Protective Relays Questions

Latest Protective Relays MCQ Objective Questions

Question1:

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Which of the following is a main relay for protection upto 80% of the transmission line length in the forward direction?

1. Directional over-current relay
2. Mho relay
3. Carrier current protection relay
4. Impedance relay
5. None of these

Answer (Detailed Solution Below)

Option 2 : Mho relay

Protective Relays Question 1 Detailed Solution

Mho relay because inherently a directional relay as it detects the fault only in the forward direction.

Mho Relay:

- Mho relay is referred to as voltage-controlled directional relay or admittance relay or high-speed relay.
- The operating torque can be determined by the V-I (voltage-ampere) element and the voltage element develops the controlling element.
- These types of relays are used to detect phase faults for long transmission lines, and at the point where there is an occurrence of synchronizing power surges.
- The mho relay is more sensitive and reliable because it is a combined unit of both distance measurement and direction.

Operating Characteristic of Mho Relay:

The diameter of the circle is practically independent of V and I, except at a very low magnitude of the voltage and current when the spring effect is considered, which causes the diameter to decrease.

Question 2:

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The most commonly used relay, for the protection of an alternator against loss of excitation, is

1. Offset Mho relay
2. Over current relay
3. Differential relay

4. Buchholz relay

5. None of these

Answer (Detailed Solution Below)

Option 1 : Offset Mho relay

Protective Relays Question 2 Detailed Solution

Concept:

Loss of Excitation for an Alternator:

- If excitation of alternator is lost then it will run asynchronously.
- If it happen for long duration then relative motion between stator field and rotor induces large currents in the rotor body and, therefore, there is high rate of heating of rotor surfaces.
- So, loss of excitation scheme is arranged to trip after certain time delay with the help of **offset mho relay** which is operated from AC current and voltage at the generator terminals.

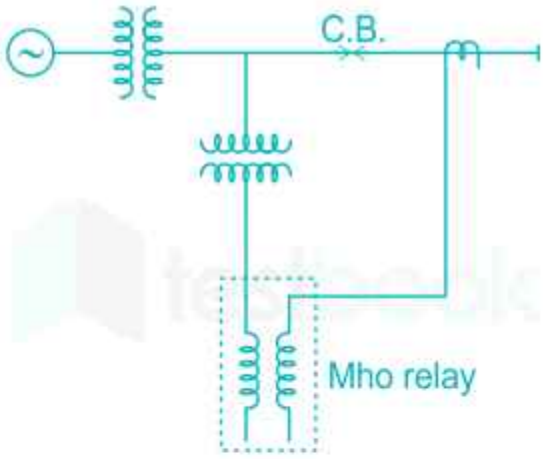

Fig. Relay connections for loss of excitation

- The relay setting is so arranged that the relay operates whenever the excitation goes below a certain value and the machine starts running asynchronously.
- Due to failure of excitation, alternator works as an induction generator, drawing reactive power from the grid and hence it operates at leading power factor.
- As a result of this, the impedance of the induction generator as seen by the relay shifts into the fourth quadrant of the R-X diagram and this impedance swings into offset mho relay characteristic as shown in the figure given below and the relay will operate.

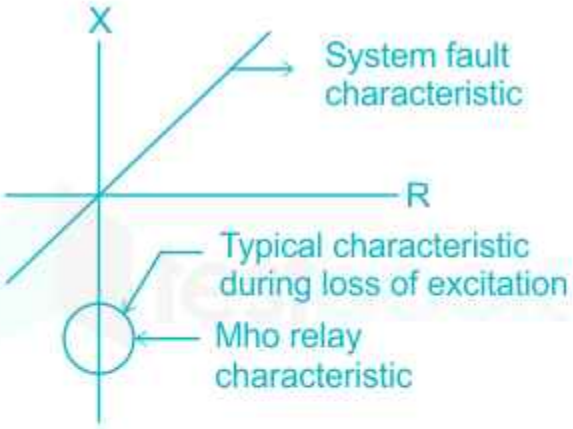

Fig: Loss of excitation characteristic

Question3:

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An overcurrent relay having a current setting of 125% is connected to a supply circuit through a current transformer of ratio 400/10. The pick-up value will be:

1. 10 A
2. 12.5 A
3. 6.25 A
4. 3.125 A
5. None of these

Answer (Detailed Solution Below)

Option 2 : 12.5 A

Protective Relays Question 3 Detailed Solution

Concept:

The plug setting multiplier of a relay is defined as the ratio of the secondary fault current to the pick-up current.

