

CBCS SCHEME

--	--	--	--	--	--	--	--	--	--

17EE72

Seventh Semester B.E. Degree Examination, July/August 2021 Power System Protection

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

1.
 - a. List and explain the essential qualities of a protective relay. (08 Marks)
 - b. With a neat diagram, explain zones of protection in a power system. (06 Marks)
 - c. How protective relays are classified? List them. (06 Marks)
2.
 - a. Derive an expression for torque produced by an induction relay. (06 Marks)
 - b. Draw the schematic diagram of a numerical relay and explain the functions of various components. (08 Marks)
 - c. What are the advantages of static relays over electromechanical relays? (06 Marks)
3.
 - a. What is an impedance relay? Explain its operating principle, torque equation and operating characteristics of impedance relay. (08 Marks)
 - b. Explain stepped time-distance characteristics of three distance relaying units used for I, II and III zones of protection. (06 Marks)
 - c. With a circuit diagram, explain directional earth fault relay. (06 Marks)
4.
 - a. Discuss the effect of power surges on the performance of different types of distance relays. (06 Marks)
 - b. With a neat schematic diagram, explain the construction and working of reactance relay. (08 Marks)
 - c. Fig.Q4(c) shows distance protection for a section of a power system. The I zone setting at A and B is 150Ω .
 - (i) What will be impedance seen by the relay at A for a fault at F_1 ?
 - (ii) Will the relay at B trip for a fault at F_1 before the circuit breaker at A has tripped?
 - (iii) If the circuit breaker C_2 fails for a fault at F_2 , will the fault be cleared by relays at A and B?
 - (iv) How will the fault at F_2 be cleared?

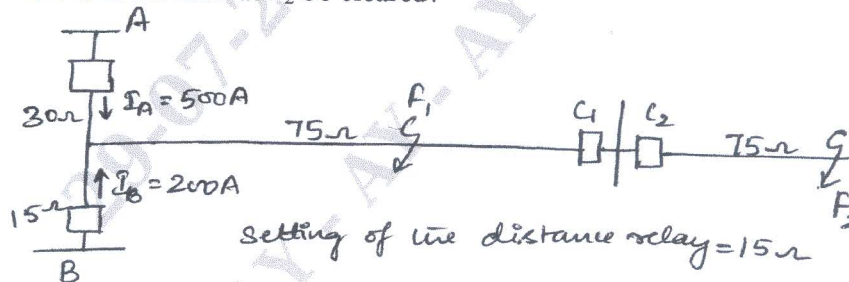


Fig.Q4(c)

(06 Marks)

5.
 - a. With a neat sketch, explain the working of differential protection of 3-phase circuits and balanced (opposed) voltage differential protection. (06 Marks)
 - b. Define the term 'pilot' with reference to power line protection. List the different types of wire pilot protection schemes and explain for any one scheme. (08 Marks)
 - c. With a neat sketch, explain the working of frame leakage protection used for bus zone protection. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. With a neat diagram, explain the working of a Bucholz's relay. (08 Marks)
- b. What are the protective devices employed for the protection of an alternator against (i) over voltage (ii) over speed (iii) motoring? Discuss them in brief. (06 Marks)
- c. A generator winding is protected by using a percentage differential relay whose characteristic is having a slope of 10%. A ground fault occurred near the terminal end of the generator winding while generator is carrying load. As a consequence, the currents flowing at each end of the winding are shown in Fig.Q6(c). Assuming CT ratio of 500/5 A, the relay operate to trip the circuit breakers.

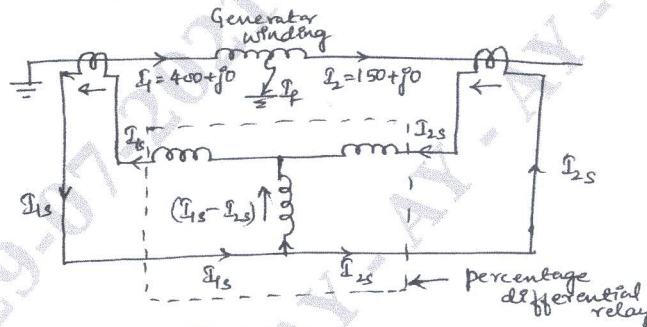


Fig.Q6(c)

(06 Marks)

- 7 a. With a neat sketch, explain the recovery rate theory and energy balance theory of arc interruption in a circuit breaker. (08 Marks)
- b. What are the advantages and disadvantages of SF₆ circuit breaker? (06 Marks)
- c. With a neat sketch, explain the working of air blast circuit breaker. (06 Marks)
- 8 a. With a neat diagram, describe the working principle of vacuum circuit breaker. (10 Marks)
- b. Explain the terms: restriking voltage, recovery voltage and RRRV. Derive expressions for restriking voltage and RRV in terms of system voltage, inductance and capacitance. What measures are taken to reduce them? (10 Marks)
- 9 a. Explain the construction and operation of the HRC cartridge fuse. What are its advantages and disadvantages? (08 Marks)
- b. Describe the phenomenon of lightning. (08 Marks)
- c. State any four essential requirements of a surge diverter. (04 Marks)
- 10 a. With a neat figure, explain the working of (i) Rod gap arrester (ii) Expulsion type arrester (08 Marks)
- b. With a neat sketch, explain the construction and working of klydonograph and magnetic link. (06 Marks)
- c. Explain the modules/components of GIS. (06 Marks)
