VIDHYADEEP INSTITUTE OF ENGINEERING AND TECHNOLOGY

Vidhyadeep Campus, Anita (Kim), Ta. Olpad, Dist. Surat

Subject Name: ***Power System II*** ***Subject Code:*** ***3150911*** ***Sem:*** ***5th (2021-22)***

Assignment-1_Transmission Line Modeling and Performance

Q.1 ***What is the purpose of an overhead transmission line? How are these lines classified?***

Q.2 ***Discuss the terms voltage regulation and transmission efficiency as applied to transmission line***

Q.3 ***Deduce an expression for voltage regulation of a short transmission line, giving the vector diagram***

Q.4 ***What is the effect of load power factor on regulation and efficiency of a transmission line?***

Q.5 ***What do you understand by medium transmission lines? How capacitance effects are taken into account in such lines?***

Q.6 ***Show how regulation and transmission efficiency are determined for medium lines using***
(i) end condenser method
(ii) nominal T method
(iii) nominal ∏ method
Illustrate your answer with suitable vector diagrams.

Q.7 ***Using rigorous method, derive expressions for sending end voltage and current for a long transmission 1ine.***

Q.8 ***An overhead 3-phase transmission line delivers 5000 kW at 22 kV at 0·8 p.f. Lagging. The resistance and reactance of each conductor is 4 Ω and 6 Ω respectively. Determine :(i) Sending end voltage (ii) percentage regulation (iii) transmission efficiency.***

Q.9 ***A 3-phase line delivers 3600 kW at a p.f. 0·8 lagging to a load. If the sending end voltage is 33 kV, determine (i) the receiving end voltage (ii) line current (iii) transmission efficiency. The resistance and reactance of each conductor are 5·31 Ω and 5·54 Ω respectively.***

Q.10 ***A short 3-Phase transmission line with an impedance of (6 + j 8) Ω per phase has sending and receiving end voltages of 120 kV and 110 kV respectively for some receiving end load at a p.f. of 0·9 lagging. Determine (i) power output and (ii) sending end power factor***

Q.11 ***A (medium) single phase transmission line 100 km long has the following constants :***
Resistance/km = 0·25 Ω ; Reactance/km = 0·8 Ω Susceptance/km = 14 × 10−6 siemen ; Receiving end line voltage = 66,000 V
Assuming that the total capacitance of the line is localised at the receiving end alone, determine (i) the sending end current (ii) the sending end voltage (iii) regulation and (iv) supply power factor.

The line is delivering 15,000 kW at 0.8 power factor lagging. Draw the phasor diagram to illustrate your calculations.

Q.12 *A 3-phase, 50-Hz overhead transmission line 100 km long has the following constants :*
Resistance/km/phase = 0.1 Ω
Inductive reactance/km/phase = 0·2 Ω
Capacitive susceptance/km/phase = 0·04 × 10− 4 siemen
Determine (i) the sending end current (ii) sending end voltage (iii) sending end power factor and (iv) transmission efficiency when supplying a balanced load of 10,000 kW at 66 kV, p.f. 0·8 lagging. Use nominal T method.

Q.13 *A 3-φ transmission line 200 km long has the following constants :*
Resistance/phase/km = 0·16 Ω
Reactance/phase/km = 0·25 Ω
Shunt admittance/phase/km = 1·5 × 10–6 S
Calculate by rigorous method the sending end voltage and current when the line is delivering a load of 20 MW at 0·8 p.f. lagging. The receiving end voltage is kept constant at 110 kV.

Subject Coordinator **H.O.D. (Elect)**

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Assignment-2_Symmetrical Fault Analysis

Q.1 Derive proper equations & explain doubling effect.

