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Question Paper Code : 50538

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 8501 – POWER SYSTEM ANALYSIS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

(Codes / Tables / Charts to be permitted, if any, may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define bus impedance matrix.
2. List the advantages of per unit computations.
3. What is P-Q bus in power flow analysis?
4. What do you mean by flat voltage start?
5. What is the need for short circuit analysis?
6. Define bolted fault.
7. What are symmetrical components?
8. List the various types of unsymmetrical faults.
9. Define power angle.
10. State equal area criterion.

PART B — (5 × 13 = 65 marks)

11. (a) Obtain PU impedance diagram of the power system of figure. Choose base quantities as 15 MVA and 33 KV.

Generator: 30 MVA, 10.5KV, X"= 1.6 ohms. Transformers T_1 and T_2: 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.

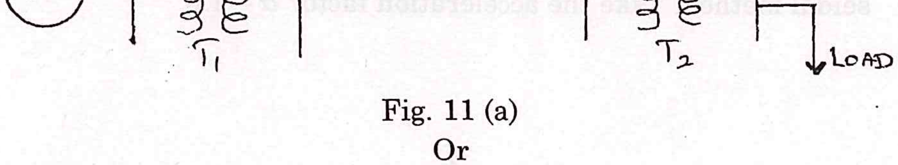

Fig. 11 (a)

Or

(b) Form Y-bus of the system shown in Fig. 11(b) using singular transformation method. The impedance data is given in the table. Take bus 1 as reference node.

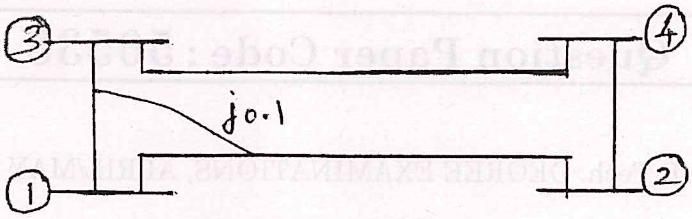

Fig. 11(b)

Element No.	Self		Mutual	
	Bus Code	Impedance (p.u.)	Bus Code	Impedance (p.u.)
1	1-2	0.5		
2	1-3	0.6	1-2	0.1
3	3-4	0.4		
4	2-4	0.3		

12. (a) Prepare the load flow algorithm using gauss seidal method with the flowchart and discuss the advantages of the method.

Or

(b) A three bus power system is shown in Fig. 12(b) and its data's are given in the table.

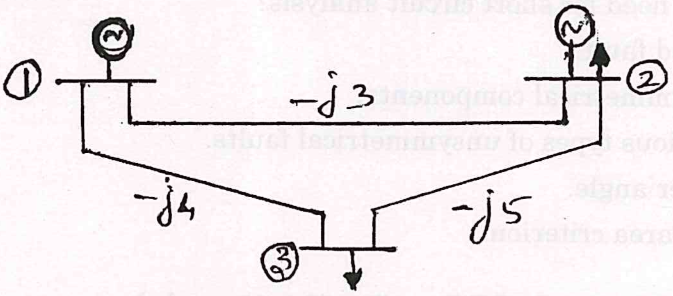

Fig. 12(b)

Bus No.	Type	Generation		Load		Bus Voltage	
		P_G	Q_G	P_L	Q_L	V	δ
1	Stack	-	-	-	-	1.02	0
2	PQ	0.25	0.15	0.5	0.25	-	-
3	PQ	0	0	0.6	0.3	-	-

Determine the voltages at buses 2 and 3 after 1st iteration using gauss-seidal method. Take the acceleration factor $\alpha = 1.6$.

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

Or

(b) For the radial network shown in Fig. 13 (b), a three phase fault occurs at point F. Examine the fault current.

