KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS TECHNOLOGY)

COURSE CODE: REN 223

COURSE TITLE: BASIC ELECTRICAL TECHNOLOGY

DATE: 6/10/2021 **TIME:** 8:00-10:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

Question One (Compulsory)

a) State the following laws as applied to electrical circuits.

i) Ohm's law

ii) Kirchhoff's voltage law (4 marks)

b) Define the following terms as used in A.C. generation:

i) Frequency

ii) Root mean square value (RMS) (4 marks)

c) Sketch the following waveforms:

i) Rectangular pulse

ii) Sawtooth wave. (2 marks)

d) Define the following terms as used in A.C. R-L-C circuits.

i) Resonance

ii) Quality factor. (4 marks)

e) With the aid of diagrams, distinguish between a shell type and core type transformer. (4 marks)

f) State the purpose of performing open circuit test on a single-phase transformer. (2 marks)

g) State **three** advantages of three-phase A.C. system over single-phase A.C. system. (3 marks)

h) State the function of each of the following in a D.C. machine:

i) Stator

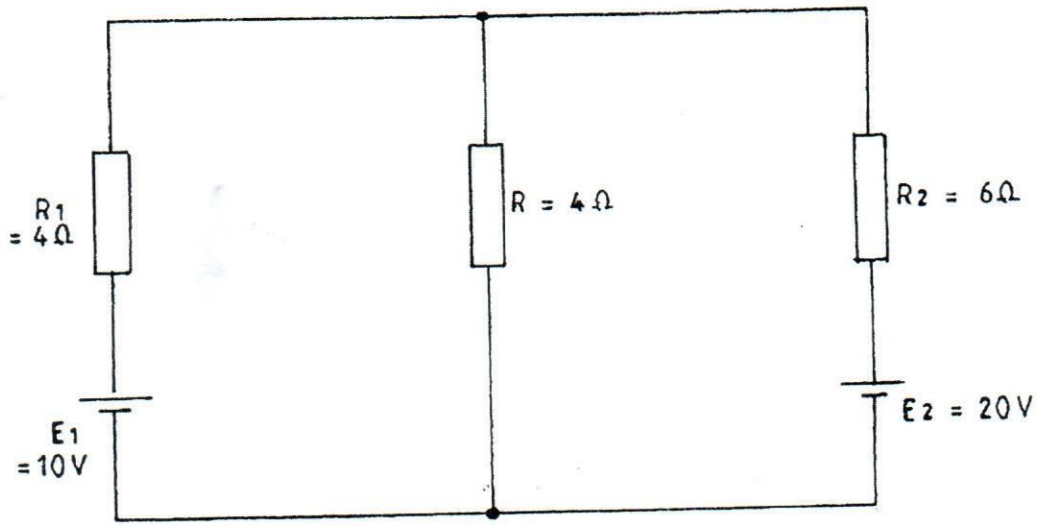
ii) Rotor. (2 marks)

i) Name **three** types of motor enclosures. (3 marks)

j) State the principle losses in D.C. machines. (2 marks)

Question Two

a) The figure below shows a D.C. electric circuit. Using Kirchhoff's laws, determine the branch currents. (6 marks)



b) The instantaneous values of two voltages are given by $V_1 = 4\ \sin 345.58t$ and $V_2 = 3\ \sin(345.58t + \frac{\pi}{5})$. Complete the table below and plot on same axes, graphs of $V_1, V_2, and\ V_1 + V_1$. Determine the: (14 marks)

i) Peak value of $V_1 + V_1$

ii) Phase angle between V_1 and $(V_1 + V_1)$

iii) Frequency of $(V_1 + V_1)$

Angle of displacement	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
V_1													
V_2													
$V_1 + V_1$													

Question Three

a) A 400 kVA transformer has a primary winding resistance of 0.5Ω and a secondary winding resistance of 0.001Ω. The iron loss is 2.5kW and the primary and secondary voltages are 5kV and 320V respectively. If the power factor of the load is 0.85, determine the efficiency of the transformer on full load. (8 marks)

b) A coil has a resistance of 12 Ω and inductance 70mH. It is connected in parallel with a capacitor of 80μF. If the supply voltage is 240V, 50Hz, determine the: (12 marks)

i) Supply current.

ii) Power factor of the circuit

iii) True power of the circuit.

Question Four

a) Three impedances each of resistance 10Ω and inductive reactance 15Ω are connected in delta across a three-phase, 415V a.c. supply. Determine the:

i) Phase current

ii) Line current

iii) Active power. (8 marks)

b) Draw the two-wattmeter method of measuring 3-phase power. (2 marks)

c) Two wattmeters are connected to measure the input power to a balanced 3-phase load by the two-wattmeter method. If the instrument readings are 8kW and 4kW, determine

i) the total power input

ii) the load power factor. (10 marks)

Question Five

a) A 4-pole armature of a D.C machine has 1000 conductors and a flux per pole of 20mWb. Determine the e.m.f generated when running at 600 rev/min when the armature is:

i) Wave-wound

ii) Lap-wound (10 marks)

b) An 8-pole lap-wound D.C motor has a 200V supply. The armature has 800 conductors and a resistance of 0.8Ω. If the useful flux per pole is 40mWb and the armature current is 30A, calculate:

i) The speed

ii) Torque developed. (10 marks)