RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2024

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Semester 6

EE 5601 & Power System Analysis

(Regulation 2019)

Time: 3hrs

Max. Marks: 100

CO1	To impart knowledge on the need for "power system analysis" and model various power system components.
CO2	To formulate the power balance equations and to conduct the power flow analysis by Gauss- Seidel and Newton-Raphson methods
CO3	To model and carry out short circuit studies of power system for symmetrical faults and to determine the fault levels of different buses
CO4	To learn about the symmetrical components and their application to carry out short circuit studies of power system for unsymmetrical faults and to determine the fault levels of different buses
CO5	To model and analyze the stability of the power system due to balanced faults by equal area criteria and explicit integration methods.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)

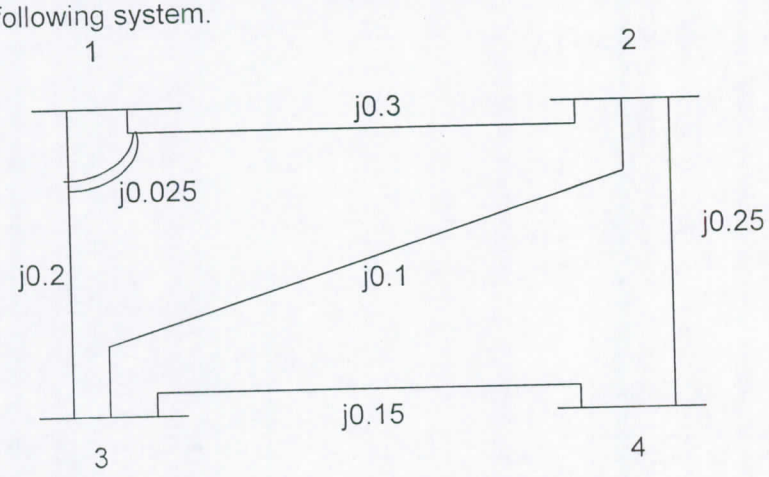
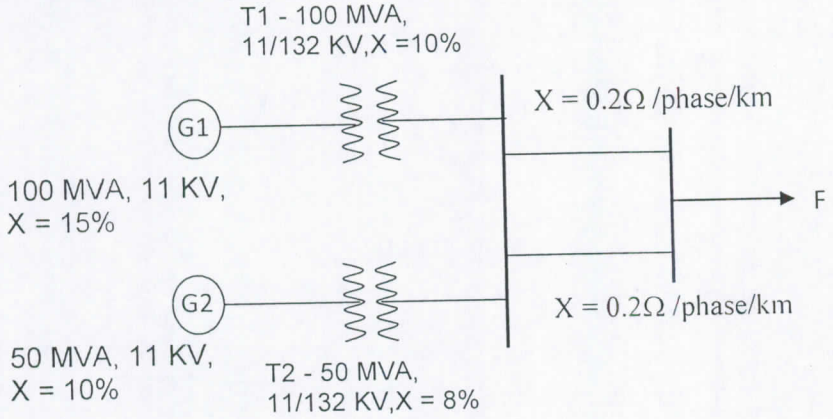
(Answer all Questions)

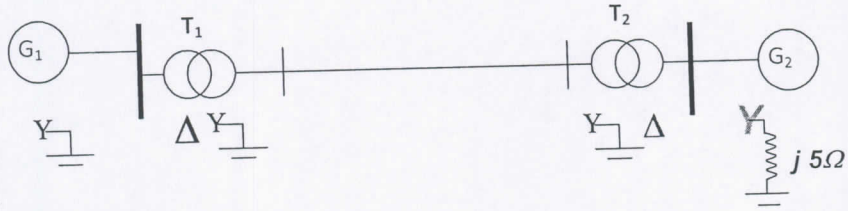
Q. No.	Questions	Marks	CO	BL
1	Define self admittance and mutual admittance in Ybus.	2	1	1
2	How synchronous generator is modeled for various studies?	2	1	1
3	What are the various constraints followed in load flow problem?	2	2	1
4	Mention the advantages and disadvantages of NR method.	2	2	1
5	What is the importance of short circuit analysis?	2	3	1
6	Draw the circuit model of a synchronous machine under loaded condition for steady, transient and subtransient conditions.	2	3	1
7	What do you meant by symmetrical components?	2	4	1
8	Name the fault in which positive and negative sequence component currents are equal and draw the network diagram.	2	4	1
9	Define steady state stability?	2	5	1
10	Define inertia constant H.	2	5	1