PSM = Secondary fault current / Relay current setting

Pick up current = (Rated secondary current in CT) x (Current setting)

Calculation:

Given that,

Current setting = 125% = 1.25

Relay CT ratio = 400 / 10

Rated secondary current = 10 A

Therefore, pickup value current of relay = 10 x 1.25 = 12.5 A

Question 4:

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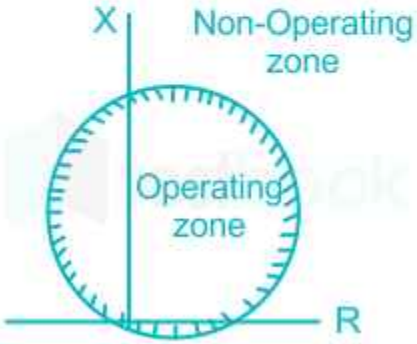


The given figure represents operating characteristics of ____ relay in R-X plane

1. Directional impedance relay
2. Reactance relay
3. Impedance relay
4. Mho relay
5. None of these

Answer (Detailed Solution Below)

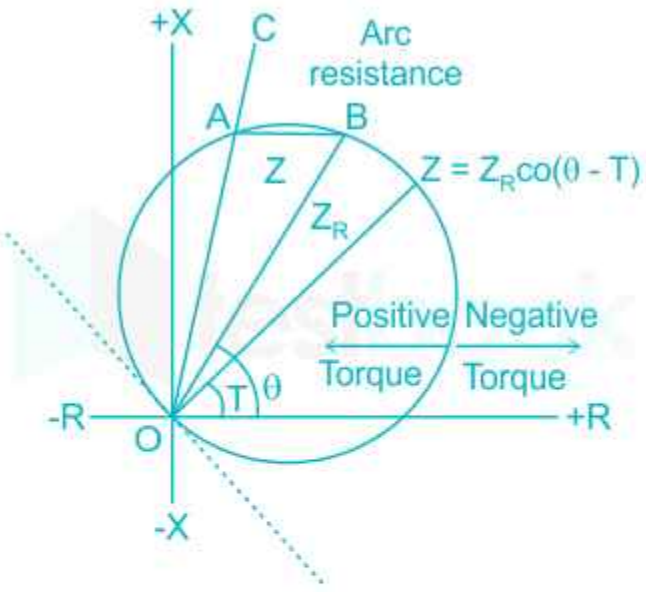
Option 4 : Mho relay

ProtectiveRelays Question4 DetailedSolution

Concept

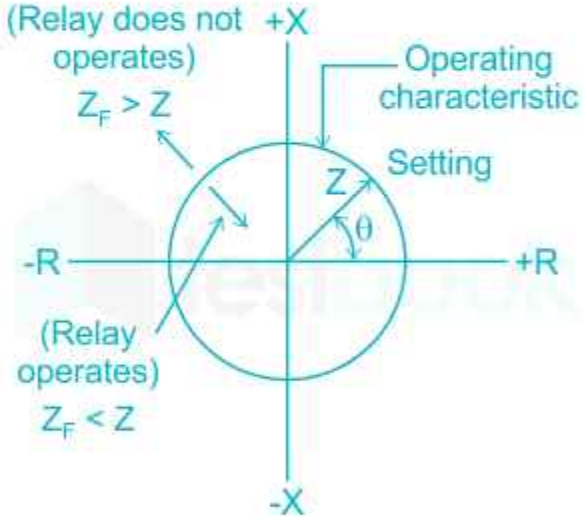
Transmissionline protection:

1) MHO Relay:



