ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

EE / EEE , 5TH

MOD- IV

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MCQ

① A Transmission line has self and mutual impedance of 0.8 PU and 0.2 PU. Find positive negative and zero sequence impedance.

(A) 0.6, 0.8 and 1.2 P.U.

(B) 0.6, 0.6 and 1.2 PU.

(C) 0.8, 0.8 and 1.2 PU

(d) 0.8, 0.6 and ~~P~~1.2 PU.

HINT:- $Z_0 = Z_s + 2Z_m$

$Z_1 = Z_2 = Z_s - Z_m$.

2. Positive, negative and zero sequence impedance of line are 2.2 and 5 P.U respectively. Find self and mutual impedance respectively.

(A) 1 and 3 PU (B) 3 and 1 PU

(C) 2 and 2 PU (D) 2 and 5 PU.

3. For symmetrical network, the neutral current is

(A) Zero (B) ~~to~~ (C) maximum (D) any of these.

4. When a reactance ~~gro~~ grounding is used in network, the voltage between neutral and ground is

(A) $I_N \cdot X_N$ (B) $I_{R0} \cdot X_n$ (C) $3I_{R0} \cdot X_n$ (D) both B & C.

5. The value of inductance used for compensation of arcing ground is

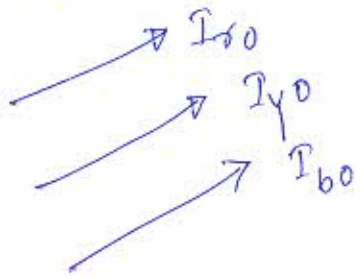
(A) $3\omega^2 c$ (B) $1/3\,\omega^2 c$ (C) $3/\omega^2 c$ (D) $\omega^2 c/3$

6. Earth Fault relay uses the which of following sequence current

(A) Positive sequence (B) Negative sequence

(C) Zero sequence (D) any of above.

7. which sequence component is represented by the following phasor.



(a) Positive sequence (b) Zero sequence.

(c) Negative sequence (d) None of these.

(8) what is the value of $(1+a+a^2)$?

(a) 0 (b) 1 (c) -1 (d) ∞

7.. in Above Question (Q-6) what is Zero Sequence Current.

Ans:- $\vec{I}_0 = \frac{1}{3}\left[\vec{I}_R + \vec{I}_Y + \vec{I}_B\right]$

$= \frac{1}{3}\left[100\angle 30^\circ + 50\angle 300^\circ + 30\angle 150^\circ\right]$

$= \frac{1}{3}\left[81.6 + j6.7\right] = 27.2 + j2.23$

$= 27.29\angle 4.68^\circ A$.

8. Prove that $\frac{1-a^2}{a-a^2} = -a$

Ans:- $\frac{1-a^2}{a-a^2} = \frac{(1+a)(1-a)}{a(1-a)} = \frac{1+a}{a} \quad (1+a+a^2=0)$

$= \frac{-a^2}{a} = -a$

(9) . what is the value of zero sequence current

a. 3 times the current in the neutral wire.

b. $\frac{1}{3}$ times of the current in neutral wire.

c. $\sqrt{3}$ times the current in the neutral wire.

d. Equal to current in the neutral wire

(10) The +ve sequence current is always equal to _____

a. Always zero (b) 1/3 of the negative seq. current

c. negative sequence current (d) 3 times of -ve.

Short Question and Answere

Q-1 What is Un Symmetrical Fault?

Ans:- These fault on the power System which gives rise to Unsymmetrical fault Current i.e. unequal fault Current in line with unequal phase displacement.

Q-2 What is the sequence impedance of Transformer?

Ans:- positive sequence impedance = Negative sequence impedance.

Zero sequence impedance = Positive sequence impedance if there is circuit for earth current.

= ∞, if there is no through cut for earth current.

3. What is the significance of operator 'a'

Ans:- The operater 'a' is one which when multiplied to a vector rotates the vector through 120° in anticlock-wise direction.

$$\boxed{aI = I\angle 120^\circ}$$

4. What are the examples of unsymmetrical fault?

Ans:- The different types of unsymmetrical faults are

(a) L-G fault.
(b) L-L fault.
(c) LL-G fault.

5. What will be the value of zero sequence current in 3ϕ, 4 wire unbalanced system.

Ans:- Zero sequence current $= \frac{1}{3}$ [current in Neutral wire]

6. In a 3 phase 4 wire system, the current in R, Y and B line under abnormal condition of loading are as under.

$\vec{I_R} = 100\angle 30^\circ A$: $\vec{I_Y} = 50\angle 300^\circ A$, $\vec{I_B} = 30\angle 150^\circ A$.

a calculate +ve seq. current.