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Two generators rated at 10MVA, 13.2KV and 15MVA, 13.2KV are connected in parallel to a bus bar. They feed supply to two motors of input 8MVA and 12MVA respectively. The operating voltage of motors is 12.5KV. Assuming base quantities as 50MVA and 20 KV, draw the reactance diagram. The percentage reactance for generators is 15% and that for motors is 20%.	13	1	L3
	OR			

11 (b)	Form Ybus with mutual coupling using inspection method for the following system.  	13	1	L3
12 (a)	Carryout one iteration of load flow analysis of the system given below using Gauss Seidal method. The Q limits are given as $1 \leq Q_2 \leq 2.5$ *pu* **Line data:** Buses / Admittance pu.: 1-2 / 2 – j 5; 2-3 / 3 – j 9; 3-1 / 1 – j 4 **Bus data:** Bus no. / Type / V (pu) / Generation (pu) P / Generation (pu) Q / Load (pu) P / Load (pu) Q: 1 / Slack bus / 1.05 / - / - / - / - 2 / PV bus / 1.2 / 3 / - / - / - 3 / PQ bus / - / / / 4 / 2	13	2	L3
	OR			
12 (b)	Derive and explain the step-by-step computational procedure for solving load flow problem by using the Newton-Raphson method.	13	2	L2
13 (a)	Fig. 13(a) shows a generating station feeding a 132 KV system. Determine the total fault current and fault current supplied by each alternator for a 3 phase fault at the receiving end bus. The line is 200 km long.  Fig. 13(a)	13	3	L3

	OR			
13 (b)	For the four-bus system given in the Table 13b, formulate the Z-bus using the Z Bus building algorithm. Table.13b S.No. From Bus To Bus Impedance (p.u.) 1. ref 1 j0.15 2. ref 3 j0.2 3. 1 2 j0.3 4. 2 3 j0.1 5. 1 3 j0.25	13	3	L3
14 (a)	Find the fault current and fault voltage when an L-G fault occurs at the three-phase transmission line.	13	4	L3
	OR			
14 (b)	Draw the positive, negative and zero sequence network for the system. Generator G_1 = 50 MVA, 11KV, X = 0.08 pu, Transformer T_1 = 50 MVA 11/220 KV, X = 0.1 pu, Generator G_2 = 30 MVA, 11KV, X = 0.07 pu, Transformer T_2 = 50 MVA 11/220 KV, X = 0.09 pu, reactance of the Transmission Line = 555.6 ohms. Consider base MVA = 50 MVA and Base Voltage = 11 KV at G_1. 	13	4	L4
15 (a)	Derive the swing equation and discuss its application in the study of power system stability.	13	5	L3
	OR			
15 (b)	Two turbo alternators given below are interconnected using a short line, Machine 1: 4-pole, 50 Hz, 150 MVA, 0.8 lag, 25000 kg-m^2 Machine 2: 4-pole, 50 Hz, 150 MVA, 0.9 lag, 20000 kg-m^2 Determine the inertia constant of the single equivalent machine on a base of 150 MVA.	13	5	L4

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	Carryout one iteration of load flow analysis of the system given below using NR method.	15	2	L5

Line data:

Buses	Impedance pu.
1-2	1 + j 4
2-3	1 + j 4
3-1	1 + j 4

Bus data:

Bus no.	Type	V (pu)	Generation (pu)		Load (pu)	
			P	Q	P	Q
1	Slack bus	1.02	-	-	-	-
2	PV bus	1.04	4	-	-	-
3	PQ bus	-			2	1.5