Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, MAY 2018

SUBJECT: SWITCHGEARS AND PROTECTION [ELE 4101]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 03 May 2018** **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. In 132 kV, 3 phase, 50 Hz grounded neutral system, the reactance per phase & capacitance per phase to earth are 3Ω & 0.015 μF respectively. Calculate the following

a. frequency of transient oscillation
b. max value of recovery voltage across the contacts of the circuit breaker
c. max value of re-striking voltage. ***(03)***

2A. With a neat circuit & phasor diagrams, explain the working of resonant grounding in power system. ***(03)***

2B. A 230 kV, 3 phase, 50 Hz, 200 km transmission line has a capacitance to earth of 0.02 μF/km per phase. Calculate the inductance & kVA rating of the Peterson coil used for earthing the above system. ***(03)***

2C. With the help of neat sketches of contacts in closed position and open position, describe the construction and principle of operation of single pressure puffer type SF6 Circuit breaker. ***(04)***

3A. What do you mean by routine tests and type tests? Why are they conducted? List the important routine tests and type tests conducted on HVAC circuit breakers. ***(04)***

3B. 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)***

3C. With a neat diagram explain the working of H.R.C fuse, mention its advantages and disadvantages. ***(03)***

4A. Explain the following related to fundamental requirements of protective relaying

a. selectivity b. speed c. sensitivity d. reliability e. simplicity f. economy ***(03)***

4B. 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)***

4C. With a neat figure, explain the working of non- directional over current relay ***(04)***

5A. Discuss the problems encountered in differential overcurrent relay in its basic version. How is it overcome in biased differential relay. ***(03)***

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. With the help of relevant diagram and wave forms explain the phase comparison method of carrier pilot protection of transmission lines. ***(04)***