Ans:-

$$\vec{I_1} = \frac{1}{3}\left[\vec{I_R} + a\vec{I_Y} + a^2\vec{I_B}\right]$$

$$= \frac{1}{3}\left[100\angle 30^\circ + 1\angle 120 \times 50\angle 300^\circ + 1\angle -120 \times 30\angle 150^\circ\right]$$

$$= \frac{1}{3}\left[126.6 + j119.28\right]$$

$$= (42.2 + j39.76) = 57.98\angle 43.3^\circ A.$$

Long Question and Answer

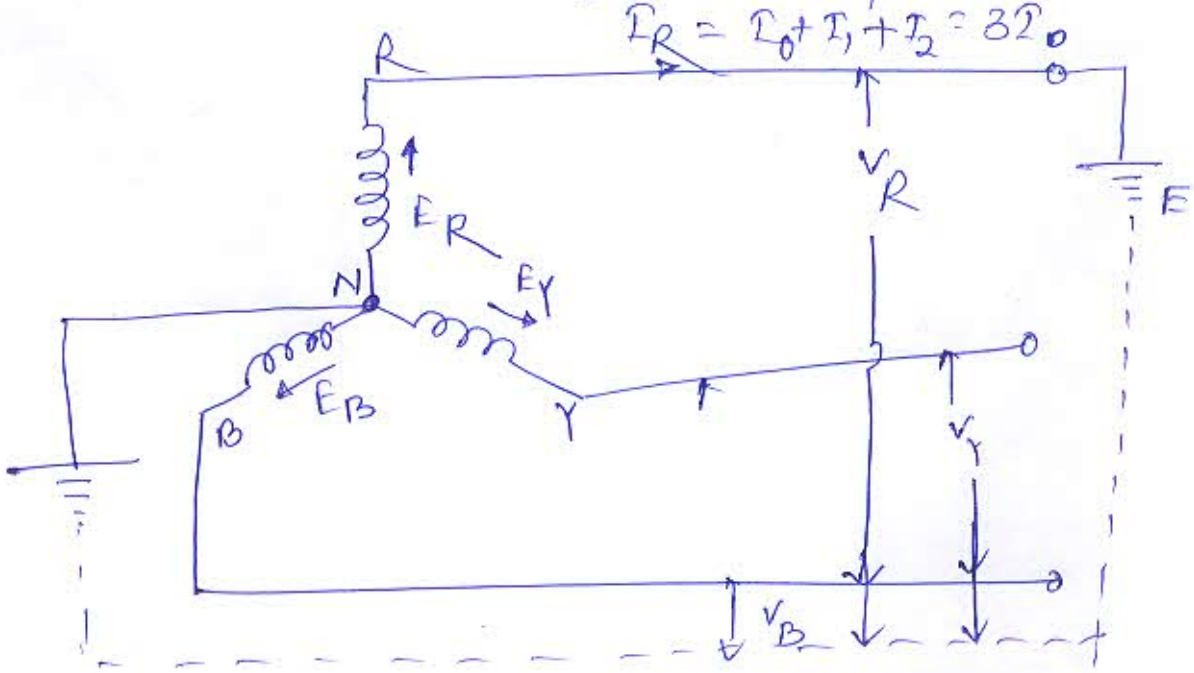
① Derive the Expression of Fault in line - ground fault.

Explanation:-

Considere a 3-ϕ System with an earthed neutral. let a Single line to ground Fault occure on the red phase.

under Fault condition $\vec{V_R} = 0$, $\vec{I_B} = \vec{I_Y} = 0$

$I_R = I_0 + I_1 + I_2 = 3I_0$



The Sequence Currcent in red phase in Terms of line currcent

$$\vec{I_0} = \frac{1}{3}\left(\vec{I_R} + \vec{I_Y} + \vec{I_B}\right) = \frac{1}{3}\vec{I_R}$$

$$\vec{I_1} = \frac{1}{3}\left(\vec{I_R} + a\vec{I_Y} + a^2\vec{I_B}\right) = \frac{1}{3}\vec{I_R}$$

$$\vec{I_2} = \frac{1}{3}\left(\vec{I_R} + a^2\vec{I_Y} + a\vec{I_B}\right) = \frac{1}{3}\vec{I_R}$$

$$\vec{I_0} = \vec{I_1} = \vec{I_2} = \frac{1}{3}\vec{I_R}$$

Fault Current :-

let $\vec{Z_1}$, $\vec{Z_2}$ and $\vec{Z_0}$ be the +ve, -ve and zero sequence network. Consider closed loop NREN applying KVL to above circuit.

