Reg. No.									

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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2019

SUBJECT: SWITCHGEAR AND PROTECTION [ELE 4101]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 15 November 2019** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Discuss Cassie's energy balance theory of arc interruption in an AC circuit breaker. ***(03)***

1B. While disconnecting a power transformer on no-load, the circuit breaker on its primary side can encounter a severe duty. With neat waveforms, explain the phenomenon encountered. ***(03)***

1C. In a 3 phase, 220 kV system, the reactance and capacitance up to the location of the circuit breaker are 8 Ω and 0.025 μF, respectively. A resistance of 600 Ω is connected across the contacts of the circuit breaker. Determine the following:

a) Natural frequency of oscillations

b) Damped frequency of oscillations

c) Critical value of the resistance which will give no transient oscillations

d) Value of the resistance which will give damped frequency of oscillations equal to one-fourth of the natural frequency of oscillations. ***(04)***

2A. Explain the construction and working of air break circuit breaker with a neat diagram. ***(03)***

2B. Write a technical note on the auto-reclosure scheme employed for the EHV transmission lines. ***(03)***

2C. With a connection diagram & waveform, explain the parallel current injection method of synthetic testing of circuit breaker. ***(04)***

3A. Illustrate how discrimination between fuses & b/n fuse and overcurrent protective relay are achieved. ***(03)***

3B. Explain all the essential qualities of protective relays ***(04)***

3C. With a connection diagram, explain the Merz-price protection scheme for star delta transformer ***(03)***

4A. Describe the consequences of loss of excitation in generator, explain the protection scheme for loss of excitation with a neat diagram. ***(04)***

4B. The generator is protected with Merz-price differential relay. Its ratings are 11kV, 5 MVA. The percentage of winding protected against ground fault is 80%. The relay setting is such that it trips for 20% of full load current. Calculate the resistance to be added in neutral to ground connection and what is the minimum value of earthing resistance to protect 90% of the winding. ***(03)***

4C. With the help of a relevant diagram and suitable illustrations, explain the protection scheme for a ring main system using definite time overcurrent relays. ***(03)***

5A. Obtain the 3 Zone settings for (i) impedance relay (ii) reactance relay and (iii) mho relay with a characteristic angle of 20^{o} from the following data: C.T:1000/1 amp P.T: 220 kV/110 volts. Primary impedances of first, second and third line are (2+j6) Ω, (2.5+j5) Ω and (3.5+j7) Ω respectively Zone #01 is designed to cover 75% of the first line. Zone #02 covers first line and extends up to 50% of the second line. Zone #03 covers both first and second line and extends up to 25% of the third line. ***(04)***

5B. What is the effect of single phasing operation of a 3 phase Induction motor on its performance? With the help of a neat connection diagram, explain the working of single phase preventer used to protect induction motor against single phasing ***(03)***

5C. Describe the working principle of static relay with its block diagram, List out its limitations ***(03)***