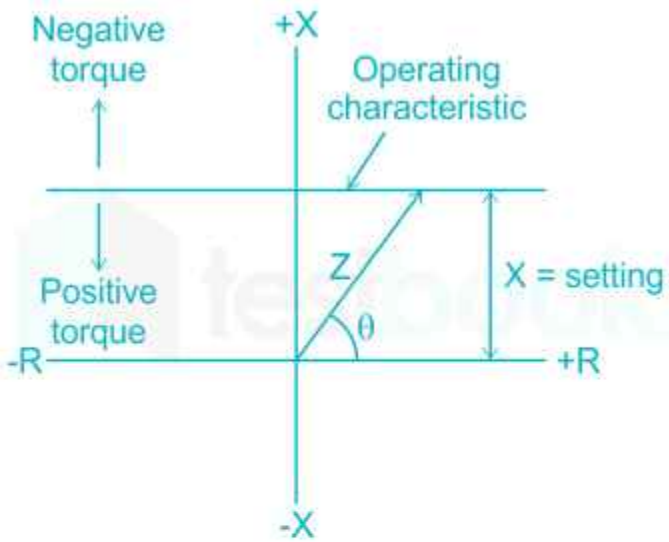
- A mho relay is a voltage-controlled directional relay.
- These relays are used for long-distance transmission line.
- MHO relays are least affected by the voltage surges.

2) Impedance Relay:



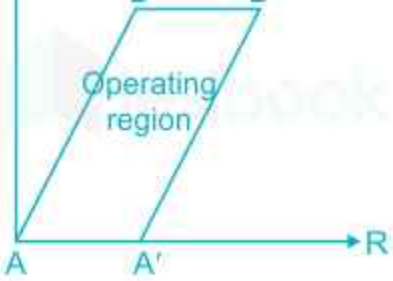
- An impedance relay is a voltage restrained overcurrent relay.
- The relay measures impedance up to the point of fault and gives a tripping command if this impedance is less than the relay setting Z.
- These relays are used for the medium transmission lines.

3) Reactance Relay:



- A reactance relay is an overcurrent relay with directional limitation.
- These relays are used for the protection of short transmission lines.
- The directional element is arranged to develop maximum negative torque when its current lag behinds its voltage by 90°.
- **Reactance relay is not affected by fault arc resistance, hence no under reach is possible in reactance relay.**

4.) Quadrilateral relays:



- The positive torque region is the region covered by all the four lines i.e. quadrilateral ABCD. If the impedance seen by the relay is inside the operating region, then relay trips.
- **Amongst all types of distance relays available today, the quadrilateral relay is one that has the least area on the R-X plane and is not affected by the arc resistance.**

Question5:

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The following image represents a section of a single bus scheme. The isolator is represented by which of the following?

1. A
2. B
3. C
4. A & D

5. B & C

Answer (Detailed Solution Below)

Option 4 : A & D

Protective Relays Question 5 Detailed Solution

In the given image,

- A and D represent isolators
- B represents the current transformer (CT)
- C represents circuit breaker

Isolator:

- An isolator is a manually operated mechanical switch that separates a part of the electrical power.
- This separates a part of the system from the rest for safe maintenance works.
- **Isolators are used to open a circuit under no load (No current condition).**
- Its main purpose is to isolate one portion of the circuit from the other and is not intended to be opened while the current is flowing in the line.
- Isolators are generally used on both ends of the breaker so that repair or replacement of circuit breaker can be done without any danger.

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Question 6 View this Question Online >

If for an IDMT relay with a plug setting of 50% and a CT ration of 400/5, the current is 3000 A, then the plug setting multiplier would be:

1. 7.5

2. 15.0

3. 18.75

4. 37.5

Answer (Detailed Solution Below)

Option 2 : 15.0

Protective Relays Question 6 Detailed Solution

Concept:

Plug setting multiplier:

Plug setting multiplier is the ratio of fault current and the product of plug setting and CT ratio.

Plug setting multiplier $= \frac{fault\ current}{plug\ setting \times CT\ ratio}$

Calculation:

Plug setting = relay setting × secondary CT current

= 0.5 × 5 = 2.5

CT ratio $= \frac{400}{5} = 80$

Plug setting multiplier $= \frac{3000}{2.5 \times 80} = 15$

Question 7

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A negative sequence relay is commonly used to protect

1. An alternator
2. A transformer
3. A transmission line
4. A bus bar

Answer (Detailed Solution Below)

Option 1 : An alternator

Protective Relays Question 7 Detailed Solution

Negative sequence relay:

- **It protects generators from the unbalanced load by detecting negative sequence current.**
- A negative sequence current may cause a dangerous situation for the machine.
- Phase to phase fault mainly occurs because of the negative sequence component.
- The negative sequence relay has earthing which protects from phase-to-earth fault but not from phase-to-phase fault.

