FINAL B. E. (Electrical) PART IIA EXAMINATION, 2007

POWER SYSTEM PROTECTION AND SWITCHGEAR

Time : Three hours Full Marks : 100

Answer any ***five*** questions

1. a) What are the essential elements in a relay. Explain the same. 4

   b) Explain the main featness of Protective Relay. 6

   c) Explain the zonal protection scheme applicable to power systems having a generator, Bus duct, Generator transformer, Bus bar and one transmission line. 10

2. a) Draw the basic circuit for series trip scheme of a circuit breaker and explain. 4

   b) Explain the principle of operation of induction type overcurrent relay.

   c) Draw a neat circuit diagram for controlling a circuit breaker having closing coil, trip coil, 2 nos overcurrent and one earthfault relay, T/N/C switch, to be operated from 110V dc auxiliary supply and explain the operation of the same. Also draw the power circuit diagram including CTs and Relays. 10

3. a) Define plug setting multiplier and time setting multiplier for IDMTL Relay. 4

b) Discuss the general principle of 3-zone protection by distance relay. 6

c) Explain the relative merits and demerits of the impedance, Mho and Reactance relays. 10

4. a) Derive appropriate expressions with symmetrical components for analysing a single line to ground fault in a three phase system. 4

b) Compare advantages and disadvantages of oil circuit breaker and vacuum circuit breaker. 6

c) Derive necessary relationship between symmetrical and assymetrical fault current when short circuit occurs at voltage zero condition. 10

5. a) A one ampere IDMTL over current relay with its plug set at 50% is carrying a fault current of 100 Amp. If the CT ratio is 200/1 Amp. determine the PSM. 4

b) Specify in detail the rating of a circuit breaker suitable for protecting a 11 kV transmission cable. 6

c) Write note on symmetrical component. Also write the relation (expressions) between phase voltages, currents and their corresponding symmetrical component values. 10

6. a) Define Recovery voltage and Active recovery voltage. 4

b) Explain the method of low resistance interruption of are in a circuit breaker. 6

c) Derive the expression for Restriking voltage and RRRV. 10

7. a) A 12.5 MVA 22KV generator is connected to a transmission line. A short circuit occurs between two line wires. The generator reactances are X_1=30 ohms, X_2=10 ohms, X_o=5 ohms. Line reactances are X_1=X_2=10 ohms, X_o=0. Calculate fault current in the faulted phases. 10

b) A 3-phase 150 MVA 13 KV alternator has positive, negetive and zero sequence reactances of 20%, 15% and 5% respectively, based on mechine rating. It is running on no load at rated voltage. Calculate value in ohms of the earthing resistor, to limit the terminal earthfault current to 750 Amp. in the event of a single line to ground fault. 10

8. Write short note on any ***four*** : 4×5

a) Air circuit breaker

b) Construction of electromagnetic relays

c) Switchger components

d) Load break fault make switches

e) Motor protection

f) Current chopping in a circuit breaker

g) Backup relaying