B.E. (Electrical Engineering (Electronics & Power)) Semester Seventh (C.B.S.)

Electrical Power System - II

P. Pages : 4 **KNT/KW/16/7460**

Time : Three Hours Max. Marks : 80

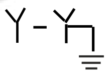
Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) State and explain Fortescue's theorem of symmetrical components. **5**

b) The resolution of a set of $3-\phi$ unbalanced voltages in to symmetrical components gave the following results $V_{a0} = 30\angle 30^o$ v, $V_{al} = 450 \angle 0^o$ v, $V_{a2} = 225 \angle 40^o$ v The current components are $I_{a0} = 10\angle 190^o$ A, $I_{a1} = 6\angle 20^o$ A, $I_{a2} = 5\angle 50^o$ A Determine the complex power represented by these voltages and currents by **8**
1) Symmetrical components.
2) Unbalanced phase components comment upon the results.

OR

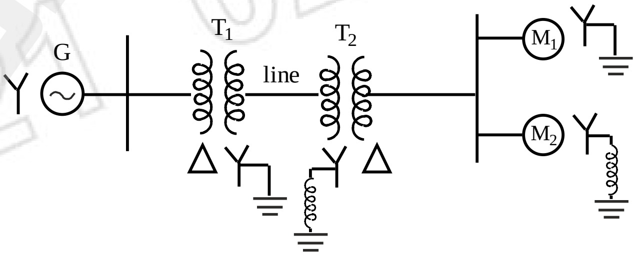
2. a) Draw zero sequence network for following types of transformer banks. **3**

1) 

2) Δ – Y

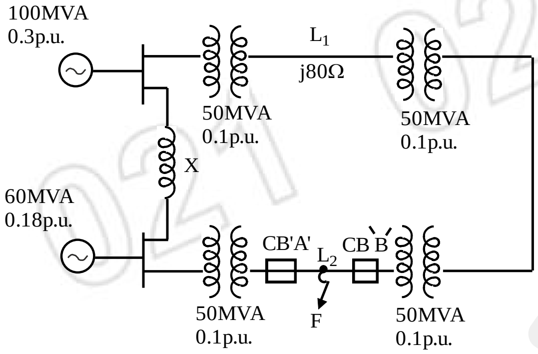
3) Δ – Δ

b) Draw the positive, negative & zero sequence network for the system shown in fig. **6**



c) Show that the power in a $3-\phi$ circuits can be computed from symmetrical components. **4**

3. a) A power system shown in fig. x = 0.2 p.u. on base of 100 MVA. The system is initially unloaded and the line voltages is 110 kV. A symmetrical 3 – ϕ short circuit take place at mid point 'F' of line L_2. Calculate SCMVA to be interrupted by C.B.'A' and C.B. 'B' with and without reactance 'X'. **9**

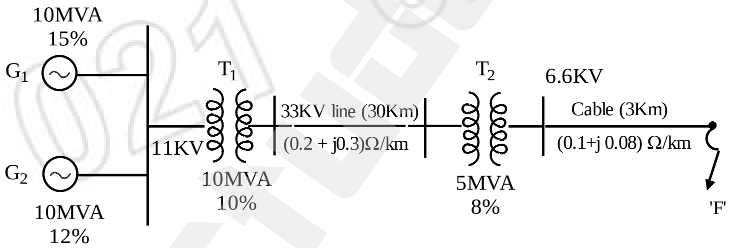


b) Explain with waveforms and magnitude of currents when symmetrical short circuit occurs on the terminals of synchronous generator at no load condition. **5**

OR

4. a) What is the need of reactors in power system? Explain the reactors as per their location in the power system. **6**

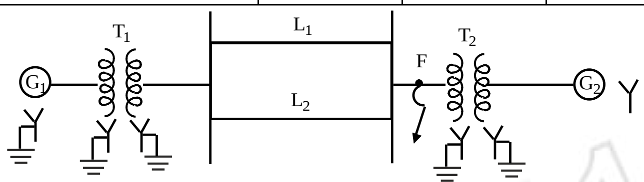
b) For the network shown, a 3 – ϕ fault occurs at point F, determine the fault current. **8**