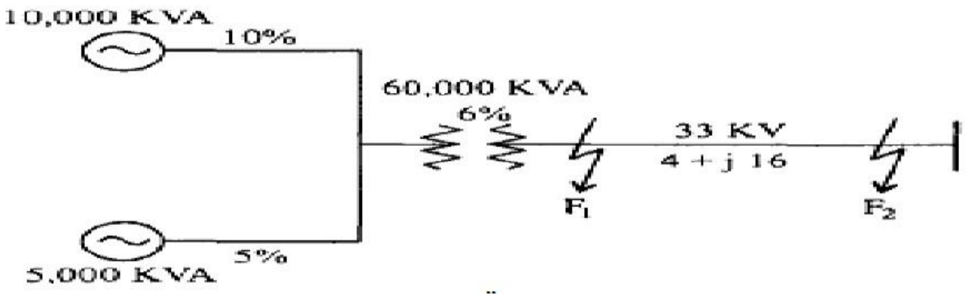
Q.2 Explain in detail how fault analysis is helpful in selection of circuit breaker.

Q.3 Draw the waveforms for fault current for a 3-phase fault on alternator terminals. Explain the sub-transient, transient and steady state reactance. What is significance in fault calculations?

Q.4 A synchronous generator and a synchronous motor each rated 25MVA, 11KV having15% sub transient reactance are connected through transformer and a line as shown in fig (B). The transformer s are rated 25 MVA, 11/66KV and 66/11 KV with leakage reactance of 10% each. The line has a reactance of 10% on a base of 25 MVA, 66 KV. The motor is drawing 15 MW at 0.8 power factor leading and a terminal voltage of 10.6 KV when a symmetrical three-phase fault occurs at the motor terminals. Find the sub transient current in the generator, motor and fault.

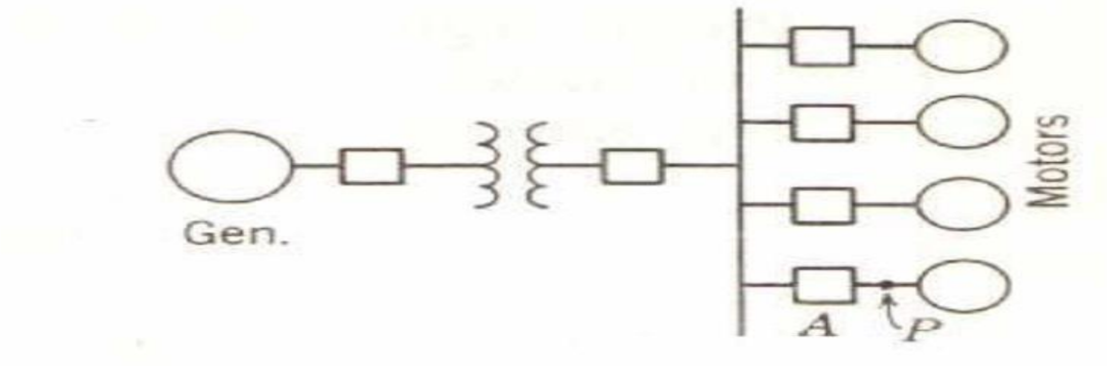
Fig (B)

Q.5 A 33 KV line has a resistance of 4 ohm and reactance of 16 ohm respectively. The line is connected to generating station bus bars through a 6000 KVA step up transformer which has a reactance of 6%. The station has two generators rated 10,000 KVA with 10% reactance and 5000 KVA with 5% reactance. Calculate the fault current and short circuit KVA when a 3-phase fault occurs at the H.V. terminals of the transformers and at the load end of the line. (See figure)

