



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

EED 211: ELECTRICAL ENG. PRINCIPLES IV

DATE: 10/11/2020

TIME: 2.00-4.00 PM

INSTRUCTIONS

Answer Question One and any Other Two Questions

QUESTION ONE (30 MARKS)

- a) i Name two methods to determine time constant values
ii Explain four (4) characteristics of sequence currents (10 marks)
- b) A capacitor is charged to 100V and then discharged through a 50 k Ω resistor. If the time constant of the circuit is 0.8 s. Determine: (i) the value of the capacitor, (ii) the time for the capacitor voltage to fall to 20V, (iii) the current flowing when the capacitor has been discharging for 0.5 s, and (iv) the voltage drop across the resistor when the capacitor has been discharging for one second. (10 marks)
- c) A relay has an inductance of 100mH and a resistance of 20 Ω . It is connected to a 60V, d.c. supply. Use the mathematical method to determine the value of current flowing at a time equal to two-time constants and the time for the current to grow to 1.5A. (10 marks)

QUESTION TWO (20 MARKS)

- a) Explain the two properties of “a” in sequence components (4 marks)
- b) A 20 μ F capacitor is connected in series with a 50 k Ω resistor and the circuit is connected to a 20V, d.c. supply. Determine: (i) the initial value of the current flowing, (ii) the time constant of the circuit, (iii) the value of the current one second after connection, (iv) the

value of the capacitor voltage two seconds after connection, and (v) the time after connection when the resistor voltage is 15V.

(16 marks)

QUESTION THREE (20 MARKS)

- a) Prove that
- $(1-a)/(a-a^2) = -a$
 - $(1-a)/(1+a^2) = 1-a^2$ (10 marks)
- b) Explain the following components
- Positive sequence components
 - Negative sequence components
 - Zero sequence components (10 marks)

QUESTION FOUR (20 MARKS)

- a) One conductor of a 3 phase line is open. The current flowing to the Δ connected load through the line R is 10A. With the current in line R as a reference and assuming that the line B is open find the symmetrical components of the line currents (10 marks)
- b) The zero and positive sequence components of red phase are as under.
 $\vec{E}_{R0} = 0.5 - j.866V$, $E_{R1} = 2\angle 0^\circ V$.
If the phase voltage $E_R = 3\angle 0^\circ V$, find the negative sequence component of red phase and the phase voltages E_Y and E_B . (10 marks)

QUESTION FIVE (20 MARKS)

A coil having an inductance of 6mH and a resistance of $R\Omega$ is connected in series with a resistor of 10Ω to a 120V, d.c. supply. The time constant of the circuit is 300 ms. When steady-state conditions have been reached, the supply is replaced instantaneously by a short-circuit. Determine: (i) the resistance of the coil, (ii) the current flowing in the circuit one second after the shorting link has been placed in the circuit, and (iii) the time taken for the current to fall to 10 per cent of its initial value.