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Question Paper Code : 31403

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Sixth Semester

Electrical and Electronics Engineering

EE 2351/EE 61/10133 EE 601 — POWER SYSTEM ANALYSIS

(Regulation 2008/2010)

(Common to PTEE 2351 Power System Analysis for B.E (Part-Time) Fourth Semester Electrical and Electronics Engineering Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the functions of modern power system?

2. Name the diagonal and off - diagonal elements of bus impedance matrix.

3. Why do Y_{bus} used in load flow study instead of Z_{bus}?

4. When will the generator bus be treated as load bus?

5. What is the order of severity and occurrence of different types of fault?

6. What are the characteristics of shunt and series faults?

7. What are the observations made from the analysis of various faults?

8. Write the boundary conditions for single line to ground fault.

9. Differentiate between voltage stability and rotor angle stability.

10. Define swing curve? What is the use of this curve.

PART B — (5 × 16 = 80 marks)

11. (a) A 90 MVA 11 KV 3 phase generator has a reactance of 25%. The generator supplies two motors through transformer and transmission line as shown in figure. 11(a). The transformer T_1 is a 3 — phase transformer, 100 MVA, 10/132 KV, 6% reactance. The transformer T_2 is composed of 3 single phase units each rated, 300 MVA, 66/10 KV, with 5% reactance. The connection of T_1 & T_2 are shown. The motors are rated at 50 MVA and 400 MVA both 10 KV and 20 % reactance. Taking the generator rating as base, draw reactance diagram and indicate the reactance in per unit. The reactance of line is 100 ohms. (16)

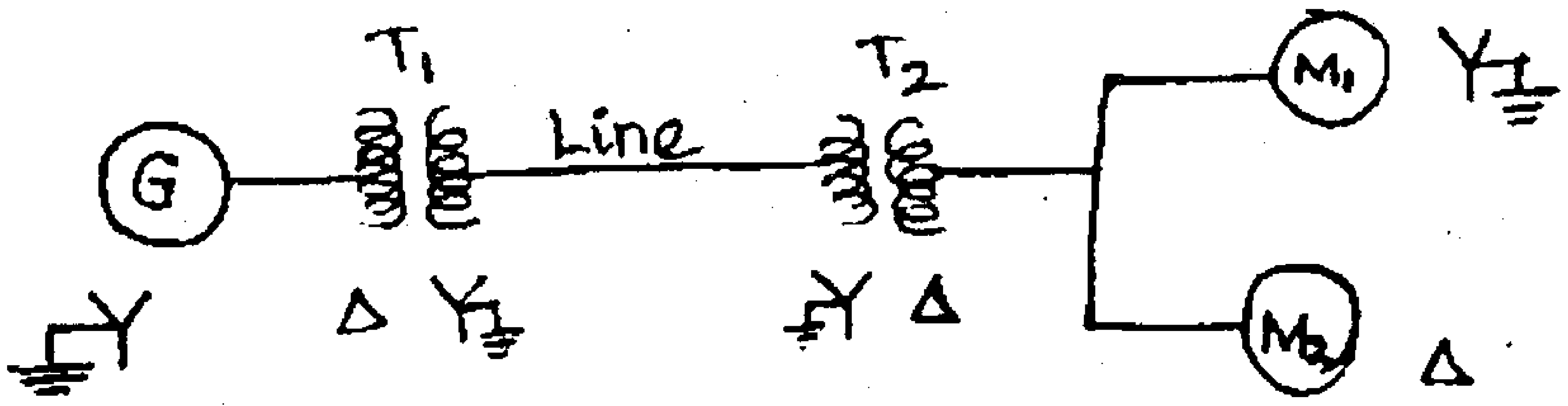

Figure. 11(a)

Or

(b) (i) Determine Y_{bus} for the 3 – bus system shown in figure. 11(b). The line series impedance as follows. (10)

Line (bus to bus)	Impedance (pu)
1 – 2	0.06 + j 0.18
1 – 3	0.03 + j 0.09
2 – 3	0.08 + j 0.24

Neglect the shunt capacitance of the lines.