5. a) Derive the relationship to determine the interconnection of sequence network for L-L-G faults. Also draw sequence network. **6**

b) Draw the sequence network for L – L fault at point 'F'. The p.u. reactances are as follows. The system as shown in the diagram. **7**

Components	X_0	X_1	X_2
Generator G_1	0.05	0.3	0.2
Generator G_2	0.03	0.25	0.15
Line L_1	0.70	0.3	0.3
Line L_2	0.70	0.3	0.3
Transformer T_1	0.12	0.12	0.12
Transformer T_2	0.1	0.1	0.1

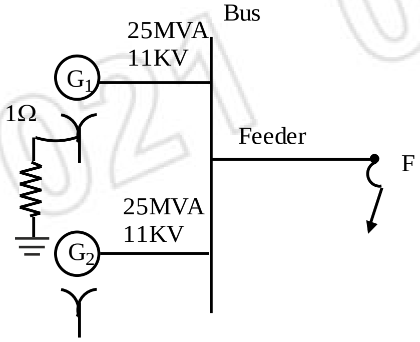


Both the generators are operating at 1 p.u. voltages. Also calculate fault current at point F.

OR

6. a) Explain sequence network interconnection for one conductor open fault. **5**

b) Two 25MVA, 11KV, synchronous generators are connected to a common bus-bar, which supplies a feeder. The star point of one of the generator is grounded through a resistance of 1Ω, while that of the other generator is isolated. A line to ground fault occurs at the far end of the feeder. Determine **8**



1) Fault current.
2) Voltage to ground of sound phases of feeder at the fault point.
3) Voltage of the star point of the grounded generator w.r.t. ground.

Impedances to seq. currents of each generator and feeder are given below.

	Generator (p.u.)	Feeder (Ω /ph)
+ve. seq.	j0.2	j0.4
- ve seq.	j0.15	j0.4
zero seq.	j0.08	j0.8

7. a) A synchronous generator at 50Hz is on load of 1 p.u. connected to infinite bus. The maximum power transfer under healthy condition is 1.8 p.u. During the fault the maximum power transfer is 0.4 p.u. after clearance of fault the maximum power transfer is 1.3 p.u. Determine the critical clearing angle for the stability. Derive the expression used. **7**

b) What is meant by swing curve? Derive the swing equation. **7**

OR

8. a) Discuss the swing equation by point by point method. **7**

b) A generator is connected to ∞ bus through a transformer and double circuit transmission line. The generator has $xd' = 0.25$ p.u. The transformer has leakage reactance of 0.1 p.u. and reactance of each line is 0.5 p.u. the generator is delivering 1 p.u. Power to ∞bus with each of generator terminal voltage and ∞bus voltage as 1 p.u. **7**

Find the steady state stability limit under following conditions and plot power angle curve for all cases.

1) When system is healthy.
2) $3-\phi$ S. C. at middle of one of the line.
3) Faulted line open.

9. a) Explain the following terms related with economic operation of power system: **6**

i) Input-Output curve.
ii) Penalty factor
iii) Incremental fuel cost.

b) Derive the co-ordination equation for economic load scheduling of power plants including transmission losses. Give the algorithm for solution of co-ordination equation. **7**

OR

10. a) Discuss block diagram of Automatic load dispatch. **6**

b) A constant load of 300 MW is supplied by two 200 MW generators 1 & 2, for which the respective incremental fuel cost are $\frac{dC_1}{dP_1} = 0.1P_1 + 20$; $\frac{dC_2}{dP_2} = 0.12\,P_z + 15$ with power 'P' in MW and cost 'C' in Rs./hrs Determine. **7**

1) The most economical division of the load between generators.
2) The saving in Rs./day obtained compared to equal load sharing.

11. a) Discuss the need of neutral grounding in power system. **5**

b) Discuss the method of grounding using zig-zag transformer. **5**

c) Explain the meaning of Arcing ground. **3**

OR

12. a) What are the types of compensation in power system? Hence define 'compensation 'factor' for each. **6**

b) Derive an expression for the reactance of the peterson COIL in terms of the capacitance of the protected line. Calculate the reactance of the COIL suitable for 33KV, $3-\phi$ transmission system of which the capacitance to earth of each conductor is 5 μf. **7**

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