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Question Paper Code : 70560

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 8501 – POWER SYSTEM ANALYSIS

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How are the loads are represented in the reactance and impedance diagram?

2. Define Bus incidence matrix.

3. What is swing bus?

4. Explain what do you mean by flat voltage start?

5. What is the need for current limiting reactor?

6. Define synchronous reactance, transient reactance, sub transient reactance.

7. Define short circuit capacity.

8. Draw the zero sequence network diagram of a delta-delta connected transformer.

9. How to improve the transient stability limit of the power system?

10. List the assumptions made in multi machine stability studies.

PART B — (5 × 13 = 65 marks)

11. (a) Give p.u impedance diagram of the power system of figure 11. a shown below. Choose base quantities as 15 MVA and 33 kV. (13)

Generator: 30 MVA, 10.5 kV, X" = 1.6 ohms.

Transformers T1 and T2: 15 MVA, 33/11 kV, X = 15 ohms referred to HV.

Transmission line: 20 ohms/phase.

Load: 40 MW, 6.6 kV, 0.85 lagging p.f.

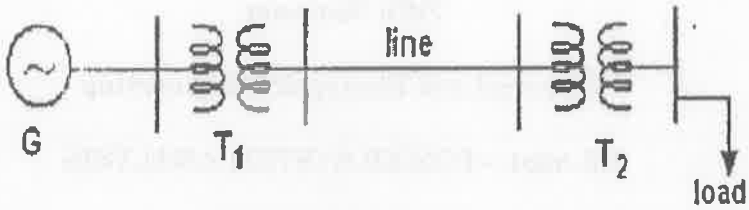

Fig. 11 a

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) Using Gauss Seidal method, examine bus voltages for the fig 12. a shown below. Take base MVA as 100, $\alpha = 1.1$. (13)

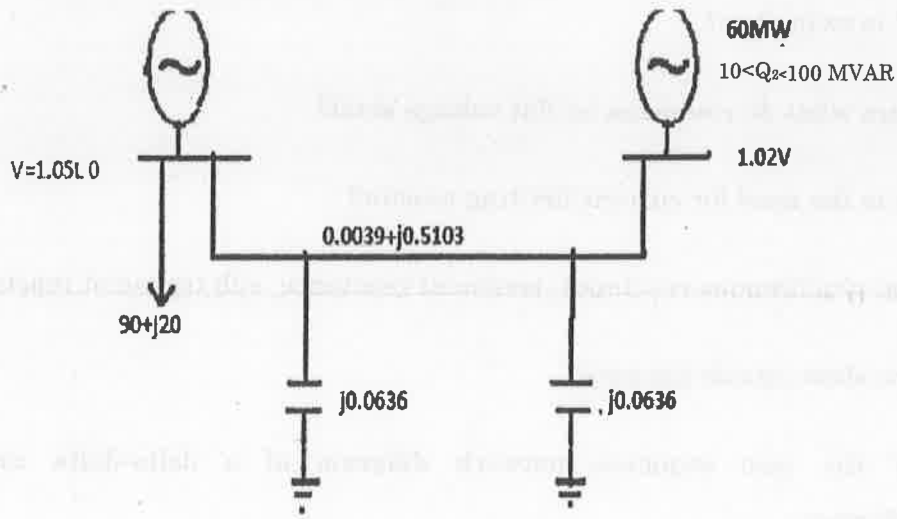

Fig. 12 a

Or

(b) Derive N-R method of load flow algorithm and explain the implementation of this algorithm with the flowchart. (13)

13. (a) A 3 phase, 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 rated at 3 MVA, 6.6 kV/33kV and has 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. (13)

Or

(b) Formulate the bus impedance matrix using bus building algorithm for the given network. Shown in Fig. 13 b. (13)

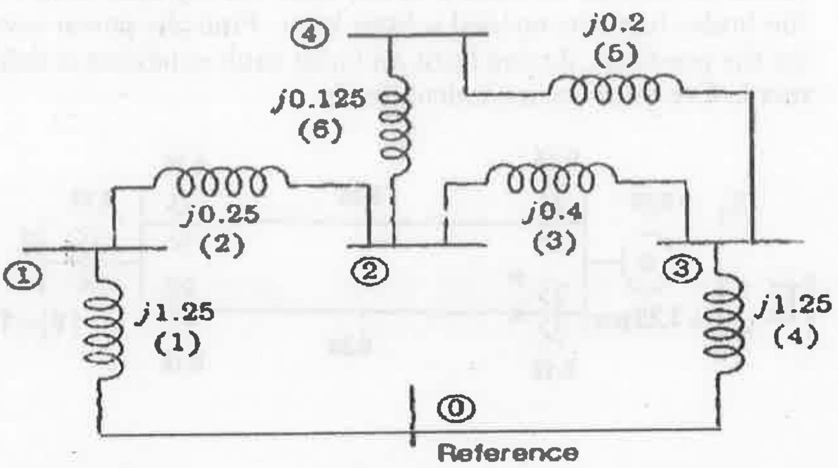

Fig. 13 b

14. (a) Discuss the expression for fault current in single line to ground fault on unloaded generator. Draw an equivalent network showing the inter connection of networks to simulate single line to ground fault. (13)

Or

(b) A 25 MVA, 13.2kV 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. (13)

15. (a) Examine the swing equation of a synchronous machine swinging against an infinite bus. Clearly state the assumption in deducing the swing equation. (13)

Or

(b) Explain with neat flow chart, the modified Euler method of analyzing multi machine power system for stability. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A 3 phase transmission line operating at 33kV and having resistance of 5 Ω and reactance of 20 Ω is connected to the generating station through 15,000 kVA step up transformer. Connected to the bus bar are two alternators one of 10,000 kVA with 10% reactance and another of 5000 kVA with 7.5% reactance. Draw the single line diagram and calculate the short circuit kVA for symmetrical fault between phases at the load end of the transmission line. (15)

Or

(b) In the power system shown in Fig 16.b, three phase fault occurs at P and the faulty line was opened a little later. Find the power output equations for the pre-fault, during fault and post-fault condition if delivering 1.0 p.u just before fault occurs, calculate δcc. (15)

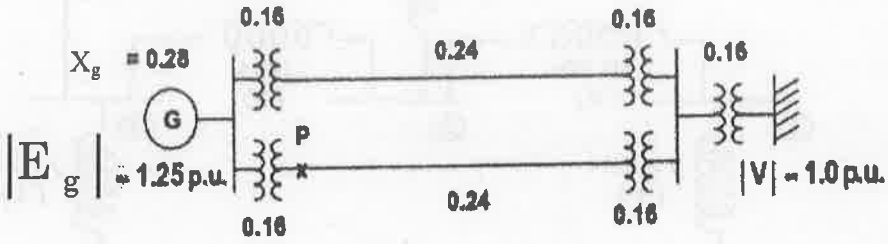

Fig. 16 b