



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS
ENGINEERING)

ECV 211: ELECTROMECHANICAL ENGINEERING

DATE: 16/12/2021

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

- (i) There are **Five** questions.
- (ii) Question No.1 is **Compulsory** and carries **30 Marks**.
- (iii) Select any **other Two** questions, each of which carries 20 Marks.
- (iv) Define all symbols used.
- (v) Marks will be awarded for procedure, methodologies used and not necessarily on the final answer.

- 1. a) (i) Explain what comprises an electrical circuit. (3 marks)
- (ii) A 15A current source is connected in parallel to three resistors whose values are 20Ω , 30Ω , and 40Ω . Draw the circuit and find the current flowing through each resistor. (7 marks)
- b) (i) Explain the role of refuse disposal in modern buildings. (4 marks)
- (ii) Consider the circuit depicted in Fig. Q1. If the switch is closed at time $t = 0$, derive an expression for current $i(t)$ and the voltage across the Capacitor. (6 marks)
- c) (i) Explain why consulting engineers are necessary or otherwise in projects, the role they play and its usefulness. (6 marks)
- (ii) Describe the relationship between the engineer and society. (4 marks)

2. (a) A $10\ \Omega$ resistor in parallel with a $20\ \mu\text{F}$ capacitor are connected to a voltage source V ; another $10\ \Omega$ resistor in series with a $20\ \mu\text{F}$ capacitor are connected to a similar voltage source.
 - (i) Sketch the two circuits. (2 marks)
 - (ii) Draw a comparison of the current flowing through each circuit. (6 marks)
 - (iii) Give the assumptions you have made. (2 marks)
- (b) Describe how you would design a Fire Protection System for a high-rise building. (10 marks)
3. (a) In circuit analysis one considers the zero-input response, zero-state response, and complete response. Using suitable examples, explain the role played by these different responses in the process. (10 marks)
- (b) Name three refuse disposal mechanisms and discuss the principle of operation of each. (10 marks)
4. Stairways, lifts, and escalators are critical for accessing and exiting a building.
 - (a) Discuss each of these indicating how you would design and/or integrate the same into a building project. (15 marks)
 - (b) What criteria would you use to determine the capacity of each. (5 marks)
5. (a) Explain how you would design electrical installation for a building project. (5 marks)
- (b)
 - (i) In the network shown in Fig. Q5, switching occurs at $t = 0$ with the network in the state with the capacitor charged to the battery voltage prior to switching. Obtain a solution for the current $i(t)$ for $t > 0$. (6 marks)
 - (ii) The capacitor having discharged completely; the switch is then moved quickly over to 1. Obtain the solution for the current flowing in the circuit for this second case. (6 marks)
 - (iii) In both (i) and (ii) sketch the current waveforms against time and label the axes clearly. (3 marks)

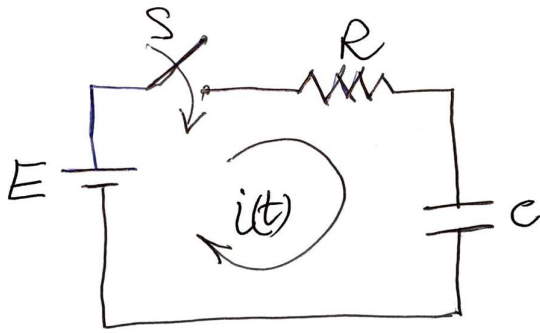


fig Q1

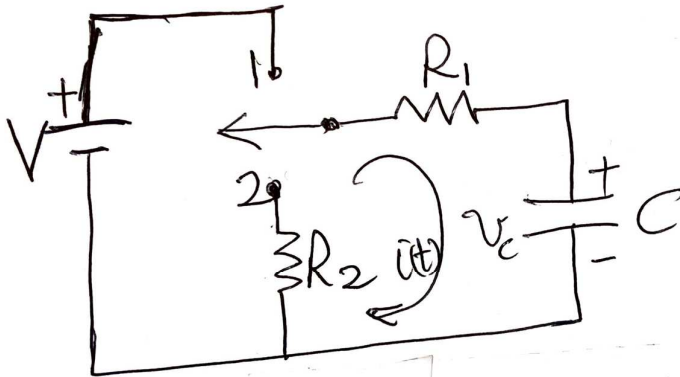


fig Q5