(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
END OF SEMESTER EXAMINATIONS
YEAR TWO SEMESTER TWO EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN RENEWABLE ENGERY

COURSE CODE : **REN 223**

COURSE TITLE : **BASIC ELECTRONICS TECHNOLOGY**

DATE: 18 / 04 /2023   **TIME: 9:00-11:00AM**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE and ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

a) Distinguish between electromotive force and potential difference. (2 marks)

b)   i. Define the term electrostatics (2 marks)

      ii. Two charged spheres in air, each carrying a charge of +1.6uC have their centres separated by 16mm. Determine the force acting between them. (3 marks)

c) Calculate the cross-sectional area, in mm² of a piece of copper wire, 40m in length and having a resistance of 0.25Ω. Take the resistivity of copper as $0.02 \times 10^{-6} \Omega m$. (5 marks)

d) A conductor is inclined at 30° to the magnetic field having a flux density of 0.9T and carrying a current of 20A. If the length of the conductor in the field is 30 cm, calculate the force acting on the conductor. (3 marks)

e) State two Faraday's Laws of electromagnetic induction. (4 marks)

f) Draw and describe the waveforms and phasor diagrams for purely inductive circuit. (4 marks)

g) A coil has a reactance of inductance 124Ω in a circuit with a supply of frequency 5 Hz. Determine the inductance of the coil. (3 marks)

h) Describe the mutual induction in a transformers (4 marks)

QUESTION TWO   [20 MARKS]

a) How long must a current of 100µA flow so as to transfer a charge of 0.8mC? (3 marks)

b) An electric heater consumes 2.4KJ when connected to 120V supply for 15minutes. Find:

      i) the power rating of the heater (3 marks)

      ii) the current taken from the supply. (3 marks)

c) Sketch a complete hysteresis loop for a ferromagnetic material. (3 marks)

d) Describe the hysteresis loop in part (c) above (6 marks)

e) State the meaning of hysteresis loss (2 marks)

QUESTION THREE   [20 MARKS]

a) For the circuit shown in figure 1 below, calculate:

      i) The current in the circuit, if the total power dissipated in the circuit is 2.5kW. (4 marks)

      ii) The value of resistor Rx (2 marks)

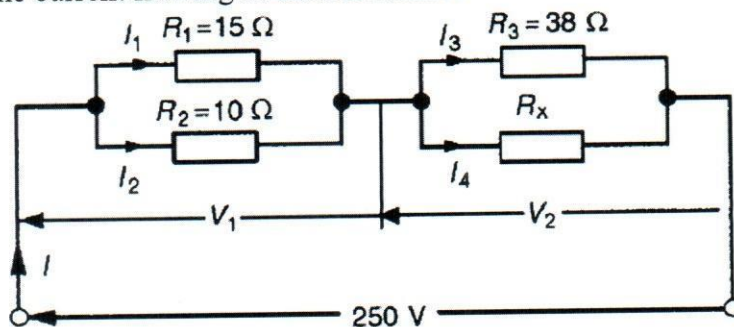   iii) The current flowing in each resistance (4 marks)

Figure 1

b) At what velocity must a conductor 75 mm long, moving mutually perpendicular to the magnetic field, cut the field of flux density 0.6T if an e.m.f. of 9V is to be induced in it? (3 marks)

c) The current in an a.c. circuit at any time t seconds is given by i=120 sin (100πt +0.36) amperes.

Find:

      i. The period time (2 marks)

      ii. The frequency (2 marks)

      iii. Phase angle (3 marks)

QUESTION FOUR   [20 MARKS]

a) Identify three industrial application of electromagnetism. (3 marks)
b) Determine the charge on a 50pF capacitor when the voltage applied to it is 2kV. (3 marks)
c) A magnetizing force of 8000A/m is applied to a circular magnetic circuit of mean diameter 30cm by passing a current through a coil wound on the circuit. If the coil is uniformly wound around the circuit and has 750 turns, find the current in the coil. (5 marks)
d) A coil having a resistance of 10Ω and an inductance of 125mH is connected series with a 60uf capacitor across a 120V supply. Determine:
   i. At what frequency resonance occurs? (6 marks)
   ii. The current flowing at the resonance frequency (3 marks)

QUESTION FIVE   **[20 MARKS]**

a) The separation distance between two parallel rectangular plates is 5mm. The plates dimensions are 200mm by 400mm and carry an electric charge of 0.2uC with a voltage of 0.25kV. Calculate:
   i. the electric flux density (3 marks)
   ii. the electric field strength (3 marks)
b) An alternating current, with similar half cycles, varies with time over half a cycle as follows:

Current(A)	0	0.7	2.0	4.2	8.4	8.2	2.5	1.0	0.4	0.2	0
Time (ms)	0	1	2	3	4	5	6	7	8	9	10

   i. Plot the curve (5 marks)
   ii. Determine the frequency (2 marks)
   iii. Determine the instantaneous value at 3.4ms (1 marks)
   iv. Peak to peak value (2 marks)
   v. The mean value of the signal (2 marks)
   vi. The r.m.s. value of the signal (2 marks)