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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP EXAMINATIONS, DECEMBER 2017

SUBJECT: SWITCHGEAR AND PROTECTION [ELE 4101]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 20 December 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. State and explain Slepian's theory of zero current arc interruption in a circuit breaker. ***(03)***

1B. While disconnecting a power transformer on no-load, the circuit breaker on its primary side can encounter a severe duty. Name the associated phenomenon. Draw neat waveforms and explain it. ***(04)***

1C. In a short-circuit test on a three-phase, 110 kV circuit breaker, the power factor of the fault involving the earth was 0.35, the recovery voltage was 0.95 times the full line value, the breaking current was symmetrical and the neutral was grounded. The restriking transient had a natural frequency of 12 kHz. Calculate the RRRV. ***(03)***

2A. Explain with relevant sketches the construction and working principle of vacuum circuit breaker. Mention its merits and demerits. ***(04)***

2B. A three-phase circuit breaker is rated at 2,000 MVA, 33 kV, 1,250 A, 4s. Find the following:

(i) Rated symmetrical breaking current.

(ii) Rated making current.

(iii) Short-time rating. ***(03)***

2C. With neat figure explain the construction and working of HRC fuse, Mention its Advantages and Disadvantages. ***(03)***

3A. Describe the essential qualities of a protective relay ***(03)***

3B. Explain the consequence of the following faults in the alternator.

a. Failure of prime mover b. failure of field c. over speed d. unbalanced loading ***(04)***

3C. With a neat figure, explain the earth fault/leakage protection of a power transformer ***(03)***

4A. A 3 phase transformer of 220/11,000 line volts is connected in star/ delta. The protective transformers on 220 V side have a current ratio of 600/5. What should be the CT on 11,000 V side. And draw the connection diagram. ***(03)***

4B. With reference to Fig. Q4B and tabular column shows portion of a typical power system protected by over current relays. TMS setting for relay 1 is 0.2. Using the given data, determine the actual time of operation of relay 1 and 2, if for discrimination a time margin of 0.5 seconds is used between the time of operation of relay 1 and 2. ***(04)***

4C. With the help of relevant diagram, explain the Zones of power system for protection and also explain the need for back up protection. ***(03)***

5A. With the help of relevant block diagram and waveforms, describe the phase comparison method of carrier pilot protection for overhead transmission lines. Describe the functions of all the components used. ***(04)***

5B. What are the consequences of overload on a 3 phase induction motor? Explain the method of protecting the motor against the consequences of overload using a replica type thermal relay ***(03)***

5C. Starting from fundamentals, derive the general equation of a phase comparator and hence show how a reactance relay characteristics can be realised using a phase comparator. ***(03)***

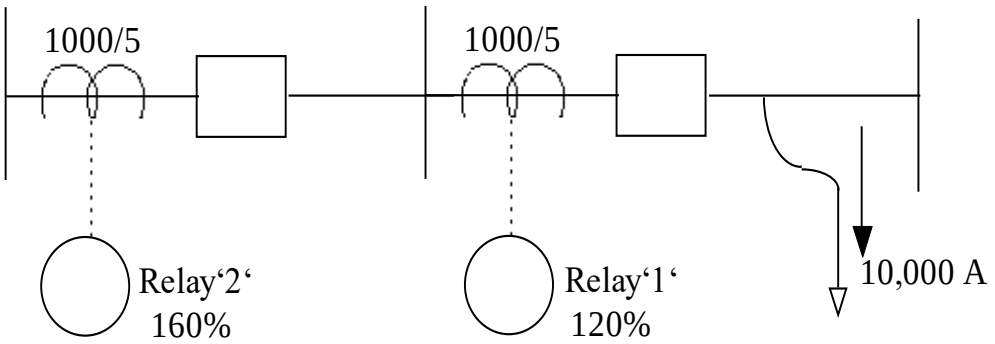

Fig. Q 4B

PSM	2	3.6	5	6.25	8	10	15	20
OPERATING TIME(S)	10	6	4	3.8	3.15	2.8	2.2	2.1