Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, DECEMBER 2019

SUBJECT: SWITCHGEAR AND PROTECTION [ELE 4101]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 20 December 2019** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Define the following:
a. Recovery voltage
b. Re-striking voltage
c. Rate of rise of re-striking voltage ***(03)***

1B. Describe the effect of the following on recovery voltage
a. Natural frequency b. power factor c. Armature reaction ***(04)***

1C. What is the main problem in the development of a HVDC circuit breaker? With the help of relevant diagrams, explain the method that can be used to overcome this problem. ***(03)***

2A. Explain the construction and working of Puffer type SF6 circuit breaker with the aid of sketches before and during arc extinction. ***(04)***

2B. With a neat diagram explain the working of H.R.C fuse, mention its advantages and disadvantages. ***(03)***

2C. Calculate the inductance and kVA rating of the ground fault neutralizer suitable for a 3 phase, 33 kV, 50 Hz ,60 km transmission line having a capacitance to earth of each conductor a 0.02 μF/km. Derive the expression used for the same. ***(03)***

3A. With the help of a single line diagram of major equipments in a substation, explain the necessity and functions of isolator and earthing switch. List the sequence of operation of these equipments along with circuit breaker while (i) opening and (ii) closing a circuit. ***(03)***

3B. Derive an expression for the operating force of an attraction type electromagnetic relay when energized by an AC quantity and hence discuss the problem associated with AC operation. How can it be overcome? ***(03)***

3C. With a neat diagram and phasor, explain the construction & working of directional power relay ***(04)***

4A. With a neat diagram explain the construction & working of Buchholtz Relay. List out its advantages and disadvantages ***(03)***

4B. A 3 Φ, 0.4 kV/11 kV transformer is connected as star-delta. The protective transformers on the 0.4 kV side have turn ratio of 500/5. What must be the C.T ratio on the high voltage side.? Draw the connection diagram for the same. ***(03)***

4C. Describe the following overcurrent relays with the help of its time-current characteristics.

a. Instantaneous OC Relay
b. Definite minimum time relay
c. Inverse time over current relay
d. Inverse definite minimum time (IDMT) OC relay **(04)**

5A. Describe the differential protection scheme for bus bar with a neat diagram. **(03)**

5B. With the help of relevant diagrams, describe the protection schemes for radial feeders using definite time relays and inverse time relays. What are the limitations of definite time relays. ***(04)***

5C. With the help of relevant diagram and wave forms explain the phase comparison method of carrier pilot protection of transmission lines. ***(03)***