Code : 031713

B.Tech 7th Semester Exam., 2017

PROTECTION OF POWER APPARATUS AND SYSTEM

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.
*(ii) There are **NINE** questions in this paper.*
*(iii) Attempt **FIVE** questions in all.*
*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) The unit protection scheme provides
- *(i)* primary protection
- *(ii)* backup protection
- *(iii)* simultaneous protection
- *(iv)* remote protection

(b) The most efficient torque producing actuating structure for induction relay is
- *(i)* shaded pole structure
- *(ii)* watt-hour meter structure
- *(iii)* induction cup structure
- *(iv)* None of the above

(Turn Over)

(c) The standard current ratings of an electromagnetic relay are
- *(i)* 5 A and 15 A
- *(ii)* 15 A and 20 A
- *(iii)* 1 A and 5 A
- *(iv)* 10 A and 15 A

(d) Mho relay is normally used for the protection of
- *(i)* long transmission line
- *(ii)* medium transmission line
- *(iii)* short length line
- *(iv)* No length criterion

(e) The relay which is most sensitive to power swings is
- *(i)* mho relay
- *(ii)* reactance relay
- *(iii)* impedance relay
- *(iv)* All are equally affected

(f) Protection scheme used for detection of loss of excitation of a very large generating unit feeding power into a grid employs
- *(i)* under voltage relay
- *(ii)* offset mho relay
- *(iii)* under frequency relay
- *(iv)* percentage differential relay

(Continued)

(g) A thermal protection relay provides protection against

(i) overload
(ii) short-circuit
(iii) temperature
(iv) All of the above

(h) A circuit breaker is

(i) power factor correcting device
(ii) a device to neutralize the effect of transients
(iii) a waveform correcting device
(iv) a current interrupting device

(i) The expression of RRRV is

(i) $\sqrt{2}\, I\omega z$
(ii) $2 I\omega z$
(iii) $I\omega z$
(iv) $\sqrt{3}\, I\omega z$

where, I, ω and z are short circuit current, angular frequency and the effective surge impedance of the short-circuited line respectively.

(j) SF_6 gas is

(i) sulphur fluoride
(ii) sulphur difluoride
(iii) sulphur hexafluoride
(iv) None of the above

2. (a) What are the causes of a fault? Discuss it briefly.

(b) List all the methods of fault discrimination. Explain the method of discrimination by power direction comparison. 7+7=14

3. (a) Explain the theory of induction relay.

(b) Describe the functioning of an impedance relay. 8+6=14

4. (a) Define plug setting multiplier and time setting multiplier of an IDMT relay.

(b) The maximum fault current that can flow through the relay is 4000 A and the relay is set to operate at 400 primary ampere with a CT ratio of 400/5 and relay current setting of 50%.

(i) Calculate PSM of the relay.

(ii) For the same primary current and relay current setting of 100%, find the new value of PSM. 6+8=14

5. (a) Draw a differential protection scheme of a Y-Δ power transformer.

(b) Explain all the problems encountered in differential protection of a transformer. 5+9=14

6. (a) Define symmetrical and asymmetrical breaking current with the help of short-circuit current wave.

(b) Explain various components of operating time of a circuit breaker.

(c) A three-phase circuit breaker is rated at 1250 A, 1000 MVA, 11 kV, 4 s. Find the rated symmetrical breaking current and making current.

7. (a) Classify circuit breaker based on medium used for arc quenching.

(b) What are the different types of oil circuit breaker?

(c) What are the advantages and disadvantages of air-blast circuit breaker? 3+4+7=14

8. (a) Discuss all the reasons for overvoltage arising in a power system.

(b) List different types of lightning arrestor.

(c) Define impulse ratio of lightning arrestor.

(d) What is the difference between surge absorber and surge diverter? 6+2+2+4=14

9. Write short notes on any *two* of the following : 7×2=14

(a) Buchholz relay

(b) SF_6 circuit breaker

(c) Basic impulse insulation level (BIL)

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