CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE

COLLEGE OF NATURAL AND APPLIED SCIENCES

B.Sc. EXAMINATION HARMATTAN SEMESSTER 2020/2021 SESSION

ICT 413: CIRCUIT ANALYSIS AND THEORY

TIME ALLOWED: $2^{1}/_{2}$**HOURS**

INSTRUCTIONS: **ANSWER 4 QUESTIONS ONLY**

1(a) Write a short note on the following and mention the unit of measurement in each case: ($4^{1}/_{2}$ mks)

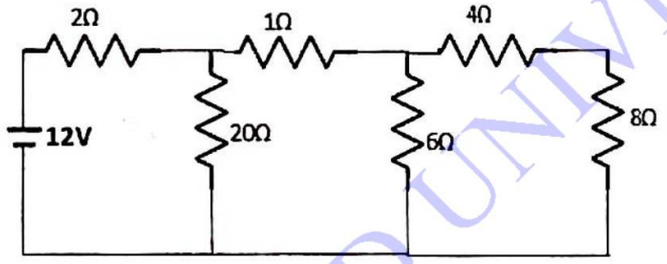
i. Emf
ii. Internal resistance
iii. Terminal voltage

(b) In a laboratory experiment, a battery with an internal resistance **r** is connected to a load having a resistance **R**. The current in the circuit is **I**.

I. Draw the circuit diagram and indicate clearly the emf of the battery, the terminal voltage, the internal resistance, the load resistance and the current flowing, all pointing in the right directions. ($4^{1}/_{2}$ mks)
II. Derive a mathematical relationship between the emf, terminal voltage, internal resistance and the current. (2 mks)

(c)The terminal voltage of a battery was found to be 8.2V when connected across 50 ohm resistor. The voltage increased to 8.8 volts when the load was changed to a 2.2 kΩ resistor. Calculate the battery emf and the internal resistance. (4 mks)

2 (a) what is a node? (1 mk)



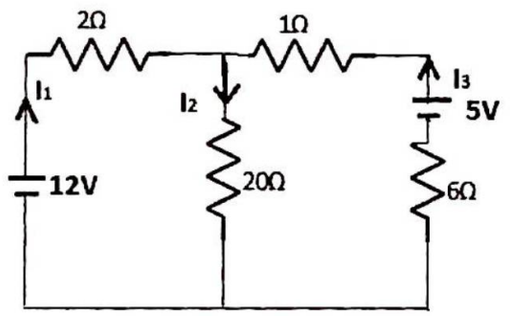
(b) Copy the circuit diagram above and label **all** the nodes with capital letters A, B, C etc. (2 mks)
(c) Using series of diagrams, find the equivalent resistance of the circuit above. (8 mks)
(d) State Ohm's Law. Use this law with your answer in (c) above to calculate the current and the voltage across the 2Ω resistor. (4 mks)

3 (a) Draw the waveform of an A.C. voltage (1 mk). In the waveform, indicate a cycle, a time period and the amplitude. (3 marks)
(b) If the time period and the amplitude in (a) are 20mS and 320V respectively, calculate the frequency and the RMS value. (2 mks)
(c) A fan in form of a coil with a load resistance of 120Ω and inductance of 0.35H is connected in series with a capacitor of 420μF across a power supply of 220 volt, 50Hz and 2Ω internal resistance.
i. Draw the circuit diagram showing the devices with all the stated parameters. (3 marks)
ii. Calculate the inductive reactance, capacitive reactance, total impedance and the current flowing. (6 marks)

4(a) State Kirchhoff's Voltage Law. (2 mks)

(b) In the circuit shown below determine the magnitude and direction of each of the currents I_1, I_2, I_3. (11 marks)

(c) From your answer in (b), calculate the voltage across the 20Ω resistor.



5. (a)State Kirchhoff's Current Law. (2 marks)

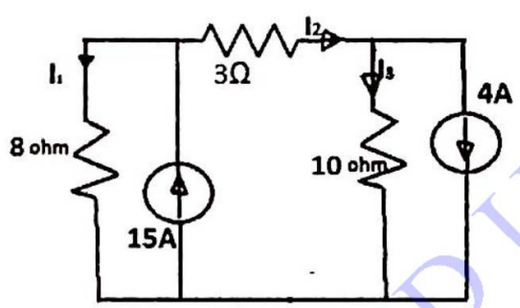
(b) What is a current source? (1 mark)

With suitable diagrams explain the difference between an ideal current source and a practical current source. (4 mk)

(c) The figure below is the equivalent circuit of a certain amplifier.

ii. Find the magnitude and direction of each of the currents I_1, $I_2$and I_3. (6 marks)

iii. Calculate the voltage across the 3Ω resistor. (2 marks)



6 (a) Define the following terms as applied to electricity mentioning unit of measurement in each case. (6 mks)

i. Charge
ii. Current
iii. Voltage
iv. Power

(b)With a suitable diagram explain the following waveforms taking care to show the differences between one and the other. For each waveform, mention one area it is used or encountered in the practice of ICT. (8 marks)

i. sinusoidal wave
ii. impulse
iii. Square wave
iv. Pulse

(c). What does duty cycle mean? (1 mk)