



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR THIRD SEMESTER EXAMINATION FOR

CERTIFICATE IN MOTOR VEHICLE TECHNOLOGY

CERTIFICATE IN MECHANICAL ENGINEERING (PLANT)

ELECTRICAL AND ELECTRONICS PRINCIPLES

DATE: 17/12/2020

TIME: 2.30-5.30 PM

INSTRUCTIONS TO CANDIDATES

This paper consists of FIVE QUESTIONS

Answer ALL Questions.

All questions carry equal marks and maximum marks for each part of a question are shown.

QUESTION ONE (20MARKS)

- a) Define each of the following terms;
 - (i) Local action
 - (ii) Polarization (4 marks)
- b) A car battery of 24 cells is charged at 20A from a 60V d.c supply. If the terminal voltage of each cell is 2.1V, Determine the value of resistance required to give this charging current. (3 marks)
- c) With the aid of a labeled diagram, explain how a wheat stone bridge is used to measure resistance. (7marks)
- d) A moving coil galvanometer of resistance $5\ \Omega$, gives full scale deflection when a current of 15mA flows through it. Determine the value of resistance to be used to extend the range of the instrument to read 5A and 150V. (6 marks)

QUESTION TWO (20MARKS)

- a) State Kirchoff laws. (4 marks)
- b) Figure 1 shows a resistance network. Use superposition theorem to determine the current each branch. (16 marks)

QUESTION THREE (20MARKS)

- a) State Lenz's law. (2 marks)
- b) Define each of the following terms with respect to magnetic circuits;
- i. Magnetomotive force
 - ii. Relative permeability
- c) With the aid of diagrams distinguish between soft and hard magnetic materials. (10 marks)
- d) Two identical coils have a resultant inductance of 27H when connected in series aiding and 15H when connected in series opposing. If the coupling coefficient between them is 0.7, determine;
- i. Mutual inductance between them
 - ii. Self-inductance of each coil. (8 marks)

QUESTION FOUR (20MARKS)

- a)
- i Define the term magnetic flux as applied to magnetism.
 - ii Determine the inductance of a coil when an e.m.f of 15 Kv is induced, if a current of 4 A collapses uniformly to zero in 8 milliseconds. (5 marks)
- b) Describe the effect of the following components in an alternating current circuit.
- i. Resistor.
 - ii. Capacitor
 - iii. Inductor. (3 marks)
- c) The graph in figure 2 shows the variations of voltage with time. Determine;
- i. The average value of voltage
 - ii. The root mean square and frequency of the voltage
 - iii. The root-mean-square value of a sine wave having the same peak value. (6 marks)
- d)
- i Figure 3 shows types of a.c rotors. Name each of them.
 - ii Justify the use of the rotor in figure 3(b) in the construction of a.c generators. (6 marks)

QUESTION FIVE (20MARKS)

- a)
- i State three types of semiconductor materials. (6 marks)
 - ii Figure 4 shows some semiconductors. Identify each of them.
- b)
- i Describe the operation of the transistor operated lamp circuit shown in figure 5.
 - ii Suggest two semiconductor devices that can be used instead of the transistor Q. (8 marks)
- c) Compare a Field effect transistor with a Bipolar Junction transistor. (6 marks)