7E4172

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B. Tech. VII Semester (Main/Back) Examination 2014

ELECTRICAL ENGINEERING # 7EE2A

POWER SYSTEM ANALYSIS

Time : 3 Hours **Min. Passing Marks : 24** **Maximum Marks : 80**

Instruction to Candidates :

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit-I

1. **(a)** Derive the expression that per unit impedance of 3-phase transformer is remain same either refer to primary side or refer to secondary side. Also give the advantages and disadvantages of per unit system. **[8]**

(b) A 90 MVA, 11 KV, 3-ϕ(Phase), generator has a reactance of 25%. The generator supplies two motors through transformers and transmission line as shown in Fig. 1. Transformer T_1 is a 3 phase X_{mer}, 100 MVA, 10/132 KV, 6% reactance. Transformer T_2 is composed of 3 single phase units each rated 30 MVA, 66/10 KV, 5% reactance. Motors are rated 50 MVA, and 40 MVA both 10 KV and 20% reactance. Taking generator rating as base draw reactance diagram and indicate reactances in per unit. The reactance of line is 1000 hms. **[12]**

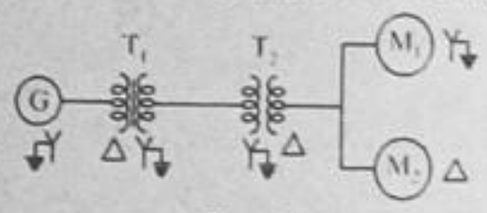

Fig. 1

OR

1. **(a)** Explain the procedure for formulation of admittance matrix also explain the modification in admittance matrix. **[8]**

(b) The parameter of a 4 bus system are as under:

Bus Code	Line Impedance (p.u.)	Charging Admittance ($Y_{P/2}$) p.u.
1-2	0.2+j0.8	0.02
2-3	0.3+j0.9	0.03
2-4	0.25+j1.0	0.04
3-4	0.2+j0.8	0.02
1-3	0.1+j0.4	0.01

Draw the network and find bus admittance matrix. **[8]**

Unit-II

2. **(a)** Explain the short circuit study of a transmission also explain the doubling effect. **[8]**

(b) Figure 2 shows system having 4 alternators each rated at 11KV, 50MVA and each having a sub transient reactance of 15%. Find:

(i) Fault level for a fault on one of the feeder (near the bus) with zero value of reactance X.

(ii) The reactance of the current limiting reactor x to limit the fault level to 800 MVA for a fault on one of the feeder. **[8]**

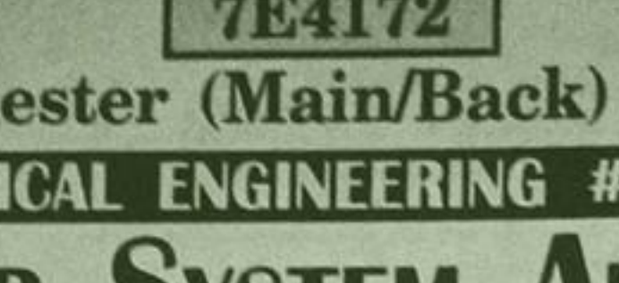

Fig. 1

OR

2. A synchronous generator and a synchronous motor each rated 25 MVA, 11KV having 15% sub transient reactance are connected through transformer and a line as shown in figure 3. The transformer are rated 25 MVA, 11/66KV and 66/11KV with leakage reactance of 25MVA, 66KV. The motor is drawing 15MW at 0.8 p.f. leading and a terminal voltage of 10.6KV when a symmetrical 3-phase fault occurs at the motor terminals. Find the sub transient current in the generator. Motor and fault. **[16]**

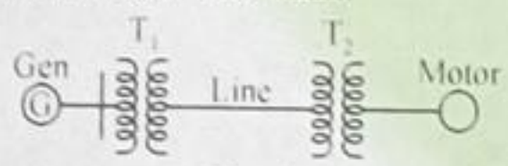

Fig. 3.