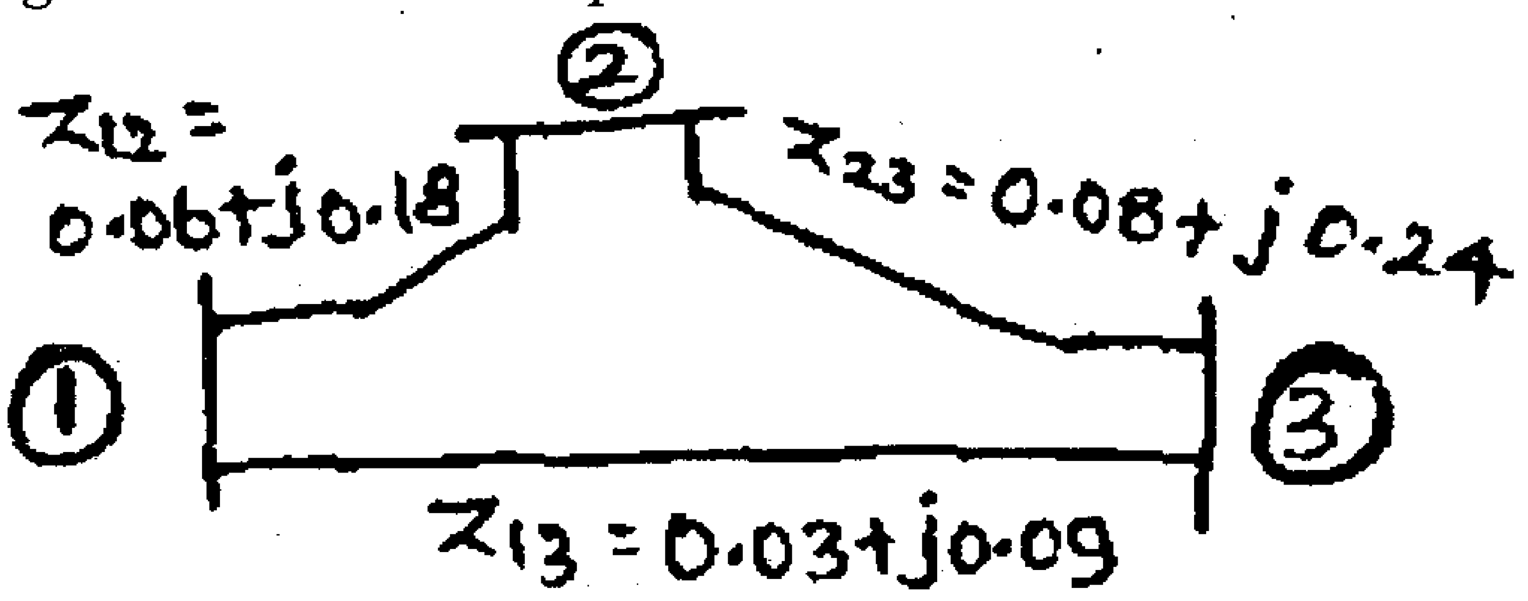

Figure. 11(b) (i)

(ii) What are impedance and reactance diagram? Explain. (6)

12. (a) A three bus power system is shown in figure. 12(a). The relevant per unit line admittance on 100 MVA base are indicated on the diagram and bus data are given in table 12. (a) Form Y_{bus} and determine the voltages at bus 2 and bus 3 after first iteration using Gauss Seidal method. Take the acceleration factor $\alpha = 1.6$. (16)

