

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BE
BRANCH: EEE**

**SEMESTER : VII
SESSION : MO/18**

SUBJECT: EE7203 SWITCHGEAR AND PROTECTION

TIME: 3.00 HRS

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

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- Q.1(a) What is making capacity and breaking capacity of a circuit breaker. [2]
- Q.1(b) From the following data of 50 Hz generator: e.m.f to neutral 7.5 kV(rms), reactance of generator is 4 ohm, capacitance to neutral 0.01 micro farad. Find (a) the maximum voltage across the contacts of circuit breaker when it breaks a short circuit current (b) the frequency of oscillation and (c) the average rate of rise of voltage. [4]
- Q.1(c) Discuss the construction operation and advantage of vacuum circuit breaker. [6]
- Q.2(a) Give the various type of over current relays and their approximate characteristics. [2]
- Q.2(b) Describe the principle of a directional over current relay. How does it help in discrimination in protection in parallel feeders? [4]
- Q.2(c) The calculated short circuit through a feeder is 1200A. An over-current relay of rating 5A is connected for the protection of the feeder through a 1000/5 A CT. Calculate the operating time of the relay when it has plug setting of 50% and time setting of 0.8. The characteristics of the relay is as follows: [6]
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|----------------|-----|----|-----|-----|----|-----|
| PSM | 1.3 | 2 | 4 | 6 | 10 | 20 |
| Time (seconds) | 30 | 10 | 6.5 | 3.5 | 3 | 2.2 |
- Q.3(a) Why biased differential relay is preferred over a simple differential relay. [2]
- Q.3(b) Describe with the help of neat diagram the operation of induction cup type MHO relay. What are the merits of mho relay and their application. Also draw the circuit diagram. [10]
- Q.4(a) Explain the field failure protection of an alternator. [2]
- Q.4(b) Explain biased differential protection of an alternator. [4]
- Q.4(c) The neutral point of a three phase 20MVA, 11kV alternator is earthed through a resistance of 5 ohm, the relay is set to operate when their an out of balance current of 300A. The CT ratio is 1000/5. What is the percentage of winding protected? Also calculate the earthing resistance required to protect 90% of winding. [6]
- Q.5(a) What is restricted earth fault protection. Discuss restricted earth fault protection for star-delta transformer when neutral is earthed within protected zone. [2]
- Q.5(b) A 50 MVA, 132/66 kV 3 phase power transformer is protected by % differential relays. The CTs located on delta and star sides of power transformer are 300/5 and 1200/5 A respectively. Determine the output current of CTs at full load and relay current at full load. Also draw the circuit diagram. [4]
- Q.5(c) Explain the protective system used for protection against internal phase to phase and phase to earth fault in case of a 3-phase transformer having capacity above 2 MVA. [6]
- Q.6(a) Describe single phasing, short circuit and earth fault condition of a 3-phase induction motor. [2]
- Q.6(b) The details of 2000 hp, 3 phase, 50 Hz induction motor are as follows: p.f.- 0.85, rated voltage - 6600 v, efficiency- 90%, continuous over load- 110% of rated current, starting current-6 times the rated current, and pick up setting is 100% of 1A. Calculate the over load and instantaneous relay setting. [4]
- Q.6(c) Explain the complete protective system with starter of an induction motor whose operating voltage is below 1000V. [6]
- Q.7(a) Discuss advantage of numerical protective system. [2]
- Q.7(b) What is pilot relaying scheme for protection of EHV and UHV transmission line. How it is better than current based and distant protection. [4]
- Q.7(c) Explain with block diagram the phase comparison carrier current protection system for protection of transmission line. Also show the transmission of carrier signals during internal and external fault. [6]