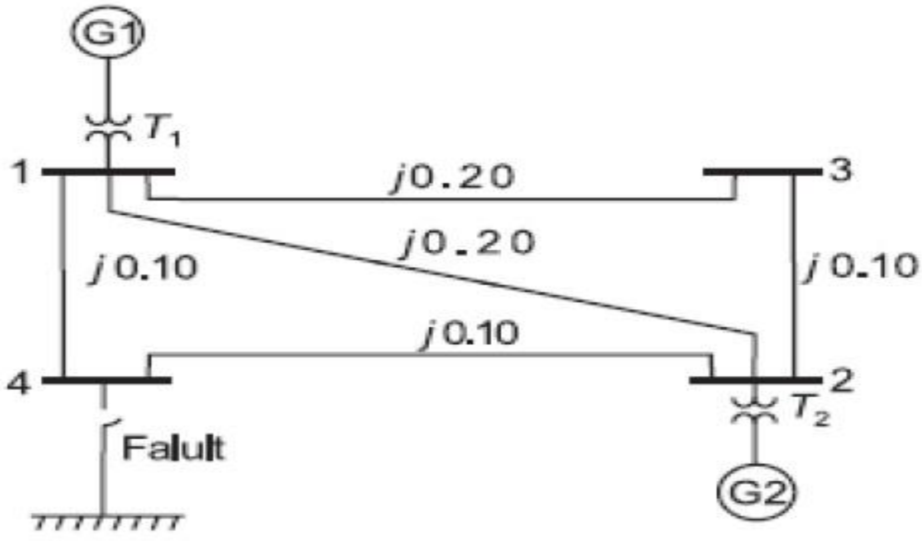


Q.6 A 25 MVA 13.8 KV generator with Xd ”=15% is connected through a transformer to a bus which supplies four identical motors as shown in Fig. The subtransient reactance Xd ” of each motor is 20% on a base of 5MVA, 6.9 KV. The three phase rating of the transformer is 25

MVA 13.8/6.9 KV with a leakage reactance of 10%. The bus voltage at the motors is 6.9 kv when a three phase fault occurs at the point P. for the fault specified, Determine (a) the sub transient current in the fault, (b) the subtransient current in breaker A.



Q.7 A four bus sample power system is shown in fig 1.Calculate the faults current at bus no 4 for three phase solid fault occurring at that bus. Various data are given below. Assume pre fault voltage as 1.0 pu and pre fault current be zero. G1:11.2 KV,100 MVA, x'g1=0.08 pu, Line from 1 to 2=0.20 pu, Line from 1 to 3 =0.20 pu,; Line from 1 to 4=0.10 pu, Line from 2 to 3=0.10 pu,; Line from 2 to 4=0.10 pu, ; G2:11.2 KV,100 MVA, x'g2=0.08 pu; T1:11/110KV,100MVA, XT1=0.06 pu; T2:11/110KV, 100MVA, XT2=0.06 pu



Q.8 Explain the importance of bus impedance matrix in fault calculation.

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Assignment-3_Symmetrical Components

Q.1 Discuss principle of symmetrical components. Derive the necessary equations to convert: (i) phase quantities into symmetrical components (ii) symmetrical components in to phase quantities

Q.2 Introduce symmetrical components and state their applications. Derive symmetrical components of a given set of three unbalanced current phasors.

Q.3 Derive the expressions of positive, negative and zero sequence voltage components in terms of given set of unbalance voltage phasors Va, Vb and Vc. Also prove that the transformation used is power invariant.

Q.4 Write a brief note on phase shift of symmetrical components in Y-Δ transformer banks

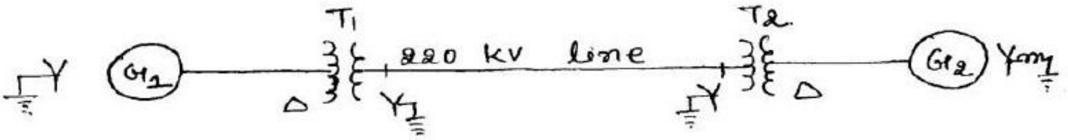
Q.5 Write a note on zero sequence networks in brief.

Q.6 Describe how zero sequence impedances of generator, transmission line and transformers are obtained. Draw zero sequence diagrams of transformer with different connections of primary and secondary.

Q.7 Explain the zero sequence impedance of transformer for various connections.

Q.8 A delta connected balanced resistive load is connected across an unbalanced threephase supply. The currents in lines A and B are 10 /_30o and 15 /_60 o respectively. Find current in line C. Find symmetrical components of phase currents flowing in the individual resistances of the delta connected load.

