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Question Paper Code : 21403

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 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 is meant by percentage reactance?

2. Draw the equivalent circuit of a 3 winding transformer.

3. What is the necessity for slack bus?

4. What is meant by acceleration factor?

5. Distinguish symmetrical and unsymmetrical faults.

6. What is meant by fault level?

7. Define negative sequence impedance.

8. Draw the sequence network connections corresponding to L-L fault at bus.

9. Define infinite bus in a power system.

10. What is meant by power angle curve?

PART B — (5 × 16 = 80 marks)

11. (a) (i) For the system shown in figure 11 (a) (i) determine the generator voltage. Take a base of 100 MVA and 210 KV in the transmission line. (10)

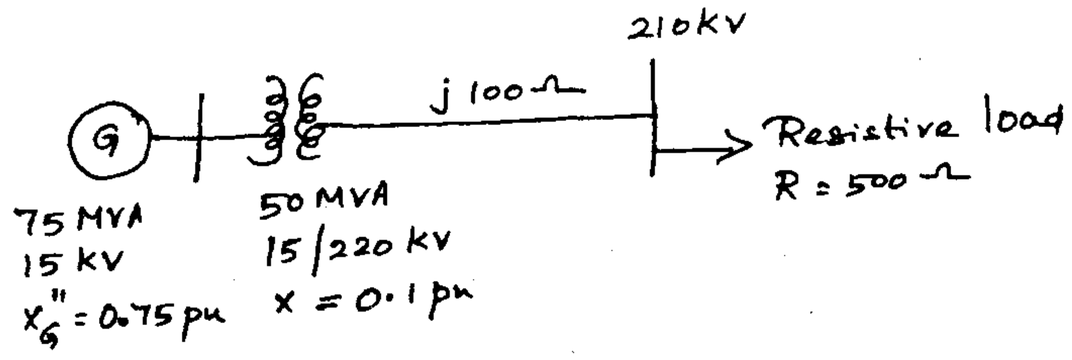

Fig. 11. (a) (i)

(ii) Why is per unit system used in power system analysis? And list its advantages. (6)

Or

(b) Form the bus impedance matrix for the network shown in fig. 11. (b) by bus building algorithm. (16)

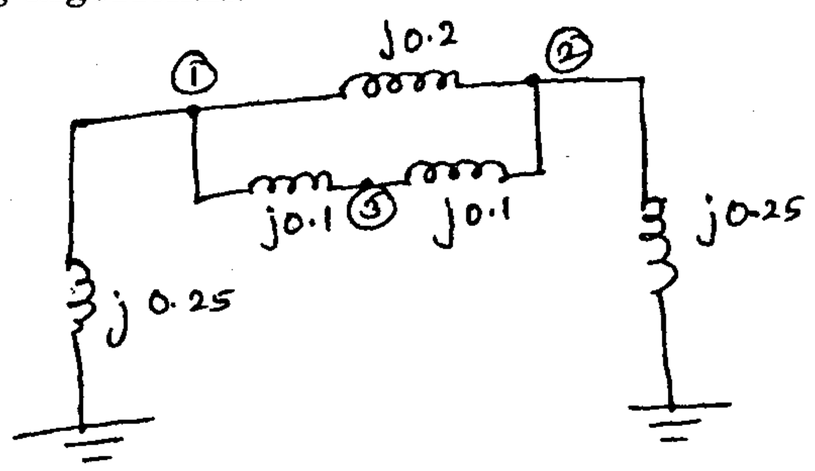

Fig. 11. (b)

12. (a) Consider the power system with the following data :

$$Y_{bus} = \begin{bmatrix} -j_{12} & j_8 & j_4 \\ j_8 & -j_{12} & j_4 \\ j_4 & j_4 & -j_8 \end{bmatrix}.$$

		Generation		Load		Voltage	
Bus No.	Type	P	Q	P	Q	Magnitude	Angle
1	Slack	–	–	–	–	1.0	0°
2	P-V	5.0	–	0	–	1.05	–
3	P-Q	0	0	3.0	0.5	–	–

Assume that the bus 2 can supply any amount of reactive power. With a flat start, perform the first iteration of power flow analysis using Newton-Raphson method. (16)

Or

(b) Discuss in detail about Gauss-Seidal load flow analysis algorithm and give steps for its implementation when Pv buses also present in the system. (16)

13. (a) A synchronous generator and motor are rated 30 MVA, 13.2 KV and both have subtransient reactances of 20%. The line connecting them has reactance of 10% on the base of machine ratings. The motor is drawing 20,000 kW at 0.8 pf leading and terminal voltage of 12.8 Kv when a symmetrical 3–ϕ fault occurs at the motor terminals. Find the sub-transient current in the generator, motor and fault by using interval voltages of the machines. (16)

Or

(b) With a help of a detailed flowchart, explain how a symmetrical fault can be analysed using Z_{bus}. (16)

14. (a) A single line diagram of a power network is shown in Fig. 14 (a).

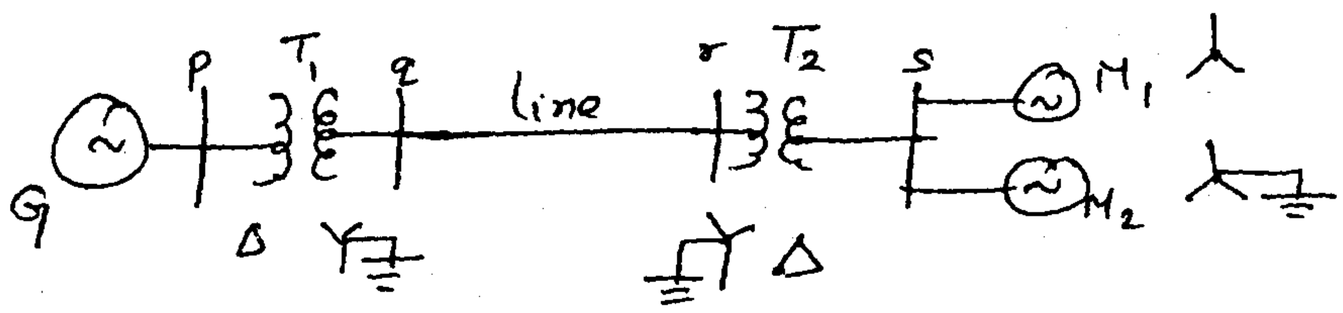

Fig. 14 (a)

The system data is given in the table 14 (a) as below:

Element	Positive sequence reactance (pu)	Negative sequence reactance (pu)	Zero sequence reactance (pu)
Generator G	0.1	0.12	0.05
Motor M_1	0.05	0.06	0.025
Motor M_2	0.05	0.06	0.025
Transformer T_1	0.07	0.07	0.07
Transformer T_2	0.08	0.08	0.08
Line	0.10	0.10	0.10

Generator grounding reactance is 0.5 pu. Draw sequence networks and calculate the fault current for a line-to-line fault on phases b and c at point q. Assume 1.0 pu prefault voltage throughout. (16)

Or

(b) Discuss in detail about the sequence impedances and networks of synchronous machines, transmission lines transformers and loads. (16)

15. (a) Derive swing equation for a single machine connected to infinite bus system. State the usefulness of this equation. State the reasons for non-linearity of this equation. (16)

Or

(b) State and explain equal area criterion and discuss how you will apply it to find the maximum additional load that can be suddenly added. (16)
