



# MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

EED 310: ELEMENTS OF POWER SYSTEMS II

DATE: 18/01/2021

TIME: 8.30-10.30 AM

## INSTRUCTIONS

Answer Question One and any Other Two Questions

### QUESTION ONE (30 MARKS)

- a) Explain the following terms with reference to Faults
- i) positive sequence
  - ii) negative sequence
  - iii) a' operator (6 marks)
- b) List the assumptions made in analysis of asymmetrical faults (4 marks)
- c) Explain the following terms with reference to protection
- i. Pick up value
  - ii. actuating quantity (4 marks)
- d) In a 3-Phase, 4-wire system the currents in the RYB are  
 $I_R$  equals 200 at 60 A     $I_Y$  Equals 70 at 200A     $I_B$  equals 80 at 150A  
Calculate all the sequence currents in the R (8 marks)
- e) Explain with reference to surge apparatus the following terms
- i. Transmission factor
  - ii. Reflection factor (8 marks)

## QUESTION TWO (20 MARKS)

- a) With reference to Three phase fault studies, explain the terms;
- i. Asymmetrical Faults
  - ii. Symmetrical Faults (4 marks)
- b) Derive an expression for Negative sequence in three phase faults (6 marks)
- c) The sequence voltages in the red phase are
- $E_{R0}$  equals 170V       $E_{R1}$  equals 260-j40V       $E_{R2}$  equals -200V
- Calculate  $E_r, E_y, E_b$  (10 marks)

## QUESTION THREE (20 MARKS)

Explain with the aid of diagrams the operation of

- a) horn gap
- b) arcing horn
- c) earth wire
- d) Valve type arrester

## QUESTION FOUR (20 MARKS)

- a) List the major causes and effects of electrical surges in power systems (6 marks)
- b) Derive the expression for surge velocity. (6 marks)
- c) A overhead line having an inductance of 1.4mh/km and a capacitance of 0.00909 $\mu$ f/km is connected in series with an underground cable with an inductance of 0.190mh/km and capacitance of 0.354 $\mu$ f/km.
- Calculate the values of transmitted and reflected waves of voltage and current at the line/cable junction caused by a 60Kv surge voltage towards the junction from the line end. (8 marks)

## QUESTION FIVE (20 MARKS)

- a) List any Five advantages of neutral earthing in power systems (5 marks)
- b) Explain the reasons for limiting phase to ground fault current by resistance grounding (6 marks)
- c) List any Four methods of neutral earthing (4 marks)
- d) A 240Kv,50Hz network has capacitance to neutral of 1.6F per phase. Calculate the reactance of an arc-suppression coil suitable for the system to limit arcing ground faults. (5 marks)