TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

Department of Electrical and Electronic engineering

Higher Diploma in Electrical Power Engineering
EEE3214: ELECTRICAL POWER SYSTEMS III

END OF SEMESTER EXAMINATION
TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions;. Attempt any THREE Questions.

Do not write on the question paper.

Question One

(a) (i) Define corona

(ii) State TWO advantages and TWO disadvantages of corona

(iii) State two methods of reducing corona effect

(8 marks)

(b) Explain the following terms with reference to corona :

      (*i*)   Critical disruptive voltage

      (*ii*)   Visual critical voltage

      (*iii*)   Power loss due to corona

(6 marks)

(b) A 3-phase overhead transmission line, consists of three stranded copper conductors spaced 2.5 m apart at the corners of an equilateral triangle. The air temperature and pressure are 21°C and 73.6 cm Hg respectively. The conductor diameter and irregularity factor are 10.4 mm and 0.85,
Determine the disruptive critical voltage

(6 marks)

Question TWO

(a) Define the following protection terms,

      (i)   Pickup level

      (ii)   Primary relays

      (iii)   Secondary relays

      (iv)   Unit protection

      (v)   Non unit protection

(5 marks)

(b) Explain THREE methods of achieving time delay in inverse time relays   (6 marks)

(c) A 30 MVA,33/11 kV three phase delta star transformer is protected by a differential relay. The CT current ratio on the primary is 500:5 and that on the secondary is 2000:5 Determine the relay current setting for faults drawing up to 200 percent of the rated current.   (9 marks)

Question THREE

(a) Explain the following ;

      (i)   Voltage regulation

      (ii)   Transmission efficiency

                                                                             (4 marks)

(b) Distinguish between the three classes of transmission line and how line parameters affect each class. (3 marks)

(c) A 200 km long 60hz transmission line supplies a 100 MW star connected load at 215KV (line to line)0.9 pf lag. The per phase parameters of the line are Resistance 2.07 Ω, inductance 310.8mH and capacitance 1.4774µF.

Determine;

      (i)   The ABCD constants for the line

      (ii)   The sending end voltage

                                                                    (13marks)

Question FOUR

(a) (i) State Four methods of grounding

     (ii) State Two advantages and Two disadvantages of each

                                                                  (8 marks)

(b) Explain the phenomenon of arcing grounds and the methods used to minimize this phenomenon (3 marks)

(c) A 132 kV, 3-phase, 50 Hz transmission line 192 km long consists of three conductors of effective diameter 20 mm, arranged in a vertical plane with 4 m spacing and regularly transposed. Find the inductance and kVA rating of the arc suppressor coil in the system.

                                                                  (9 marks)

Question FIVE

(a) Explain how an arc is initiated and sustained in a circuit breaker when the circuit breaker contacts separate.

(b) Explain the electronegativity of SF6 gas and state its four characteristic   (6 marks)

(c) Explain the terms ;

      (i)   Symmetrical breaking current

      (ii)   Asymmetrical breaking current

      (iii)   making current

      (iv)   Current chopping

                                                                    (8 marks)

(d) A circuit breaker is rated as 2500 A, 1500 MVA, 33 kV, 3 secs, 3-phase oil C.B.
Determine;
- (i) Normal rated current
- (ii) Breaking current
- (iii) Short time rating

(3 marks)