

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 91038

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fifth Semester

Electrical and Electronics Engineering

EE 3501 – POWER SYSTEM ANALYSIS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define bus admittance matrix, bus impedance matrix.
2. List out the various inter connected power system components.
3. What is the information that are obtained from a load flow study?
4. What is the significance of acceleration factor in the load flow solution algorithm?
5. Distinguish between symmetrical and unsymmetrical short circuits.
6. What are the effects of short circuit in a power system network?
7. Write boundary conditions for single line to ground faults.
8. Draw the connection of sequence networks for line-to-line fault without fault impedance.
9. Define steady state stability limit.
10. Give the expression for swing equation.

PART B — (5 × 13 = 65 marks)

11. (a) Examine the reactance diagram for the power system shown in Fig. 1. Neglect resistance and use a base of 100 MVA, 220 kV in 50 Ω line. The ratings of the generator motor and transformer are given below.

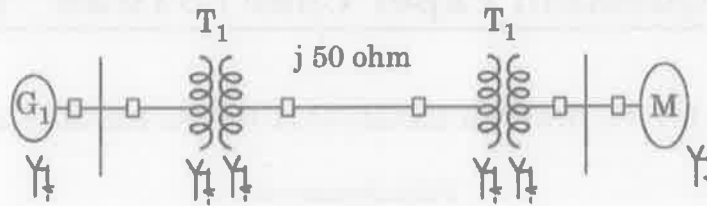


Fig. 1

Generator : 40 MVA, 25 KV, $X'' = 20\%$.

Synchronous Motor : 50 MVA, 11 KV, $X' = 30\%$ T1 : Y-Y transformer : 40 MVA 33/220 KV, $X = 15\%$ T2 : Y-Y transformer : 30 MVA 11/220 KV, $X = 15\%$.

Or

- (b) (i) Show that the per unit equivalent impedance of a two winding transformer is the same whether the calculation is made from the high voltage side or the low voltage side. (7)
- (ii) Explain the π model for a transformer with off nominal tap ratio. (6)
12. (a) Prepare the load flow algorithm using Gauss Seidal method with flow chart and discuss the advantages of the method.

Or

- (b) In the power system network shown in figure 2, bus 1 is slack bus with $V_1 = 1.0 + j0.0$ per unit and bus 2 is a load bus with $S_2 = 280 \text{ MW} = j60 \text{ MVAR}$. The line impedance on a base of 100 MVA is $Z = 0.02 + j0.04$ per unit. Using Gauss – Seidal method, give V_2 . Use an initial estimate of $V_2(0) = 1.0 + j0.0$ and perform four iterations. Also find S_1 and the real, reactive power loss in the line, assuming that the resistance, reactance and susceptance are constant.

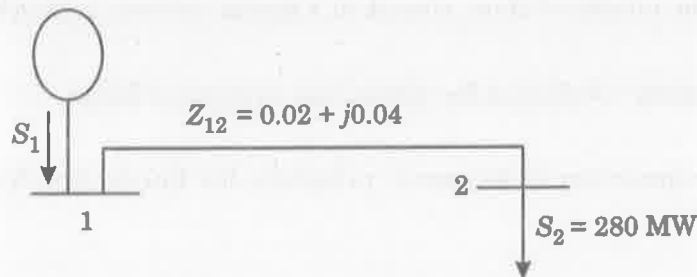


Fig. 2

13. (a) Explain the step-by-step procedure to find the fault current of three-phase symmetrical fault by using thevenin's theorem.

Or

- (b) A 3-phase 5 MVA, 6.6 KV alternators with a reactance of 8% is connected to a feeder of series impedance $(0.12+j0.48)$ ohm/phase/Km through a step up transformer. The transformer is rated at 3 MVA, 6.6 KV/33 KV and has a reactance of 5%. Calculate the fault current supplied by the generator operating under no load with a voltage of 6.9 KV when a three phase symmetrical fault occurs at a point 15 km along the feeder.

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

Or

- (b) A 25 MVA, 13.2 KV alternator with solidly grounded neutral has a sub-transient reactance as 0.25 the negative and zero sequence reactance are 0.35 and 0.01 p.u respectively if a double line to ground fault occurs at the terminals of the alternator. Point out the fault current and line-to-line voltage at the fault.

15. (a) Examine a short note on

- (i) Factors influencing transient stability (7)
(ii) Voltage collapse. (6)

Or

- (b) A generator rated 75 MVA is delivering 0.8 pu power to a motor through a transmission line of reactance $j 0.2$ p.u. The generator's terminal voltage is 1.0 p.u and that of the motor is also 1.0 p.u. Determine the generator e.m.f behind transient reactance. Obtain the maximum power that can be transferred.

PART C — (1 × 15 = 15 marks)

16. (a) Prepare a per phase schematic of the system shown in figure 3 and show all the impedance in per unit on a 100 MVA, 132 kV base in the transmission line circuit. The necessary data are given follows

G1 : 50 MVA 12.2 kV $X = 0.15$ p.u

G2 : 20 MVA, 13.8 kV, $X = 0.15$ p.u

T1 : 80 MVA 12.2/161 kV, $X = 0.1$ p.u T2 : 40 MVA,
13.8/161 kV, $X = 0.1$ p.u

Load : 50 MVA, 0.8 pf lag operating at 154 kV. Determine the p.u impedance of the load.

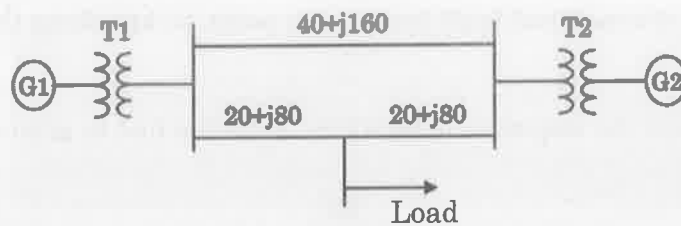


Fig. 3

Or

- (b) With a neat flow chart explain the computational procedure for load flow solution using Newton Raphson method when the system contain all types of buses.