Unit-III

3. **(a)** Draw the general circuit diagram which can be used to determine the zero sequence network of a two winding transformer. Using this circuit draw the zero sequence networks of different connection of 3-phase transformer. **[8]**

(b) Figure-4 show a power system network. Draw the zero sequence diagram for this system. **[8]**

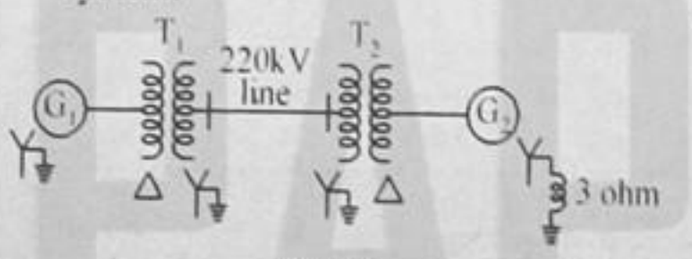

Fig. 4.

The system data are as.

Generator G_1	50MVA	11KV	$X_0 = 0.08$p.u.
Transformer T_1	50MVA	11/220KV	$X_0 = 0.1$p.u.
Generator G_2	30MVA	11KV	$X_0 = 0.07$p.u.
Transformer T_2	30MVA	11/220KV	$X_0 = 0.09$p.u.

OR

3. **(a)** Explain the sequence impedance and network of a synchronous machine. **[8]**

(b) Explain phase shift in star-delta transformer. **[8]**

Unit-IV

4. **(a)** Derive the expression for fault current by symmetrical component method for line to line fault. **[8]**

(b) Two 11KV, 20MVA three phase star connected generators operate in parallel as shown in figure 5. The positive, negative and zero sequence reactances of each being respectively j0.18, j0.15 and j0.10 p.u. The star point of one of the generator is isolated and that of the other is earthned through 2.0 ohm resistor. A single line to ground fault occurs at the terminals of one of the generator. Estimate:

(i) The fault current

(ii) Current in ground resistor

(iii) Voltage across ground resistor. **[8]**

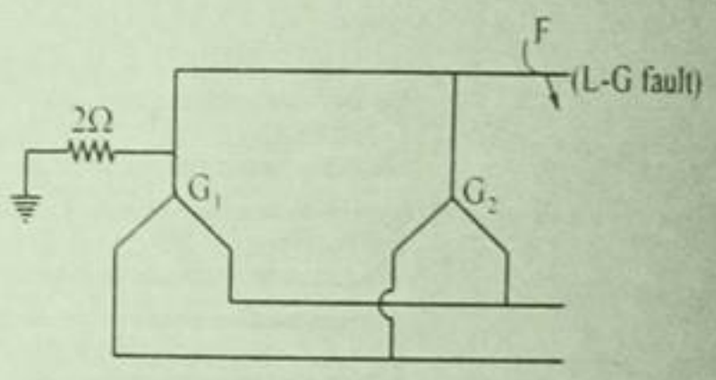

Fig. 5

OR

4. **(a)** Give the comparison of single line to ground fault and 3-phase fault current for a fault at generator terminal and transmission line. **[8]**

(b) Explain:

(i) Distinguish between symmetrical and unsymmetrical fault.

(ii) Short circuit and open circuit fault.

(iii) The neutral ground impedance Zn appears as 3Zn in the zero sequence equivalent circuit. **[8]**

Unit-V

5. Explain different type of busses and variables in given power system. Also derive steady state load flow equation. Also give assumption and restriction for solving load flow equation. **[16]**

OR

5. **(a)** Give reason:

(i) NR method is preferred to G-S method for load flow study in power system.

(ii) Majority of busses in power system are load busses.

(iii) Bus admittance matrix is preferred for load flow study. **[8]**

(b) Explain Gauss-Siedal method for load flow study. **[2]**