MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

ELEMENTS OF POWER SYTSEMS II

DATE: 21/10/2020 **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

$I_{R\ equals}$ 100 at 30^0 A I_Y Equals 50 at 300^0A I_B equals 70 at 180^0A

Calculate all the sequence currents in the R (8 marks)

e) A cable has a conductor of radius 0.75 cm and a sheath of inner radius 2.5 cm. Find (i) the inductance per meter length (ii) capacitance per meter length (iii) surge impedance and (iv) velocity of propagation, if the permittivity of insulation is 4. (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 150V E_{R1} equals 160-j80V E_{R2} equals -100V

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 sytems (6 marks)

b) Derive the expression for surge velocity. (6 marks)

c) A overhead line having an inductance of 1.38mh/km and a capacitance of 0.00808µf/km is connected in series with an underground cable with an inductance of 0.187mh/km and capacitance of 0.217µf/km.

Calculate the values of transmitted and reflected waves of voltage and current at the line /cable junction caused by a 50Kv 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 230Kv,50Hz network has capacitance to neutral of 1.2µF per phase.Calculate the reactance of an arc-suppression coil suitable for the system to limit arcing ground faults.

(5 marks)