Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER ARREAR EXAMINATIONS, NOV / DEC 2023

ELECTRICAL AND ELECTRONICS ENGINEERING
VI Semester
EE5601 Power System Analysis
(Regulation 2019)

Time:3hrs Max.Marks: 100

CO1	Model the various power system components for steady-state analysis.
CO2	Carry out the power flow analysis by Gauss-Seidel and Newton-Raphson methods.
CO3	Conduct the fault analysis of power system for balanced faults.
CO4	Carry out the short circuit analysis of the power system for unbalanced faults using symmetrical component theory.
CO5	Compute the stability of the system with the help of equal area criteria and Modified-Euler and Runge-Kutta fourth order methods.

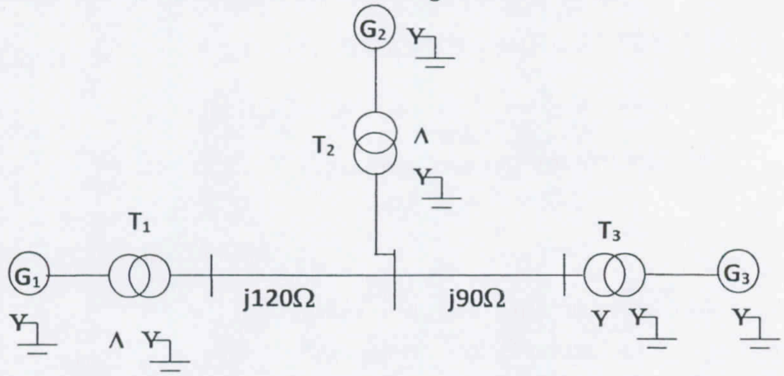
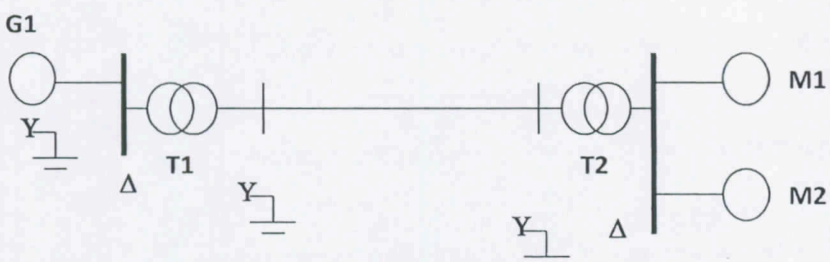
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

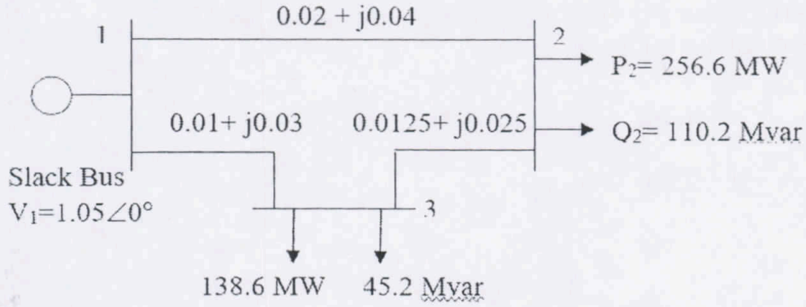
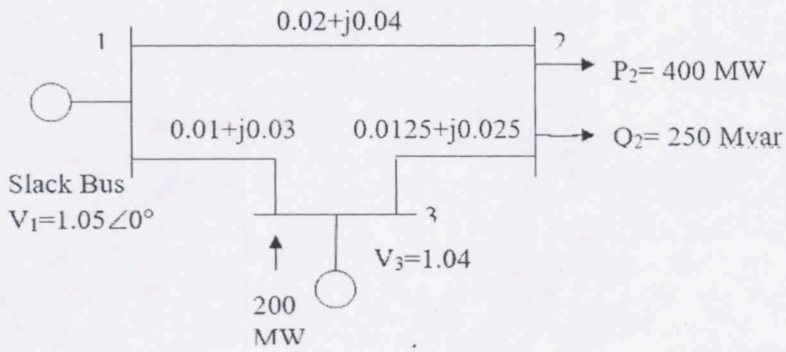
PART- A (10x2=20Marks)
(Answer all Questions)

