MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

EED 310: ELEMENTS OF POWER SYTSEMS

DATE: 18/8/2021 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Answer Question One And Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Explain the following terms with reference to Faults

i) Zero 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) Back up protection

ii) primary protection (4 marks)

d) In a 3-Phase, 4-wire system the currents in the RYB are

$I_{R\ equals}$ 100 at 80^0 A I_Y Equals 90 at 30^0A I_B equals 120 at 120^0A

Calculate all the positive and negative sequence currents in the R-line

(8 marks)

e) Explain with reference to surge apparatus the following terms

i) Wave Tail

ii) Wave front (8 marks)

QUESTIONTWO (20 MARKS)

a) With reference to Three phase fault studies, explain the terms;

i. Unbalanced Faults
ii. Symmetrical Faults (4 marks)

b) Derive an expression for Positive sequence voltages in three phase faults (6 marks)

c) The sequence voltages in the red phase are

E_{R0} equals 220 –j100V E_{R1} equals 70-j80V E_{R2} equals 30-j20V

Calculate E_r, ,E_y ,E_b (10 marks)

QUESTION THREE (20 MARKS)

Explain with the aid of diagrams the operation of
i) Peterson coil
ii arcing horn
iii earth wire
iv Valve type arrester

QUESTION FOUR (20 MARKS)

a) List the major causes and effects of electrical surges in power sytems (6 marks)

b) Derive the expression for surge impedance in surges. (6 marks)

c) A overhead line having an inductance of 1.8mH/km and a capacitance of 20μF/km is connected in series with an underground cable with an inductance of 0.180mH/km and capacitance of 0.45μF/km.

Calculate the values of transmitted and reflected waves of voltage and current at the line /cable junction caused by a 100Kv 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 500Kv,50Hz network has capacitance to neutral of 2μF per phase.Calculate the reactance of an arc-suppression coil suitable for the system to limit arcing ground faults. (5 marks)