the base MVA base. Draw the impedance diagram.			
Q.3(a)	What is the objective of load flow study? How it is different from network analysis problem?	[2]	2	1
Q.3(b)	Why are the buses classified for solving load flow problem? What are the different types of busses? How is the transmission line loss addressed while solving load flow problem?	[3]	2	2
Q.4(a)	Construct the bus admittance matrix for the network shown in figure below. Values indicated the line impedance.	[2]		
			2	2

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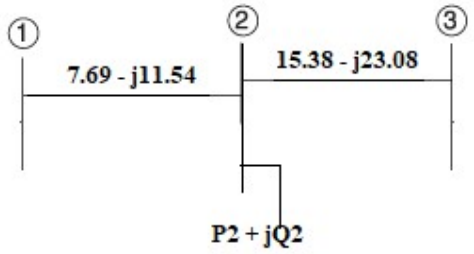
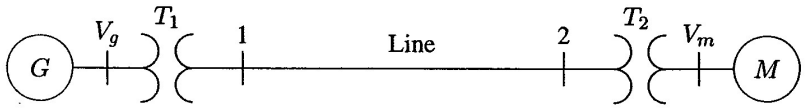
Q.4(b) Using Gauss-Seidel method find the bus voltage of bus 2 at the end of first iteration, the network is shown in figure below. The line admittances are shown in per-unit, $P_2 + jQ_2 = -5.96 + j1.46$, $|V_3| = 1.02$ and $V_1 = 1.0\angle 0^0$. Take initial estimate of voltage magnitude as 1.0 and angle 0^0. [3] 2 3



Q.5(a) Write down the load flow equations in polar form and rectangular form. [2] 2 1

Q.5(b) The three-phase power and line ratings of the electric power system shown in figure are given below [3]



1 3

G: 60 MVA, 20 kV, X = 9%; T_1: 50 MVA, 20/200 kV, X = 10%; T_2: 50 MVA, 200/20 kV, X = 10%; M: 43.2 MVA, 18 kV, X = 8%; Line: 200 kV, Z = 120 + j200Ω. The motor is drawing 45 MVA, 0.80 power factor lagging at a line-to-line terminal voltage of 18 kV. Determine the terminal voltage of the generator in per-unit. Take 100 MVA base and 20 kV voltage base for generator.

::::::24/02/2023::::::M