

**EE701**

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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE - 560 054

SEMESTER END EXAMINATIONS - JANUARY 2016

Course & Branch	: B.E.- Electrical & Electronics Engg.	Semester	: VII
Subject	: Switchgear and Protection	Max. Marks	: 100
Subject Code	: EE701	Duration	: 3 Hrs

Instructions to the Candidates:

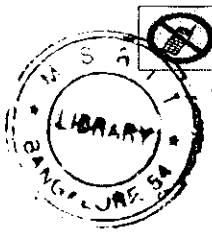
- Answer one full question from each unit.

UNIT - I

1. a) What are the factors considered in selecting a fuse for CO1 (10)
(i) Transformer protection (ii) Motor protection (iii) Capacitor protection (iv) heaters (v) Lighting loads
b) In a short circuit test on a circuit breaker, the following readings CO1 (04)
obtained on a frequency transient:
(i) time to reach the peak restriking voltage 70 μ -sec.
(ii) the peak restriking voltage 100 kV
Calculate the average rate of rise of restriking voltage and the natural frequency of the circuit.
c) Define the following terms with respect to circuit breaker: CO1 (06)
i) Symmetrical breaking capacity.
ii) Breaking capacity
iii) Making capacity
2. a) With a neat sketch explain the principle of working of low voltage HRC CO1 (06)
cartridge fuse. How can this fuse ease the duty on circuit breakers?
b) A 3 phase circuit breaker is rated at 1250 A, 2000 MVA, 33 kV, 4 CO1 (05)
seconds. Find the rated symmetrical breaking current, making current
and short time rating
c) Derive an expression for Restriking Voltage and Rate of Rise of CO1 (09)
Restriking Voltage (RRRV).

UNIT - II

3. a) With a neat sketch explain the construction and working of Arc chute air CO2 (08)
break circuit breaker.
b) Bring out the advantage and disadvantages of SF6 circuit breaker CO2 (07)
c) A oil circuit breaker is rated at 2000A, 1500MVA, 33KV, 3phase, CO2 (05)
3seconds, OCB. determine: i) Rated normal current. ii) Rated
symmetrical breaking current iii) Rated making current. Iv) short
time rating v) Rated service voltage
4. a) With a neat sketch explain the construction and working of cross blast CO2 (07)
circuit breaker
b) Compare bulk oil and minimum oil circuit breaker and hence mention its CO2 (06)
applications.



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- c) With a neat sketch, explain the construction and working of vacuum CO2 (07)
circuit breaker

UNIT - III

5. a) With a neat diagram explain zones of protection in a typical power CO3 (05)
system.
b) With the help of block schematic explain static relays. CO3 (04)
c) Given a situation where cost is a main constraint in designing a CO4 (05)
protection scheme, you are given an option to go for either a complete
solid state relay with thyristor being used to generate the trip signal or
a combination of solid state relay and an electromagnetic relay as a
slave relay. Which one would you prefer and why? Explain briefly
d) Discuss amplitude and phase comparators. CO4 (06)
6. a) With the help of a block diagram explain static inverse over current CO3 (07)
relay.
b) With a neat circuit diagram explain the working principle of rectifier CO3 (05)
bridge type amplitude comparator.
c) What are the essential qualities of a protective relaying? Explain each CO3 (08)
one of them.

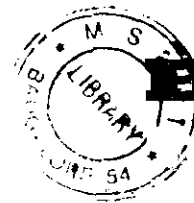
UNIT - IV

7. a) Explain how an impedance relay is used for distance protection? Obtain CO3 (10)
its operating characteristics. Draw its operating characteristics on an R-
X diagram
b) Determine the time of operation of an IDMT relay of rating 5 A and CO3 (05)
having current setting of 125% and TMS = 0.5. The relay is connected
through a CT of 400/5A. The fault current is 4,000A. The operating time
for PSM of 8 is 3.2 seconds
c) With a neat sketch explain how the combination of directional and non CO4 (05)
directional relay can be used to protect a parallel feeder.
8. a) Draw time - current characteristics for different over current relays and CO3 (08)
compare them based on their applications.
b) A 20 MVA transformer which is used to operate at 30% overload feeds CO4 (12)
an 11 kV busbar through a circuit breaker. The transformer circuit
breaker is equipped with a 1000/5 current transformer and the feeder
circuit breaker with 400/5 current transformer and both the current
transformers feed IDMT relays having the following characteristics

PSM	2	3	3.33	3.5	4.2	5	5.5	15	20
Operating time in secs	10	6	5.6	5.4	4.8	4.2	4.0	2.5	2.2

The relay on the feeder circuit breaker has 125% plug setting and a 0.3 time multiplier setting. If a fault current of 5000 A flow from the transformer to the feeder, determine

- (i) Operating time of feeder relay
(ii) Suggest suitable plug setting and time multiplier setting of the transformer relay to ensure adequate discrimination of 0.5 s between the transformer relay and feeder relay.

**EE701****UNIT - V**

9. a) With a neat sketch explain the modified differential protection scheme for generators grounded through high resistance. CO4 (10)
- b) A 50 MVA, 132/66 kV, star - delta, three phase power transformer is protected by percentage differential relays. If the current transformer located on delta and star sides of the power transformer are 300/5 A and 1200/5A respectively, determine (i) the output current at full load (ii) the relay current at full load (iii) the minimum relay current setting to permit 25% overload. CO4 (10)
10. a) With a neat sketch explain the protection scheme for the transformer that takes care of magnetizing inrush current without affecting the sensitivity CO4 (12)
- b) An 11 kV, 100 MVA alternator is provided with differential protection. The percentage of winding to be provided against phase to ground faults is 85%. The relay is set to operate when there is 20% out of balance current. Determine the value of resistance in the neutral to ground connection. CO4 (08)