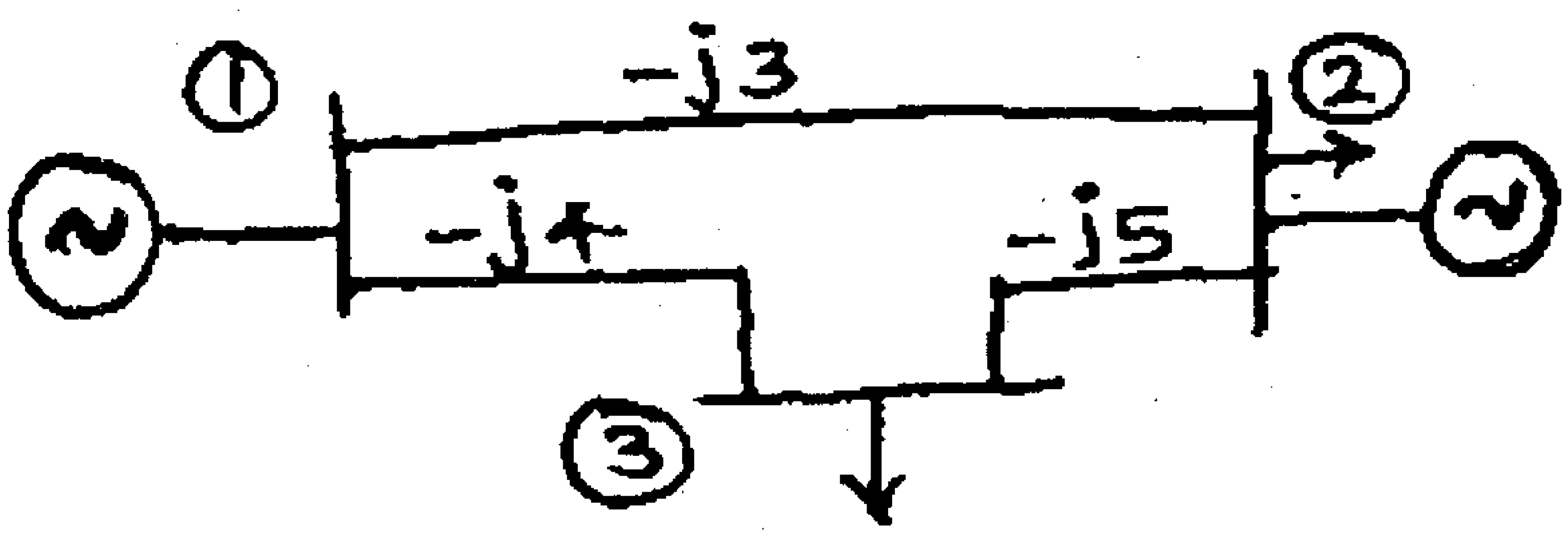

Figure. 12(a) A three – bus power system

Table: 12(a)

Bus number	Type	Generation		Load		Bus voltage	
		P_G	Q_G (MVAr)	P_L	Q_L	V (pu)	δ deg
1	Slack	?	?	0	0	1.02	0°
2	PQ	25	15	50	25	?	?
3	PQ	0	0	60	30	?	?

Or

(b) (i) Give the classification of various types of buses in a power system for load flow studies. (6)

(ii) Give the advantages and limitations of Newton Raphson method. (6)

(iii) What is meant by decoupled load flow method? (4)

13. (a) A 11 KV, 100 MVA alternator having a sub — transient reactance of 0.25 pu is supplying a 50 MVA motor having a sub — transient reactance of 0.2 pu through a transmission line. The line reactance is 0.05 pu on a base of 100 MVA. The motor is drawing 40 MW at 0.8 power factor leading with a terminal voltage of 10.95 KV when a 3-phase fault occurs at the generator terminals. Calculate the total current in the generator and motor under fault conditions. (16)

Or

(b) Figure 13. (b) Shows a generating station feeding a 132 KV system. Determine the total fault current, fault level and fault current supplied by each alternator for a 3 — phase fault at the receiving end bus. The line is 200 km long. Take a base of 100 MVA, 11 KV for LV side and 132 KV for HT side. (16)

