



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

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING (PLANT)

ELECTRICAL AND ELECTRONICS PRINCIPLES

DATE: 17/12/2020

TIME: 8.30-11.30AM

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) Three resistors of resistance 2,4 and 6 Ω are connected in parallel. This parallel combination is connected in series with a resistor of 1.5 Ω . A voltage of 10V is then applied across the circuit.
- Draw the circuit diagram.
 - Determine the current through each resistor. (10 marks)
- b) Figure 1 shows the circuit of a resistor network. Determine the value of resistor R. (8 marks)
- c) Distinguish between transmittive and reflective liquid crystal displays. (2 marks)

QUESTION TWO (20MARKS)

- a) i Define the following terms as applied in semiconductors;
- Doping
 - Donor
- ii State three advantages of field effect transistors (FETS) over bipolar junction transistors (BJTS). (5 marks)

- b) Figure two shows a magnetic circuit of cast steel of cross-sectional area of 2cm^2 and a mean length of 25cm. The air gap is 1mm wide and the coil has 5000 turns. When the flux density in the air gap is 0.8T, the magnetizing force is 750 A/m. Determine the current in the coil. (12 marks)
- c) State any three applications of field effect transistors (FETS). (3 marks)

QUESTION THREE (20MARKS)

- a) Define the term 'electric flux density' and state its units. (2 marks)
- b) Three capacitors of $3\mu\text{F}$, $6\mu\text{F}$ and $12\mu\text{F}$ are connected in series across a 350V supply. Determine;
- Equivalent circuit capacitance
 - Charge on the $12\mu\text{F}$ capacitor.
 - Potential difference across the $3\mu\text{F}$ capacitor. (6 marks)
- c) A coil of resistance 5Ω and inductance 120 nH in series with a $100\mu\text{F}$ capacitor is connected to a 300V, 50Hz supply. Determine;
- Current flowing in the circuit
 - Phase angle in degrees
 - Voltage across the capacitor. (12 marks)

QUESTION FOUR (20 MARKS)

- a) i Define the term electrolysis and state any two areas of its application. (2 marks)
- ii A source of E.M.F 5V supplies a current of 3A for 10 minutes. Determine the amount of energy provided in this time. (4 marks)
- b) Ten 1.5V cells each having an internal resistance of 0.2Ω are connected in series to a load of 58Ω . Determine;
- The current flowing in the circuit.
 - Potential difference between the battery terminals. (6 marks)
- c) i State any three advantages of thermocouples
- ii With the aid of a labeled diagram explain the operation of an attraction type moving coil instrument. (8 marks)

QUESTION FIVE (20 MARKS)

- a) i State three applications of a capacitor.
- ii Explain the functions of each of the following components of a rectifier circuit shown in figure 3 below. (7 marks)
- I. Capacitor C_1 ;
- II. Inductor L
- b) i Illustrate the generation of 24 Volts from a 12V diode rectifier.
- ii Differentiate between zener regulator and transistor regulator. (10 marks)
- c) Match the components in table 1 with their correct applications.

Table 1

Component	Application
Thyristor	Smoke detection
Photo diode	Light dimmer
TRIAC	Power control

(3 marks)