Note:

Relay	Application
Buchholz relay	Transformer
Translay relay	Feeder
Carrier current, phase comparison relay, Mho's relay	Long overhead transmission line
Directional overcurrent relay	Ring main distributor
Negative sequence relay	**Generator**
Inverse directional overcurrent relay	Radial distribution

Question8 View this Question Online >

An over-current relay, having a current setting of 12.5% is connected to a supply circuit through a current transformer with a ratio of 400/5. The pick-up value of the current in Amperes is:

1. 0.625
2. 10
3. 12.5
4. 15

Answer (Detailed Solution Below)

Option 1 : 0.625

Protective Relays Question 8 Detailed Solution

Concept:

The pick-up current of a relay is given by:

Pick-up current = Rated secondary current of CT × Current setting

Calculation:

Given, the CT ratio = 400/5

Secondary current = 5 A

Relay setting = 12.5%

Pick-up current = 5 × 0.125

Pick-up current= 0.625 A

Question9 View this Question Online >

Match the items is List – I (Type of transmission line) with the items in List – II (Type of distance relay preferred) and select the correct answer using the codes given below the lists.

List – 1

a. Short Line

b. Medium Line

c. Long Line

List - II

1. Ohm Relay

2. Reactance Relay

3. Mho Relay

1. a → 2, b → 1, c → 3

2. a → 3, b → 2, c → 1

3. a → 1, b → 2, c → 3

4. a → 1, b → 3, c → 2

Answer (Detailed Solution Below)

Option 1 : a → 2, b → 1, c → 3

Protective Relays Question 9 Detailed Solution

Distance Relay:

- **A distance protection relay** is a name given to the protection, whose action depends on the distance of the feeding point to the fault.
- The time of operation of such protection is a function of the ratio of voltage and current, i.e., impedance.
- This impedance between the relay and the fault depends on the electrical distance between them.
- Types of distance relays are impedance relays, reactance relays, and the mho relays.

Transmission line	Length & Operating voltage	Distance Relay
Short-line	(0-80) km (0-20) kV	Reactance relay
Medium line	(80-200) km (20-100) kV	Ohm relay
Long-line	(>200) km (>100) kV	Mho relay

Important Points

- **Reactance relay** is suitable for the protection of a **short transmission line** because its operation is independent of arc resistance.
- The relay which is selected for a **long transmission line** should be less affected due to power swings. Hence **Mho relay** is preferred.
- **Ohm relay** is suitable for **medium transmission lines**.

Question 10

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Which relay is also called angle impedance relay?

1. Impedance relay
2. Reactance relay
3. Mho relay
4. Frequency relay

Answer (Detailed Solution Below)

Option 3 : Mho relay

Protective Relays Question 10 Detailed Solution

Mho Relay:

A Mho relay measures a component of admittance $|Y| \angle \theta$. But its characteristic when plotted on the impedance diagram is a circle passing through the origin. It is also known as angle impedance relay.

The relay is called Mho relay because its characteristic is a straight line, when plotted on an admittance diagram.

admittance diagram.

Important Points:

- Impedance relay is a voltage restrained overcurrent relay.
- Reactance relay is an overcurrent relay with directional restraint.
- Mho relay is a voltage restrained directional relay.

- Reactance relay is suitable for the protection of a short transmission line because its operation is independent of arc resistance.
- The relay which is selected for a long transmission line should be less affected due to power swings. Hence Mho relay is preferred.
- Impedance relay is suitable for medium transmission lines.