Q.9 Below figure shows a power system network. Draw zero sequence networks for this system. The system data is as under. (1)Generator (G1): 50 MVA, 11KV, X0 =0.08 p.u.(2) Transformer (T1): 50 MVA, 11/220 KV, X0 =0.1 p.u. (3)Generator (G2):30 MVA, 11KV, X0 =0.07 p.u. (4)Transformer (T2): 30 MVA, 220/11 KV, X0 =0.09 p.u.(5)Zero sequence reactance of line is 555.6 Ω



Q.10 The currents in three phase unbalance system are IR=(12+j6) A,IY=(12- j12) A, IB = (-15+j10) A. The phase sequence is RYB. Calculate, positive, negative and zero sequence component of current.

Q.11 Below figure shows a power system network. Draw positive, negative and zero sequence networks. The system data is as under:

Equipment	MVA Rating	Voltage Rating	X_1	X_2	X_3
Gen. G_1	100	11 kV	0.25 p.u.	0.25 p.u.	0.25 p.u.
Gen. G_2	100	11 kV	0.2 p.u.	0.2 p.u.	0.2 p.u.
Transformer T_2	100	11/220 kV	0.06 p.u.	0.06 p.u.	0.06 p.u.
Transformer T_2	100	11/220 kV	0.07 p.u.	0.07 p.u.	0.07 p.u.
Line 1	100	220 kV	48.4 Ω	48.4 Ω	145.2 Ω
Line 2	100	220 kV	48.4 Ω	48.4 Ω	145.2 Ω

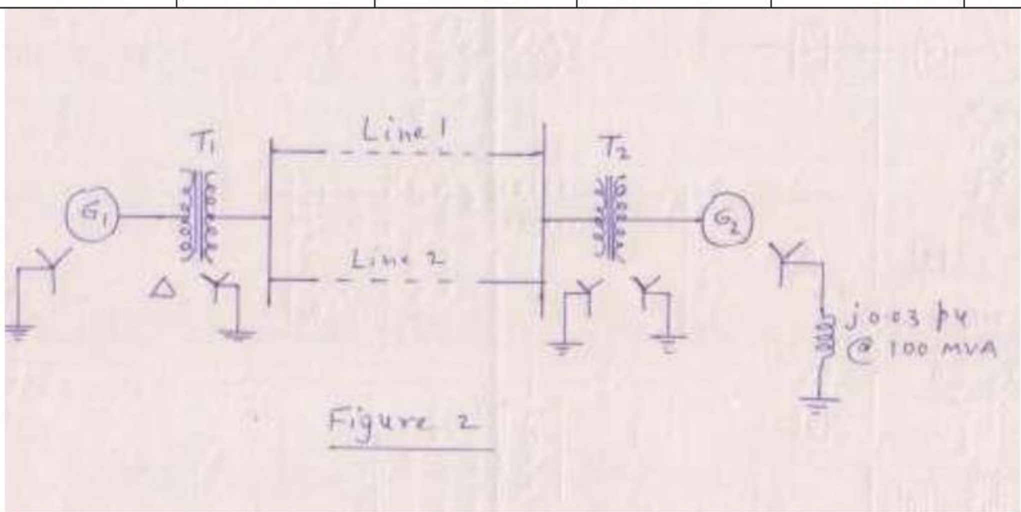


Figure 2

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Assignment-4_ Unsymmetrical Fault Analysis

Q.1 Explain single line to ground fault on an unloaded generator using symmetrical components. Draw connection of sequence networks.

Q.2 Describe analysis of single line to ground fault at a point of power system using symmetrical components and sequence networks.

Q.3 Derive an expression for the fault current for a double-line fault as an unloaded generator.

Q.4 Explain how fault current can be calculated when L-G fault occur through a fault impedance Z^f.

Q.5 Using appropriate interconnection of sequence networks, derive the equation for a line to line fault in a power system with a fault impedance of Z^f

Q.6 Why the 3-Φ symmetrical fault more severe than a 3-Φ unsymmetrical fault?

Q.7 A 25 MVA, 13.2 KV alternator with solidly grounded neutral has a sub transient reactance of 0.25 p.u The negative and zero sequence reactances are 0.35 and 0.1 p.u. respectively. Find the fault current when (1) a single line to ground fault occurs at the terminals of an unloaded alternator (2) L-L fault occurs.

