Q. Code:770050

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fifth Semester

EE18501 – POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Develop the equivalent model of power system and construct the admittance and impedance matrices	**3**
CO 2	Formulate the steady-state power flow problem and apply numerical solution algorithms for analysis	**4**
CO 3	Compute short circuit capacity (SCC) of power system using matrix building algorithm under balanced fault.	**4**
CO 4	Compute short circuit capacity (SCC) of power system using symmetrical components under various faults.	**4**
CO 5	Formulate power system stability problem under large disturbance and apply numerical solution algorithms for analysis.	**4**

PART- A (10 x 2 = 20 Marks)

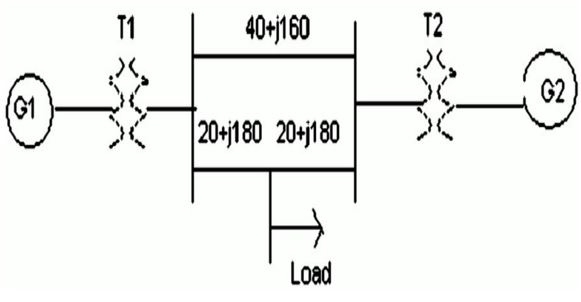
(Answer all Questions)

		CO	RBT LEVEL
1.	Illustrate the changes in Y-bus if one line is added between the buses i and j.	**1**	**2**
2.	Prepare the single-phase equivalent circuit of three winding transformer.	**1**	**2**
3.	What will be the reactive power of the PV bus if it violates beyond the limit?	**2**	**2**
4.	What are the assumptions made in the derivation of the decoupled Load Flow algorithm?	**2**	**2**
5.	What is the application of Kron reduction techniques in the bus building algorithm?	**3**	**2**
6.	Why fault MVA computed in short circuit studies.	**3**	**2**
7.	Write the boundary conditions for the L-G fault.	**4**	**2**

8.	Derive the equation to compute the fault current for the L-L fault.	**4**	**2**
9.	What are the methods adapted to study the voltage stability of the power system?	**5**	**2**
10.	Describe the need for computing the critical clearing time.	**5**	**2**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Prepare a per-phase schematic of the system in fig. and show all the impedance per unit on a 100 MVA, 132 KV base in the transmission line circuit. The necessary data are given as follows. G1: 50MVA, 12.2KV, X=0.15 pu. G2: 20MVA, 13.8KV, X=0.15 pu. T1: 80MVA, 12.2/161KV, X=0.1 pu. T2: 40MVA, 13.8/161KV, X=0.1 pu. LOAD: 50MVA, 0.8 power factor lag operating at 154KV. Evaluate the p.u impedance of the load.	**(14)**	**1**	**3**



(OR)

			Marks	CO	RBT LEVEL
(b)	**(i)**	Point out the Network and find the bus admittance matrix. The parameters of a four-system are as under:	**(10)**	**1**	**3**

Line No.	Sending end	Receiving end	Line Impedance (pu)	Line Charging Admittance

				(pu)
1	1	2	0.2+j0.8	j0.02
2	2	3	0.3+j0.9	j0.03
3	2	4	0.25+j1.0	j0.04
4	3	4	0.2+j0.8	j0.02
5	1	3	0.1+j0.4	j0.01

(ii) Generalize the impedance and reactance diagram. Explain with assumptions. **(4)** **1** **3**

12. (a) Sketch the complete flowchart for the computation of unknown quantities of power system using the Gauss-Seidel method. **(14)** **2** **4**

(OR)

(b) Relate the competitiveness between different Load flow solutions (Newton Raphson, Gauss-Seidel, and Fast Decoupled method) in the following aspects: **(14)** **2** **4**

- Iteration count,
- Convergence characteristics,
- Equations types,
- Polar and rectangular coordinates.

13. (a) 3 phases 5 MVA, 6.6 kV alternator with a reactance of 8% is connected to a feeder series impedance (0.12+j0.48) ohm/phase/km through a step-up transformer. The transformer is rated at 3 MVA, 6.6 kV/33kV, and has a reactance of 5%. Determine the fault current supplied by the generator operating under no load with a voltage of 6.9 kV, when a 3-phase symmetrical fault occurs at a point 15km along the feeder. **(14)** **3** **3**

(OR)

(b) **(i)** A single-line diagram of the power system is shown in Figure 4. The transmission line is 60 km long and has a reactance of 0.92Ω/km. **(7)** **3** **3**

Draw the reactance diagram on a 30 MVA, 11kV base.

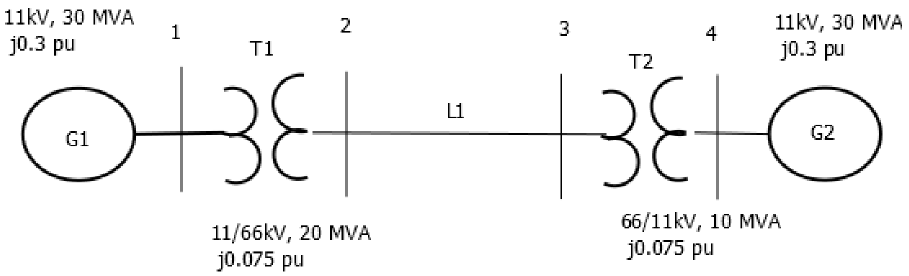


Figure.4

(ii) Determine the actual fault current in KA for a 3-phase fault at bus 3 using the Z bus building algorithm. **(7) 3 3**

14. (a) Examine the sequence network for a double line to ground (LLG) fault. **(14) 4 4**

(OR)

(b) Obtain the expression for fault current for a Line-to-Line (L-L) fault taking place through impedance Z_f in a power system. Draw the Corresponding sequence network. **(14) 4 4**

15. (a) Examine the swing equation of a synchronous machine swinging against an infinite bus. Clearly state the assumption in deducing the swing equation **(14) 5 4**

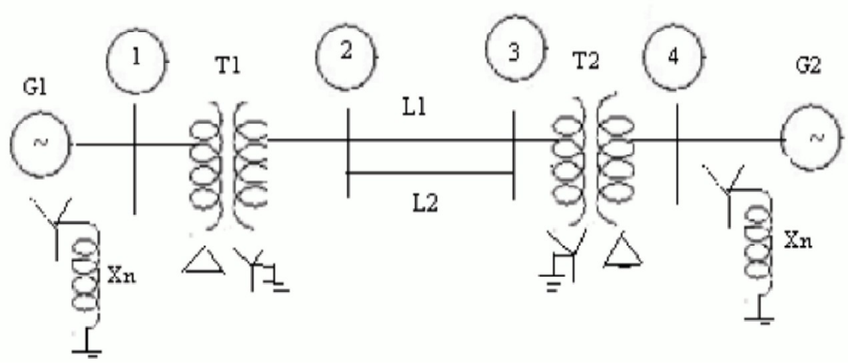
(OR)

(b) Explain the modified Euler method of analyzing multi-machine power systems for stability, with a neat flow chart. **(14) 5 4**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

			Marks	CO	RBT LEVEL
16.	The symmetrical fault occurs on bus 4 of the system through Zf=j0.14 pu in the figure. Using the bus building algorithm, calculate the fault current, post-fault voltages, and line flows. G1, G2: 1 0 0MVA, 2 0 kV, X+ = 1 5% Transformer T1, T2: X leak = 9% Transmission line L1, L2, X+=10%.		**(10)**	**3**	**5**



G1
1
T1
2
L1
L2
3
T2
4
G2
Xn
Xn