$$\vec{E_R} = \vec{I_1}\vec{Z_1} + \vec{I_2}\vec{Z_2} + \vec{I_0}\vec{Z_0} + \vec{V_R}$$

as $\vec{V_R} = 0$ and $\vec{I_1} = \vec{I_2} = \vec{I_0}$

$$\therefore \vec{E_R} = \vec{I_0}\left(\vec{Z_1} + \vec{Z_2} + \vec{Z_0}\right)$$

$$\vec{I_0} = \frac{\vec{E_R}}{\vec{Z_1} + \vec{Z_2} + \vec{Z_0}}$$

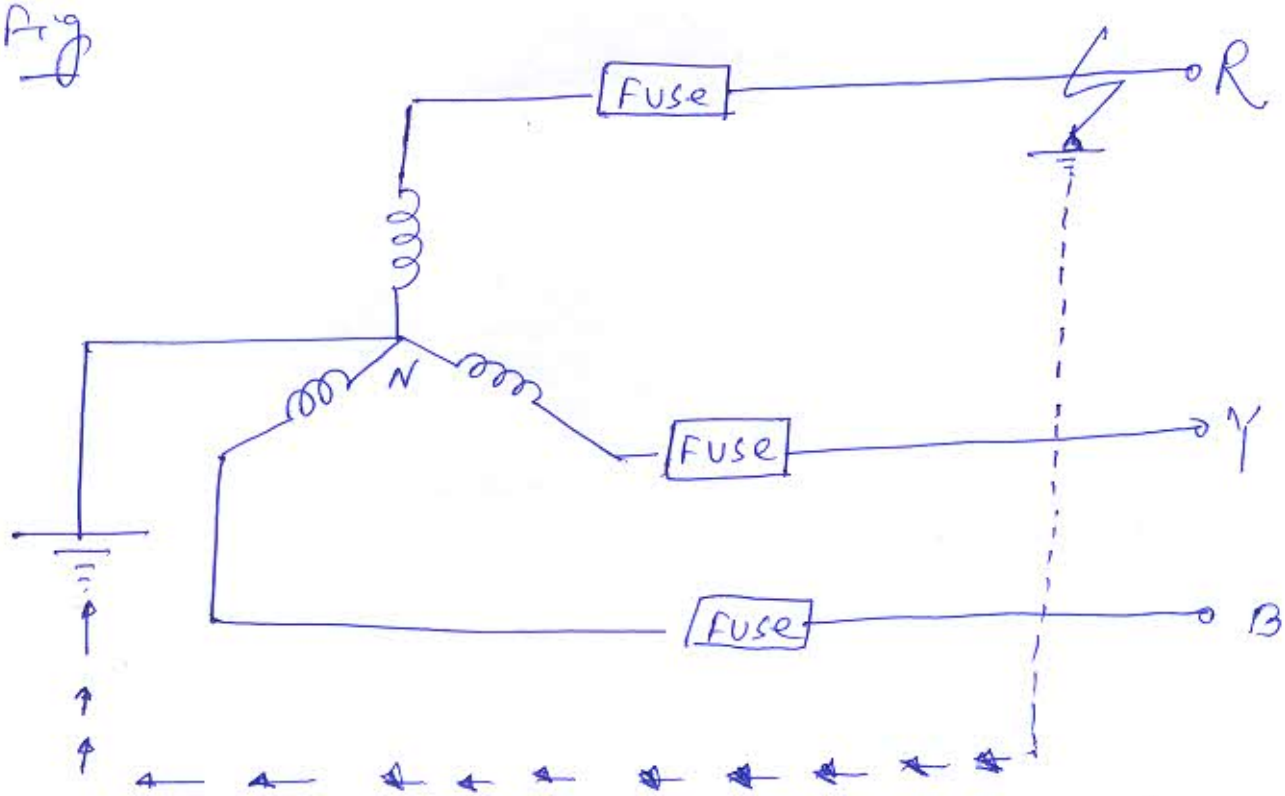
Fault Current $\vec{I_R} = 3\vec{I_0} = 3 \cdot \dfrac{\vec{E_R}}{\vec{Z_1} + \vec{Z_2} + \vec{Z_0}}$

② Write short notes on neutral grounding.

Explanation:-

The Process of connecting neutral point of 3-phase system to earth either directly or through some circuit element (Resistance, Reactance) is called neutral grounding.

Fig



The figure shows, star connected system with neutral earthed. Suppose a single line to ground fault occurs in line R at point F. This will cause the current to flow through a ground path. Note that current flows from R-phase to earth then to neutral point N and back to R-phase

Since the impedance of the current path is low, a large current flow through this path. This large current will blow the fuse in R-phase and isolate the faulty line R.

Advantage :-

(i) The high voltage due to arcing ground are eliminated.

(2) It provide improved service reliability.

(3) The over voltage due to lightning are discharged to earth.