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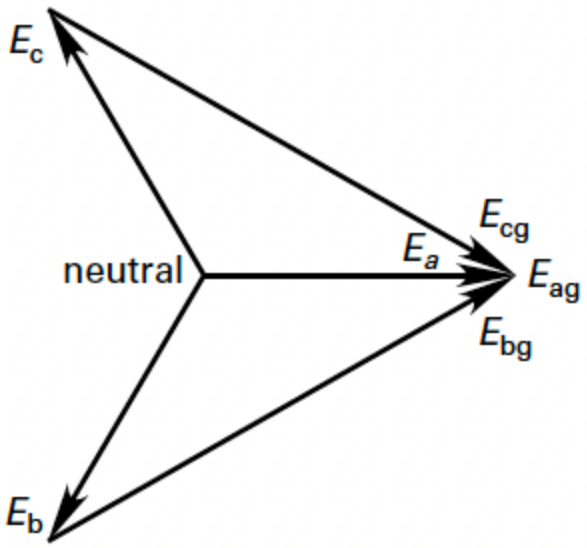
Continuing Education Course #634
Power System Protection:
Relaying Basics+

1. What is the advantage/disadvantage of an ungrounded system
- a. delayed trip on first fault / fault causes ungrounded phases to decrease by √3
- b. delayed trip on first fault /delayed trip on second fault
- c. high reliability / fault causes ungrounded phases to decrease by √3
- d. high reliability / fault causes ungrounded phases to increase by √3

2. Which phase is ground given the following phasor diagram?



- a. Phase A
- b. Phase B
- c. Phase C
- d. Neutral

3. An ungrounded system is built for a military marine system with a normal voltage level, A. Following fault analysis design, the insulation of the distribution system is selected. What is most nearly the voltage level for which the insulation on the distribution system is designed?
- a. (1/√3)A
- b. √2A
- c. √3A
- d. 2A

4. What power system configuration is known for being economical to build but having a low reliability?

○ a. network bus
○ b. radial bus
○ c. single bus, single breaker
○ d. two bus, single breaker

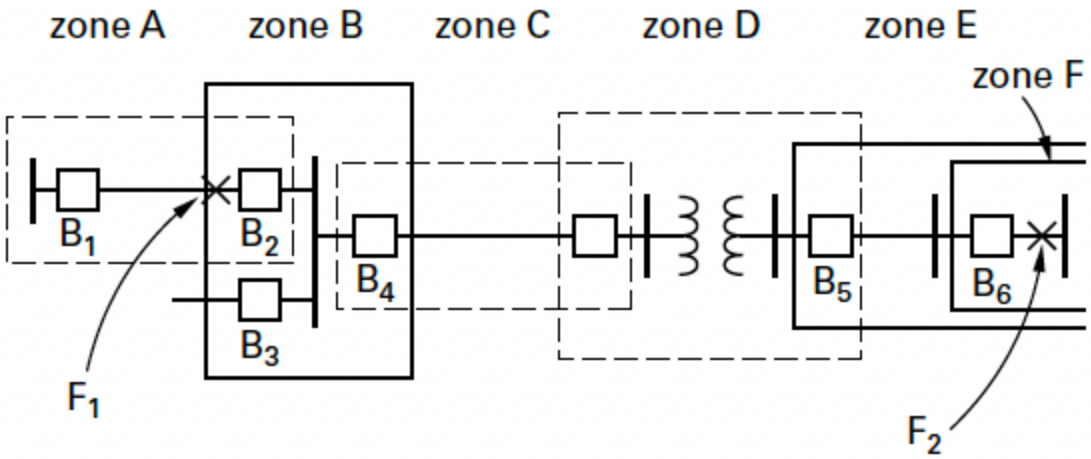
5. What is the most common configuration for extra high voltage substations?
○ a. breaker-and-a-half
○ b. radial
○ c. ring
○ d. two bus, two breaker

6. What relay designation (device number) is applied to an AC circuit breaker?
○ a. 25
○ b. 52
○ c. 64
○ d. 87

7. As a reliable relay becomes more _____ it becomes less _____.
○ a. dependable / secure
○ b. reliable / secure
○ c. secure / dependable
○ d. secure / reliable

8. What zone terminology is used if the zone is defined by the fault level?
○ a. absolutely selective zone
○ b. differential
○ c. closed
○ d. open