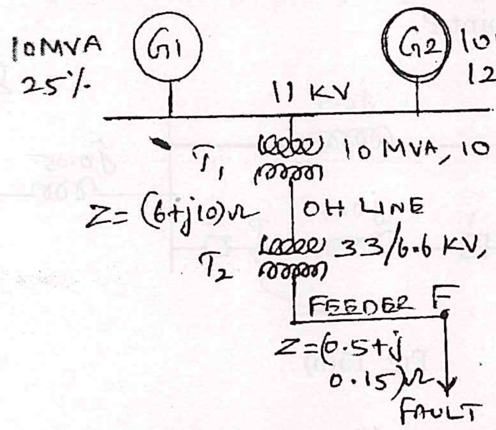

Fig. 13 (b)

14. (a) A single line to ground fault occurs at bus 4 of the system shown in Fig. 14(a). (i) Draw the equivalent networks (ii) Compute fault current.

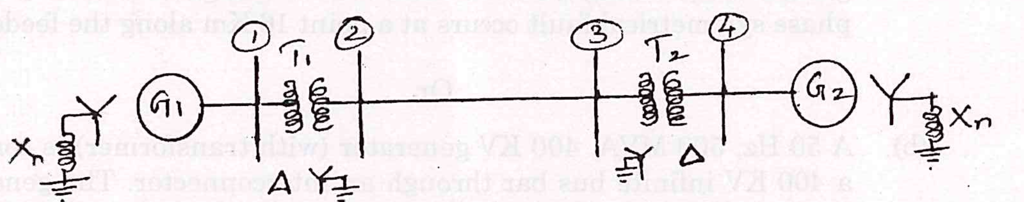

Fig. 14(a)

G_1, G_2: 100 MVA, 20 kV, X'=X" = 20%, X_0 = 4%, X_n = 5%

T_1, T_2: 100 MVA, 20/345 kV, X_{leak} = 8% on 100 MVA

Tr. Line: X' = X" = 15%, X = 50% on a base of 100 MVA, 20kV.

Or

(b) Derive the expression for fault current for a double line to ground fault in an unloaded generator in terms of symmetrical components.

BBB

15. (a) Describe the equal area criterion for transient stability analysis of a system.

Or

(b) Given the system of Fig. 15(b) shown below where a three phase fault is applied at a point P as shown. Examine the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated in the diagram. The generator is delivering 1.0 p.u. power at the instant preceding the fault. The fault occurs at point P.

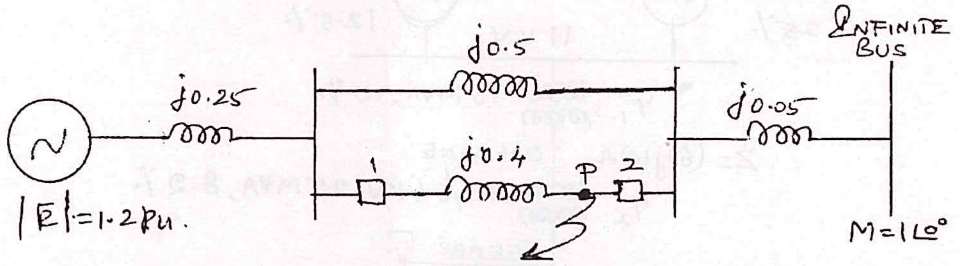

Fig. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) A 3-phase 6 MVA, 6.6 KV alternator with a reactance of 12% is connected to a feeder of series impedance (0.10+j0.5) ohm/phase/Km through a step up transformer. The transformer is rated at 3 MVA, 6.6 KV/33KV and has a reactance of 7%. Determine 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 16 Km along the feeder.

Or

(b) A 50 Hz, 500 MVA, 400 KV generator (with transformer) is connected to a 400 KV infinite bus bar through an interconnector. The generator has H = 2.5 MJ/MVA. Voltage behind transient reactance of 450 KV and is loaded 460 MW. The transfer reactances between generator and bus bar under various conditions are: Prefault 0.5 p.u., During Fault 1.0 p.u., Post fault 0.75 p.u. Calculate the swing curve using intervals of 0.05 sec and assuming that the fault is cleared at 0.15 sec.