Q.8 An unloaded star connected solidly grounded 10 MVA, 11KV generator has positive, negative and zero sequence impedances are j1.3 Ω, j0.8 Ω, and j0.4 Ω respectively. A single line to ground fault occurs at the terminals of the generator. (1) Calculate the fault current. (2) Determine the value of the inductive reactance that must be inserted at the generator neutral to limit the fault current to 50% of the value obtained in (1).

Q.9 A salient-pole generator without dampers is rated 20 MVA, 13.8 kV and has a direct axis subtransient reactance of 0.25 pu. The negative- and zero–sequence reactances are 0.35 pu and 0.1 pu respectively. The neutral of the generator is solidly grounded. Determine the subtransient currents and the line-to-line voltages at the fault under subtransient conditions when a line-to-line fault occurs at the b and c terminals of the generator. Assume that the generator is unloaded and operating at rated terminal voltage when the fault occurs. Neglect resistance.

Q.10 A 50 MVA, 11 kV, 3-phase alternator was subjected to different types of faults. The fault currents were: 3-Φ fault1870A, line to line fault 2590 A, single line to ground fault 4130 A. The alternator neutral is solidly grounded. Find *pu* values of the three sequences reactance of the alternator.

Q.11 A generator rated 100 MVA, 20kV has X1 = X2 = 20% and X0 = 5%. Its neutral is grounded through a reactor of 0.32 ohms. The generator is operating at rated voltage with load and is disconnected from the system when a single line to ground fault occurs at its terminals. Find the sub-transient current in the faulted phase and line to line voltages.

Q.12 A generator rated 100 MVA, 20kV has X1 = X2 = 20% and X0 = 5%. Its neutral is grounded through a reactor of 0.32 ohms. The generator is operating at rated voltage with load and is disconnected from the system when a line to line fault occurs at its terminals. Find the sub-transient current in the faulted phase and line to line voltages. (Repetition of above example for line to line fault).

Q.13 Two 25 MVA, 11 kV generators are connected to a common busbar which supplies a feeder. The star-point of one of the generators is grounded through a resistance of 1 4, while that of the other generator is isolated. A line-to-ground fault occurs at the far end of the feeder. Determine: (i) the fault current and (ii) the voltage to ground of healthy phases of the feeder at the fault point. The sequence impedances of each generator are and feeder are given below:

	Each Generator p.u.	Feeder(Ω/ph.)
X_1	j 0.2	
X_2	j 0.15	
X_3	j 0.08	

Q.14 A 25 MVA, 11 kV generator has X'' = 0.2 p.u., X = 0.3 p.u. and X = 0.1 p.u. The neutral of the generator is solidly grounded. Determine the sub-transient current in the generator and the line-to-line voltages for sub-transient condition when a Y-B-G fault occurs at the generator terminals. Assume pre-fault currents and fault-resistance to be zero.

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Assignment-5_Corona

Q.1 ***What are the factors and conditions affecting corona loss? Explain them briefly***

Q.2 ***Find the disruptive critical voltage for 3-ph line of 21mm diameter conductors spaced in a 6 m delta configuration. Take temperature as 25◦ C, pressure as 73cm of Hg and surface factor 0.85. What should be the voltage of transmission?***

Q.3 ***Give: The disruptive Critical Voltage is less than visual critical voltage.***

Q.4 ***Write a short note on phenomena of corona.***

Q.5 ***What is corona? State the advantages and disadvantages of corona? Outline different methods to reduce corona.***

Q.6 ***Explain Inductive interferences due to corona between power and communication line.***

Q.7 ***The 3 –ph 220kv, 50Hz line is 250km long consisting of 22.26 mm diameter conductor spaced in a 6 mt delta configuration. The following data can be assumed. Temperature 25◦ Cpressure as 73cm of Hg and surface factor 0.84.Irregularity factor for local corona 0.72, irregularity factor for general corona 0.82.Find the total loss in fair weather using Peek's formula.***

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