Question 11

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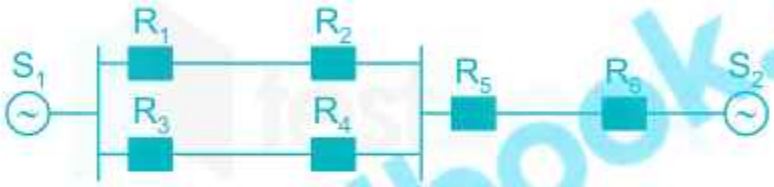
A power system with two generators is shown in the figure below. The system (generators, buses and transmission lines) is protected by six overcurrent relays R_1 to R_6. Assuming a mix of directional and non-directional relays at appropriate locations, the remote backup relays for R_4 are



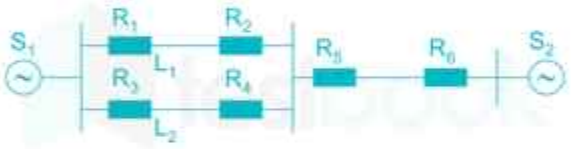
1. R_1, R_2
2. R_2, R_6
3. R_2, R_5
4. R_1, R_6

Answer (Detailed Solution Below)

Option 4 : R_1, R_6

Protective Relays Question 11 Detailed Solution

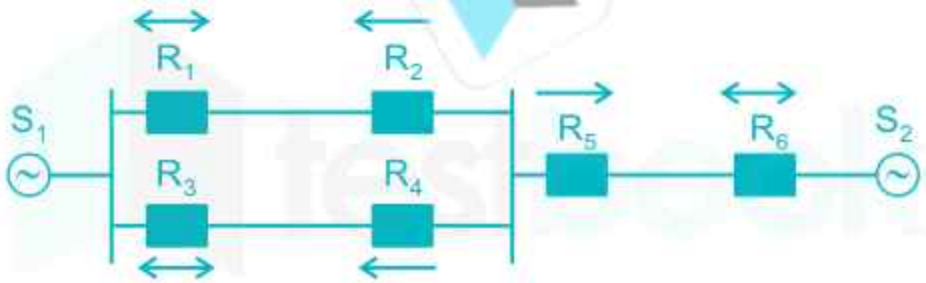
Given the network is:



In the given network,

R_2, R_4, and R_5 are directional overcurrent relays. R_1, R_3 and R_6 are non-directional overcurrent relays.

For the fault on line 2 i.e. L_2, R_3 and R_4 must be operated. If R_4 is not operated then R_1 and R_6 will operate.



Therefore, back up for R_4 are R_1 and R_6

The relay R_3 is directly connected to relay R_4, so that relay R_3 can't provide remote backup.

Question 12 View this Question Online >

The relay used for feeder protection is:

1. Undervoltage relay

2. Translay relay

3. Thermal relay

4. Buchholz relay

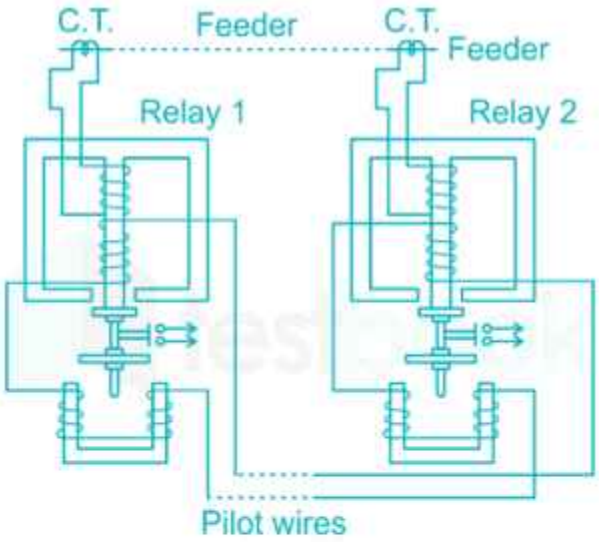
Answer (Detailed Solution Below)

Option 2 : Translay relay

Protective Relays Question 12 Detailed Solution

Translay relay:

- The translay relay is a differential relay
- The arrangement is similar to overcurrent relay, but the secondary winding is not closed on itself
- **These types of relays are used in the feeder protection** and the scheme is called the Translay scheme
- In this scheme, two such relays are employed at the two ends of the feeder as shown in the Fig