9. Consider the following figure.



What zone(s) are open?
○ a. A
○ b. B & C
○ c. D
○ d. E and F

10. How many cycles may occur before a high-speed relay reacts?

- a. 1/4
- b. 1
- c. 3
- d. 10

11. When two separate battery systems are used one powers the _____ relays and the other powers the _____ relays.

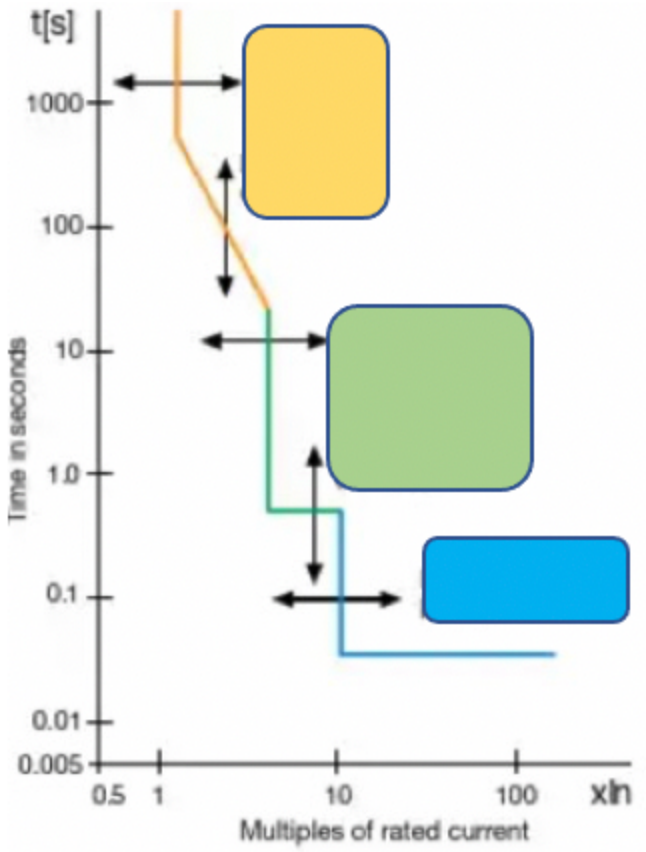
____

- a. differential / zone
- b. electromechanical / solid state
- c. level / zone
- d. zone / differential

12. What is the output of a CT if the input is 480 V at a phase angle of 10°? The turns ratio is 100:5.

- a. 24 V∠10°
- b. 24 V∠50°
- c. 48 V∠10°
- d. 100 V∠50°

13. What color of curve represents short time values?



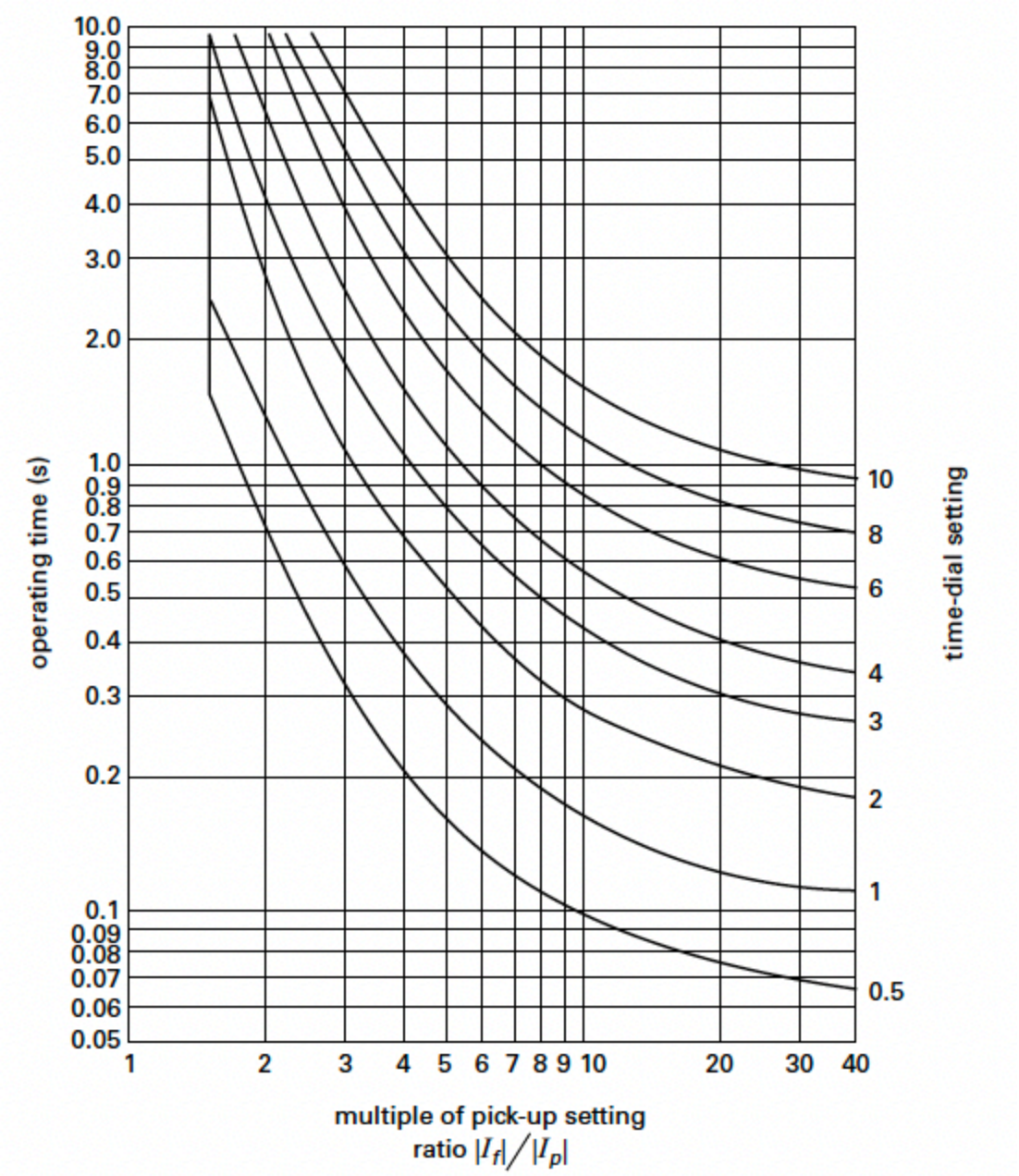
- a. blue
- b. green
- c. yellow
- d. yellow & blue