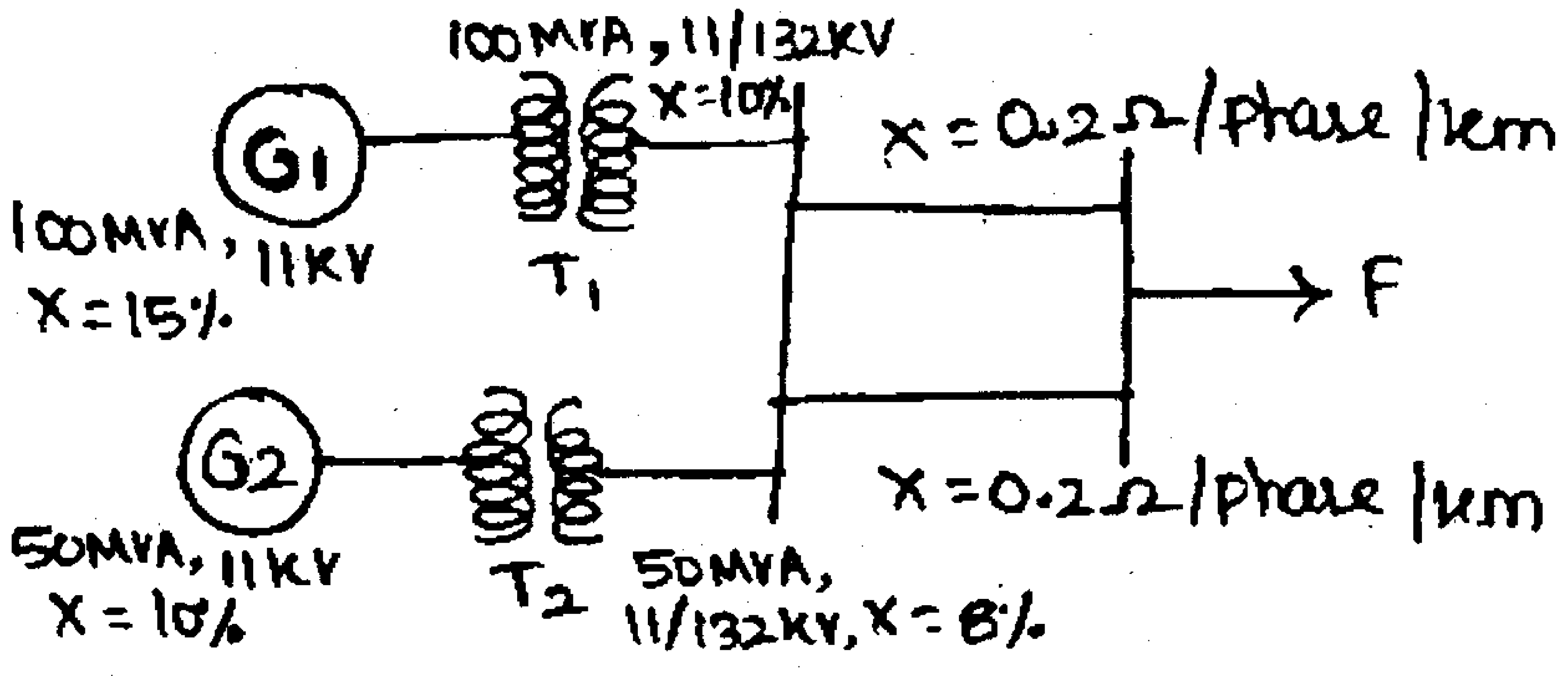

Figure. 13(b)

14. (a) Derive the necessary equation to determine the fault current for a Line - to - Line fault. Draw a diagram showing the interconnection of sequence networks. (16)

Or

(b) Figure. 14(b) Shows a power system network. Draw zero sequence network for this system. The system data is as under.

Generator G_1	50 MVA	11 KV,	$X_0 = 0.08$ pu
Transformer T_1	50 MVA	11/220 KV	$X_0 = 0.1$ Pu
Generator G_2	30 MVA	11 KV,	$X_0 = 0.07$ Pu
Transformer T_2	30 MVA	11/220 KV	$X_0 = 0.09$ pu

Zero sequence reactance of line is 555.6 ohms. Choose base MVA 50 and base voltage 11 KV for LT side and 220 KV for HT side. (16)

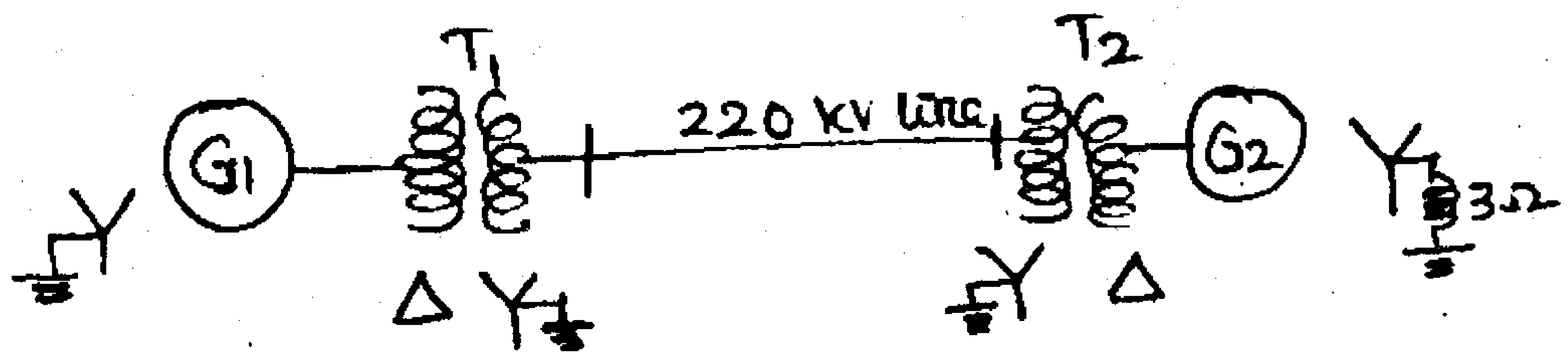

Figure. 14(b) Power System Network

15. (a) (i) Distinguish between steady state, transient and dynamic stability. (6)

(ii) Derive the swing equation of a synchronous machine. (10)

Or

(b) (i) Explain the methods of improving power system stabilitv. (10)

(ii) Explain the terms critical clearing angle and critical clearing time in connection with the transient stability of a power system. (6)