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NEW SCHEME

Sixth Semester B.E. Degree Examination, Dec. 06 / Jan. 07
Electrical and Electronics Engineering
Switchgear and Protection

Time: 3 hrs.]

[Max. Marks:100

Note : 1. Answer any FIVE full questions.
 2. Any missing data may be suitably assumed.

1. a. How interruption of capacitive currents takes place in AC circuit breakers? Explain. (10 Marks)
- b. From the following data of a 50Hz generator : e.m.f to neutral 7.5 kV (rms), reactance of generator and connected system 4 Ω , distributed capacitance to neutral 0.01 μF resistance negligible. Find
 - i) The maximum voltage across the contacts of circuit breaker when it breaks a short-circuit current at zero current.
 - ii) The frequency of the transient oscillation and
 - iii) The average rate of rise of voltage up to the first peak of oscillation. (10 Marks)
2. a. Explain the working of air blast circuit breaker with reference to
 - i) Axial blast
 - ii) Cross blast. (10 Marks)
- b. Enumerate the properties of SF₆ gas which render its use in high voltage circuit breaker. With the help of a neat sketch explain anyone type of SF₆ breaker. (10 Marks)
3. a. Explain the construction, working, advantages and disadvantages of vacuum circuit breakers. (10 Marks)
- b. Write notes on :
 - i) Unit testing
 - ii) Synthetic testing (10 Marks)
4. a. Explain with neat sketch the construction and working of HRC fuse. Also explain its properties and characteristics. (10 Marks)
- b. State and explain briefly the characteristics of good relaying. (10 Marks)
5. a. Explain with the help of neat diagram, the construction and working of non directional induction type over current relay. Draw and explain its time-current characteristics. (10 Marks)
- b. Explain the working of percentage differential relay. (05 Marks)
- c. Write a note on Frame leakage protection. (05 Marks)
6. a. Explain the construction, working, torque equation and operating characteristics of reactance relay. (10 Marks)

- b. A line section has an impedance of $2.8 + j 5$ ohms. Show this on R-X diagram as impedance vector. If the relay is adjusted to just operate for a zero impedance short circuit at the end of the line section, show on the R-X diagram the operating characteristics of: i) an impedance relay ii) a reactance relay iii) A mho relay used for the purpose. Assume that the centre of the mho relay operating characteristics lies on the line impedance vector.

If the arcing short circuit occurs having an impedance of $1.5 + j 0$ ohms anywhere along the line, find for each type of distance relay the maximum portion of the line that can be protected. (10 Marks)

- 7 a. Which are the various abnormal running conditions which may exist in a generator? What are the effects? How can it be minimized? (10 Marks)
- b. Fig.7(b)-1 shows percentage differential relay applied to the protection of an alternator winding. The relay has 10% slope of characteristics $(I_1 - I_2)$ v/s $(I_1 + I_2) / 2$. A high resistance ground fault occurred near the grounded neutral end of the generator winding while generator is carrying load. As a consequence, the current in amperes at each end of the winding is shown in Fig.7(b)-2. Assuming CT ratio of 400/5 amperes, will the relay operate the trip of the breaker?

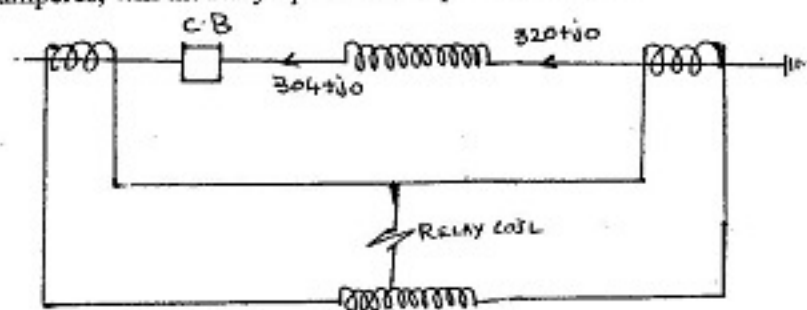


FIG. 7(b)-1

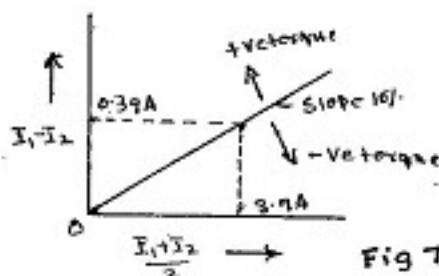


Fig 7(b)-2

(10 Marks)

- 8 a. With neat sketch explain the construction and working principle of Buchholz relay. (08 Marks)
- b. Draw and explain the Merz-price protection scheme of star-delta transformer. (04 Marks)
- c. Explain the block diagram of phase comparison method of carrier current protection. (08 Marks)