Translay scheme of feeder protection

- The secondaries of the two relays are connected to each other using pilot wires
- The connection is such that the voltages induced in the two secondaries oppose each other
- The copper coils are used to compensate the effect of pilot wire capacitance currents and unbalance between two currents transformers
- Under normal operating conditions, the current at the two ends of the feeder is the same
- The primaries of the two relays carry the same currents inducing the same voltage in the secondaries
- As these two voltages are in opposition, no current flows through the two secondaries circuits and no torque is exerted on the discs of both the relays
- When the fault occurs, the currents at the two ends of the feeder are different, hence unequal voltages are induced in the secondaries

- Hence the circulating current flows in the secondary circuit causing torque to be exerted on the disc of each relay
- But as the secondaries are in opposition, hence torque in one relay operates to close the trip circuit while in another relay the torque just holds the movement in an unoperated position
- The care is taken that at least one relay operates under the fault condition

Question13 View this Question Online >

Which of the following relay is used for the protection of feeders and large busbars?

1. Under frequency relay
2. Buchholz relay
3. Distance relay
4. Differential relay

Answer (Detailed Solution Below)

Option 4 : Differential relay

Protective Relays Question 13 Detailed Solution

Differential relay:

- Differential relay operation depends on the phase difference of two or more electrical quantities.
- It works on the principle of comparison between the phase angle and the magnitude of the same electrical quantities.
- **The differential relay is used for the protection of the feeder, large busbars, etc.**

Distance relay:

- **Distance relay is widely used for the protection of high-voltage AC transmission line** and distribution lines.
- Distance protection schemes are commonly employed for providing the primary or main protection and backup protection for AC transmission line and distribution line against three-phase faults, phase-to-phase faults, and phase-to-ground faults.

Under frequency relay:

- **Under frequency relay is used to protect the alternator** when the frequency drops below the operating frequency.
- It is a backup protection for over fluxing (V/F) protection.
- Under frequency occurs due to turbine low speed, grid frequency fluctuation, etc.
- The generator can tolerate moderate under frequency operation provided voltage is within an acceptable limit.

Buchholz relay:

- **Buchholz relay protects the transformer from internal faults.**
- It is the gas actuated relay.
- The Buchholz relay is placed between the main tank and the conservator.
- Buchholz relay is used in the transformer having a rating higher than 500KVA.
- It is not used in a small transformer because of economic considerations.

Question14 View this Question Online >

Impedance relay is used for protection in:

1. medium transmission lines
2. short transmission lines
3. both long transmission lines and short transmission lines
4. long transmission line

Answer (Detailed Solution Below)

Option 1 : medium transmission lines

Protective Relays Question 14 Detailed Solution

Distance Relay:

This type of relay is used for the protection of the transmission lines.

Depending upon the length of the transmission line, the distance relay is divided into:

1.) Impedance Relay:

- This relay is a voltage restrained overcurrent relay.
- This relay operates when the impedance seen from the fault point is less than the relay setting (Z).

- **It is used in the protection of medium transmission lines.**

2.) Reactance Relay:

- This relay is a current restrained overcurrent relay.
- This relay is used for the protection of short transmission lines.
- Reactance relay is independent of resistance value.

3.) Mho Relay:

- This relay is used for the protection of long transmission lines.
- Mho relay is least affected by power surges.
- Mho relay is inherently a directional relay as it detects the fault only in the forward direction.

Shortcut Trick

R	Short
I	Medium
M	Long

Question15 View this Question Online >

A relay is connected to a 400/5 ratio current transformer with circuit setting of 150%. Calculate the plug setting multiplier when circuit carries a fault current of 3000 A.

1. 5
2. 6
3. 8
4. 7

Answer (Detailed Solution Below)

Option 1 : 5

Protective Relays Question15 Detailed Solution

Concept:

Plug setting multiplier is the ratio of fault current and the product of plug setting and CT ratio.

Plug setting multiplier $= \frac{fault\ current}{plug\ setting \times CT\ ratio}$

Calculation:

Plug setting = relay setting × secondary CT current

= 1.5 × 5 = 7.5

CT ratio $= \frac{400}{5} = 80$

Plug setting multiplier $= \frac{3000}{7.5 \times 80} = 5$