14. What symbology represents the breaker frame size, its nominal/rated value?

○ a. I_m
○ b. I_n
○ c. I_o
○ d. I_r

15. Which trip generally occurs within 0.1 sec to 60 sec?
○ a. instantaneous with delay
○ b. ground fault with delay
○ c. long time with no delay
○ d. short time without/with delay

16. Consider the level detector curves shown.



The fault current is ten times the pickup. What dial setting can be used to prevent the operating time from exceeding 0.2 sec?

- a. 0
- b. 1
- c. 2
- d. 3

17. What type of relay has the following disadvantage?

The disadvantage to this scheme is that currents at each end of the zone can be separated by a significant distance, requiring an increased equipment cost for wiring and imposing possible time delays.

- a. differential
- b. level
- c. magnitude
- d. phase angle

18. The impedance angle of a faulted transmission line is often near 90°. Therefore, a phase angle relay that detects a _____ degree phase angle can assume a fault exists.

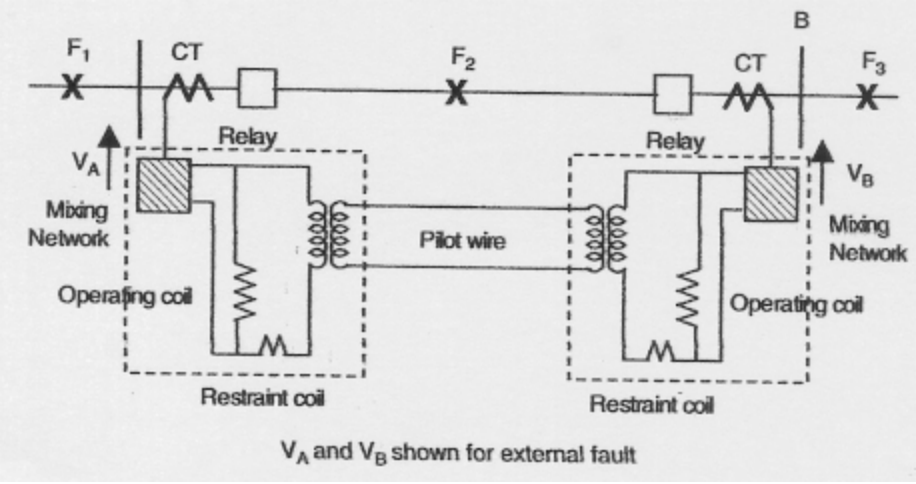
- a. 0
- b. 30
- c. 90
- d. 180

19. A differential relay, which is designed to protect a zone of the distribution system, uses current transformers (CTs) connected to auxiliary CTs. The auxiliary CTs must match both the phase shift and the turns ratio of the differential relay CTs. If the values do not match, which of the following is the least likely outcome?

Hint: Consider wiring of differential relay. Figure 19.

- a. trip occurs only when CTs are wired in parallel
- b. trip occurs at a higher level than expected
- c. trip occurs at a lower level than expected
- d. trip occurs at non-fault conditions

20. Consider the figure below for a pilot relay setup.



A fault occurs at F2. What is the phase relationship for the currents entering points A and B?

