ANNA UNIVERSITY :: CHENNAI – 600 025

MODEL QUESTION PAPER

VI - SEMESTER

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

EE338 - PROTECTION AND SWITCHGEAR

Time: 3hrs **Max. Marks: 100**

Answer all Questions

PART – A (10 x 2 = 20 Marks)

1. Differentiate between a fuse and a protective relay.

2. Define the following terms as related to protective relaying: (a) pick-up current, (b) reset value and (c) reset ratio.

3. What are the different types of faults and abnormal conditions expected in an alternator?

4. What are the requirements of line protection?

5. Define (a) arc voltage, (b) restriking voltage, (c) recovery voltage and (d) breaking capacity of a circuit breaker.

6. What is the importance of arc resistance? On which factor does it depend?

7. A three-phase oil circuit breaker is rated at 1500 A, 1000MVA and 33kV Find (a) rated symmetrical breaking current, (b) making capacity.

8. Suggest a suitable choice of circuit breakers for the following voltage ranges: (a) 3.3kV to 33kV, (b) 400kV to 760kV.

9. What is Peterson coil? What protective functions are performed by this device?

10. Differentiate between a surge diverter and surge absorber.

PART B – (5 x 16 = 80 Marks)

11. With a neat sketch explain the Merz-Price circulating current scheme for protection of alternators. (16)

12.a) Explain the principle of a distance relay, stating clearly the difference between electromagnetic version of an impedance relay and a mho relay. Your answer

should include typical schematics the characteristics of these relays in an R-X diagram.

(OR)

12.b)i) Give the block diagram of a typical microprocessor based protective relay for motor protection. (8)

ii) What are the typical protective functions that can be built into the relay? (8)

13.a) A star connected, 3 phase, 10 MVA, 6.6kV alternator has a per phase reactance of 10%. It is protected by a Merz-Price circulating current protection which is set to operate for fault currents not less than 175 A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the alternator winding remains unprotected. (16)

(OR)

13.b)i) Explain current chopping phenomenon. (6)

ii) Discuss the various methods of arc quenching in circuit breakers. (10)

14.a)i) Derive an expression for restriking voltage and rate of rise of restriking voltage (RRRV) in terms of system voltage, inductance up to the fault location and bushing to earth capacitance of the circuit breaker. (8)

ii) For a 132KV system, the reactance up to the fault location and bushing capacitance are 3 ohms and 0.015μF respectively. Calculate the maximum value of RRRV. (8)

(OR)

14.b) In a 132kV systems, the reactance and capacitance up to the location of the circuit breaker is 5Ω and 0.02μF respectively. A resistance of 500 Ω is connected across the contacts of the circuit breaker. Determine

(i) natural frequency of oscillations (4)
(ii) frequency of damped oscillations (4)
(iii) critical value of resistance (4)
(iv) the value of resistance which will give frequency of damped oscillations which is equal to $1/4^{th}$ the natural frequency (4)

15.a)i) Describe the construction and the operation of metal oxide surge arrester?(10)

ii) What are its advantages over conventional arrester and its drawbacks? (6)

(OR)

15.b) Explain the following:(i) Earthing screen (8)
(ii) Overhead ground wires (8)
