International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018
Course Code: EEE-4801
Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)
Course Title: Power System protection
Full Marks: 50

Part A

[Answer any ***two*** questions from the followings; figures in the right margin indicate full marks.]

1(a). Describe the operation of SF6 circuit breaker with proper sketch. **4**

1(b). An air blast circuit breaker is designed to interrupt a transformer magnetizing current of 11 A (r.m.s) chops the current at an instantaneous value of 7 A. If the values of L and C in the circuit are 35.2 H and 0.0023 uF, find the value of voltage that appears across the contact of the breaker. Assume that all the inductive energy is transferred to the capacitance. **2**

1(c). Define the term 'Breaking capacity'. For a country like Bangladesh which type of circuit breaker should prove a definite advantage? Why? **4**

2(a). Design a Buchholz relay based transformer protection scheme. **3**

2(b). Design a combined leakage and overload protection. **3**

2(c). A 3-phase, 33/6·6 kV, star/delta connected transformer is protected by Merz-Price circulating current system. If the CTs on the low-voltage side have a ratio of 1000/5, determine the ratio of CTs on the high voltage side. **4**

3(a). Discuss briefly about maintenance of oil circuit breaker. **4**

3(b). In a short circuit test on a circuit breaker, the following readings were obtained on single frequency transient: **6**

i) time to reach the peak re-striking voltage,50 μ sec

ii) the peak re-striking voltage,100 kV

Determine the average RRRV and frequency of oscillations.

Part B

[Answer any ***three*** questions from the followings; figures in the right margin indicate full marks.]

4(a). Write down the main types of stator winding faults in an alternator in order of importance. **2**

4(b). How will you protect an alternator from turn-to-turn fault on the same phase winding? **3**

4(c).	A 10 MVA, 11 kV, 3-phase star-connected alternator is protected by the Merz-Price balance-current system, which operates when the out-of-balance current exceeds 20% of full-load current. Determine what portion of the alternating winding is unprotected if the star point is earthed through a resistance of 9 Ω. The reactance of the alternator is 2 Ω.	5
5(a).	Describe the operation of ring mains system using proper sketch.	5
5(b).	What are the requirements of line protection?	3
5(c).	Write down the advantages and disadvantages of Merz- price voltage balance system with proper sketch.	2
6(a).	What is numerical relay? Write down the features of numerical relay?	4
6(b).	Draw the basic structure of numerical relay?	4
6(c).	What is grounding? Write down the advantages of neutral grounding?	2
7(a).	Write down the types of lightning arresters. Design a lightning arrester with nonlinear resistor.	5
7(b).	Point out the causes of over voltages on a power system.	2
7(c).	What is equipment grounding? Discuss shortly with proper sketch.	3