- a. A and B are in phase
- b. A and B are 90° out of phase
- c. A and B are 180° out of phase
- d. A and B phases depend on the load

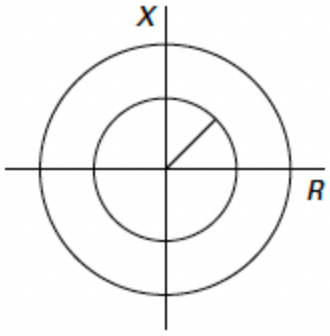
21. Positive-, negative-, and zero-sequence harmonics occur in many systems.

Which type of harmonics is expected to result in three times the current amplitude of the fundamental frequency?

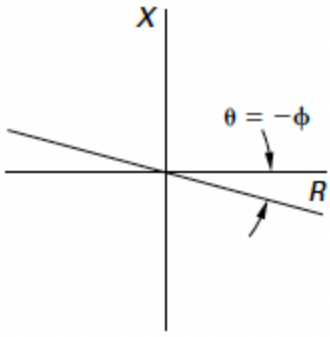
- a. zero-sequence / 3rd fundamental
- b. zero-sequence / 1st fundamental
- c. positive sequence / 1st fundamental
- d. negative sequence / 2nd fundamental

22. Universal relay characteristics result in the following general diagrams in the R-X plane. Which represent(s) a directional relay?

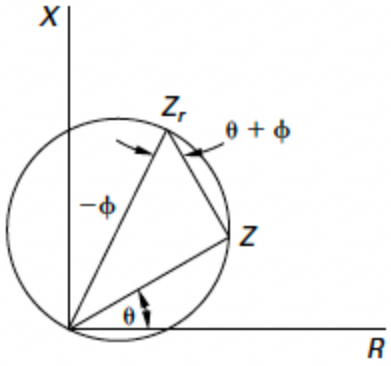
I.



II.



III.



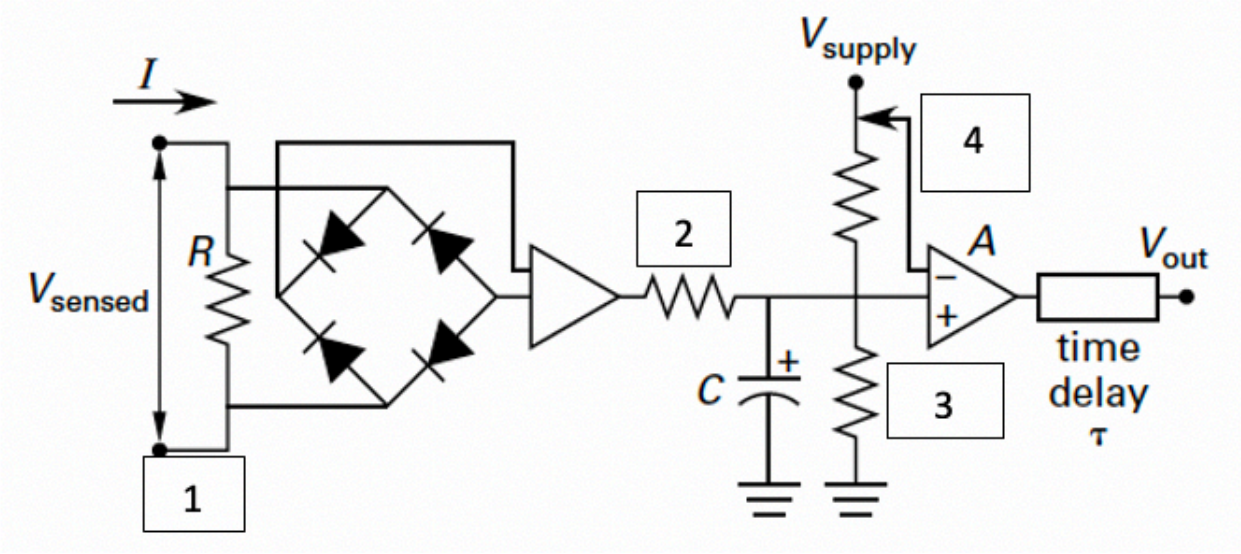
- a. I only
- b. II only
- c. I, II, and III
- d. II and III only

23. Which type of protection relay operates (i.e., protects) for faults at a given distance from the relay and is bidirectional?

- a. phase angle relay
- b. differential relay

○ c. directional relay
○ d. distance relay

24. Consider the solid state relay shown.



The reference value that determines the output of A is set by which resistor?
○ a. 1
○ b. 2
○ c. 3
○ d. 4

25. What is likely the best protective device, ignoring cost?
○ a. directional
○ b. inverse-time
○ c. recloser
○ d. pilot