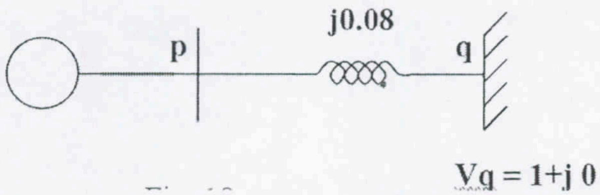
Q. No.	Questions	Marks	CO	BL
1	What are the advantages of pu representation?	2	1	L1
2	Draw the single line diagram showing the essential parts in the power system network.	2	1	L2
3	Explain why one of the bus in the system is taken as slack bus in the load flow studies.	2	2	L2
4	What do you mean by flat voltage start?	2	2	L4
5	Define the following terms: (i) momentary current, (ii) interrupting current.	2	3	L1
6	Name any two methods of reducing short-circuit current.	2	3	L3
7	Draw the sequence network connection for a double line to ground fault at any point in a power system.	2	4	L4
8	Name the fault in which negative and zero sequence current are equal.	2	4	L4
9	Define the term "transient stability".	2	5	L1
10	What is Equal area criterion.	2	5	L2

PART- B (5x 13=65Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	Fig. 11 (a) shows a single-line diagram of a power system. The ratings of generators and transformers are: Generator G_1: 25 MVA, 6.6 kV, j0.2 pu; Generator G_2: 15 MVA, 6.6 kV, j0.15 pu; Generator G_3: 30 MVA, 13.2 kV, j0.15 pu Transformer T_1: 30 MVA, 6.6 Δ - 115 Y kV, j0.1 pu Transformer T_2: 15 MVA, 6.6 Δ - 115 Y kV, j0.1 pu	13	1	L2

	Transformer T_3: Single phase units each rated 10MVA, 69/6.9 kV, j0.1 pu. Draw impedance diagram with all values in pu on a base of 30 MVA, 6.6 kV in the circuit of generator G_1.  Fig. 11 a			
	OR			
11 (b)	Fig. 11 (b) shows a generator feeding two motors through transformers and line. The ratings and reactance are as under. G1: 100 MVA, 11 kV, 3 phase, x= 20%;T1: 3 phase, 100 MVA, 11/132 kV, x=5%;T2: Bank of 3 single-phase transformers, each rated at 35 MVA, 66/11kV, x=4%;M1: 40 MVA, 3phase, 10 kV, x=20%; M2: 60 MVA, 3phase, 11 kV, x=15%. The line reactance is 80 ohms. Select suitable base values. Draw the reactance diagram.  Fig. 11 b	13	1	L2
12 (a)	Fig. 12 a shows the one-line diagram of a simple three-bus power system with generation at bus 1. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltages after two iterations using Gauss-Seidel method.	13	2	L5

	 Fig 12 a			
OR				
12 (b)	Fig. 12 b shows the one-line diagram of a simple three-bus power system with generators at buses 1 and 3. The line impedances are marked in per unit on a 100 MVA base. Find out the bus voltages after two iterations using Newton-Raphson method.	**13**	2	L5
	 Fig 12 b			
13 (a)	Explain the step-by-step procedure involved in z-bus building algorithm by considering all possible cases.	13	3	L2
OR				
13 (b)	Derive the symmetrical short circuit current using Z-bus. Also derive the relations for post fault bus voltage and branch current calculations.	13	3	L4
14 (a)	Derive the relationship for fault currents in terms of symmetrical components when there is a line-to-line (L-L) fault between phase b and c. Also draw a diagram showing interconnection of sequence networks for L-L fault.	13	4	L3
OR				
14 (b)	Derive the relationship for fault currents in terms of symmetrical components when there is a line-to-ground (L-G) fault on phase a. Also draw a diagram showing interconnection of sequence networks for L-G fault.	13	4	L3
15 (a)	Starting from first principles, derive the swing equation of a synchronous machine.	13	5	L5
OR				
15 (b)	The synchronous machine shown in Fig. 18 is generating 100 MW and 75 MVAR. The voltage of the infinite bus q is 1+j0 pu. The generator is connected to the infinite bus through a line of reactance 0.08 pu on a 100 MVA base. The machine transient reactance is 0.2 pu and the inertia constant is 4 pu on a 100 MVA	13	5	L3

	base. A 3-ϕ fault occurs at bus 'p' for a duration of 0.1 sec. Compute the rotor angle at t=0.02 sec (Δt=0.02 sec) using modified Euler method. The frequency of the supply is 50Hz. 			

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	What is the need for system analysis in planning and operation of power system? Knowing the Power scenario in India, explain what studies are to be carried out for power system planning.	15	1	L6