TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

Department of Electrical and Electronic engineering

Diploma in Electrical Power Engineering

ELECTRICAL SWITCHGEAR AND PROTECTION
EEP 2305

SERIES: AUGUST 2024
TIME: 2 HOURS

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
Answer THREE of the following FIVE questions.

Question ONE

(a) (i) State the required attributes of power system protection gear.
(ii) Distinguish between a unit and non-unit protective system.
(8 marks)

(b) With the aid of circuit diagrams Explain the principles of both the current balance and voltage balance differential protection and explain how they are used in the protection of alternators and transformers. (12 marks)

Question TWO

(a) Define the following as applied to protection:
(i) Breaking capacity
(ii) Recovery voltage
(iii) Restriking voltage
(6 marks)

(b) Explain:
(i) The meaning of current chopping.
(ii) Resistance switching
(4 marks)

(c) (i) Explain the meaning of electronegativity of SF_6 gas.
(ii) State **FOUR** advantages of SF6 gas in arc quenching
(iii) State **FOUR** advantages of SF6 gas in arc quenching
(10 marks)

Question THREE

(a) State the faults that affect an alternator. (4 marks)

(b) (i) State the functions of oil in circuit breakers.
(ii) State the hazards of oil when used as an arc quenching medium.
(6 marks)

(c) State:
(i) The advantages of minimum oil CB over bulk oil CB.
(ii) The disadvantage of MOCB over bulk oil circuit breaker.
(iii) Advantages of air blast circuit breaker over oil circuit breaker.
(iv) Demerit of using air as an arc quenching medium.
(10 mark)

Question FOUR

(a) State the limitation of merz price protection in alternators. (6 marks)

(b) Explain the working principle of distance relays. **(**5 marks)

(c) A star connected **3** phase 1OMVA **6.6KV** alternator has a per phase Reactance of 10%. It is protected by merz price circulating current principle while it is set to operate for fault currents not less than 1**75** A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the alternator winding remains unprotected.

(9 marks)

Question FIVE

(a) State:

(i) Functions of a circuit breaker.
(ii) Factors determining arc resistance
(iii) Factors that maintain an arc between contacts

(6 marks)

(b) Explain the methods of arc extinction and how each is achieved.

(10 marks)

(c) Explain why a self blast oil circuit breaker takes much longer to extinguish the arc developed when breaking low currents than when high fault currents are interrupted.

(4 marks)