ALUPE UNIVERSITY COLLEGE
...Bastion of Knowledge...
P. O.Box 845-50400 Busia(K)
principal@auc.ac.ke
Tel: +254 741 217 185
+254 736 044 469
off Busia-Malaba road

OFFICE OF THE DEPUTY PRINCIPAL

ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: PHY 111

COURSE TITLE: BASIC PHYSICS II

DATE: 16TH OCTOBER, 2020 TIME:0900 – 1200 HRS

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 6 PRINTED PAGES PLEASE TURN OVER

PHY 111
REGULAR – MAIN EXAM

STREAM: BSC (COM) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer Question **ONE** and **TWO** in **SECTION A** and any other **THREE** questions in **SECTION B**.*
ii. *The following constants maybe useful:*

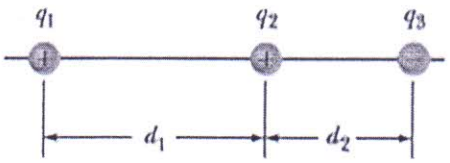
Permittivity of free space $\epsilon_o = 8.85 \times 10^{-12} Fm^{-1}$,
Charge of an electron=1.6X10^{-19} C,
*K=1/(4πεo) = 9*10^9, Mass of an electron,*
Me=9.11×10^{-31} Kg, 1eV= 1.6×10^{-19} J,
Permeability of free space, μo=4π×10^{-7} Tm/A

SECTION A (24 Marks)

Question One (12 Marks)

a) What is the meaning of the magnetic flux? (1 Mark)

b) Three point charges lie along a straight line as shown below where $q_1 = 6.00\,\mu C$, $q_2 = 1.50\,\mu C$ and $q_3 = -2.00\,\mu C$. The separation distances are $d_1 = 3.00cm$ and $d_2 = 2.00cm$. Calculate the magnitude and direction of the net electric force on q_2.

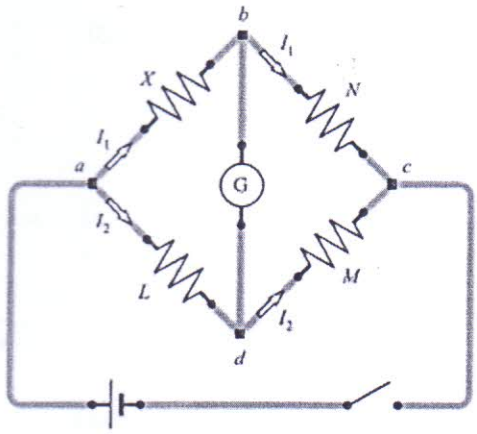


(3 Marks)

c) Define capacitance. (1 Mark)

d) Two capacitors, $C_1 = 25.0\,\mu F$ and $C_2 = 5.0\,\mu F$, are connected in parallel and charged with a 100-V power supply. Calculate the total energy stored in the two capacitors. (3 Marks)

e) The Wheatstone bridge shown below is being used to measure resistance X. At balance, the current through the galvanometer G is zero and resistances, L, M and N are 3.0 Ω, 2.0 Ω, and 10.0 Ω, respectively. Find the value of X. (3 Marks)



f) Calculate the resonant frequency of a circuit of negligible resistance containing an inductance of $40.0mH$ and capacitance of $600 \times 10^{-12} F$. (3 Marks)

Question Two (12 Marks)

a) Explain the meaning of rms value of alternating current. (2 Marks)

b) An inductor is connected in series across an AC source. Plot instantaneous current, I and voltage, V across the inductor as a function of ωt. (2 Marks)

c) Distinguish between relative permeability and magnetic susceptibility. (2 Marks)

d) An electric motor takes current of 5.00 A from a 110 V line. Determine the power input and energy in J, supplied to the motor in 2 hours. (2 Marks)

e) Discuss the behavior of *pn* junction under forward and reverse biasing. (2 Marks)

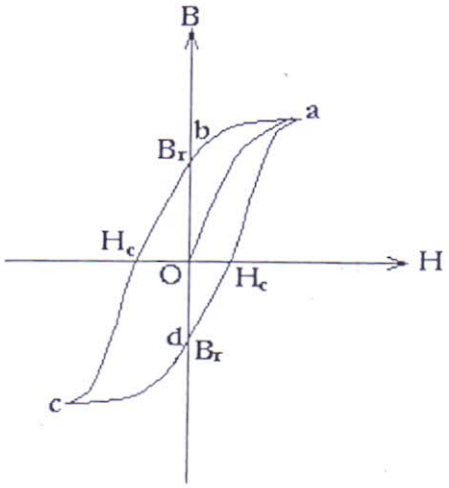
f) Distinguish between an intrinsic semiconductor and extrinsic semiconductor. (2 Marks)

SECTION B (36 Marks)

Question Three (12 Marks)

(a) What is meant by magnetic hysteresis? (1 Mark)

(b) Sketch of a typical hysteresis curve is shown below.



(i) Describe processes oa, ab, bc, (3 Marks)

(ii) What is the meant by remanance (B_r) and coercive force of the specimen (H_c) (2 Marks)

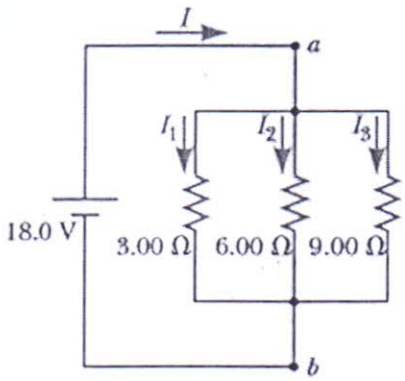
c) State the main differences among the three main categories of magnetic materials: diamagnets, paramagnets and ferromagnets. (3 Marks)

d) The total flux density $\vec{B}$ in a toroid of length L, total number of turns = N, mean radius = r and n is number of turns per unit length ($n = N/L$), is $\vec{B} = \vec{B}_o + \vec{B}_m$. $\vec{B}_o = \mu_o nI$, determine $\vec{B}_m$ and show the relationship between $\vec{B}$, $\vec{H}$ and $\vec{M}$. (3 Marks)

Question Four (12 Marks)

a) State Ohm's law. (1 Mark)

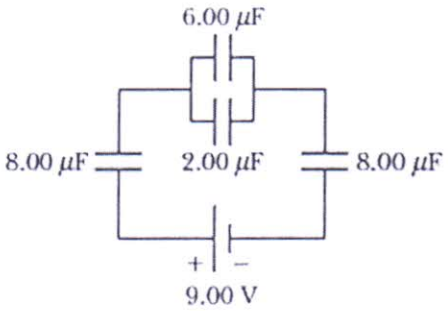
b) Three resistors are connected in parallel as shown below. A potential difference of 18.0 V is maintained between points *a* and *b*.



i) Calculate the equivalent resistance of the circuit. (2 Marks)

ii) Find the current in each resistor (3 Marks)

c) For the system of four capacitors shown below. Find



i) The equivalent capacitance of the capacitors (2 Marks)

ii) The charge on $8\mu F$ and $2\mu F$. (2 Marks)

iii) The potential difference $8\mu F$ and $2\mu F$ capacitors (2 Marks)

Question Five (12 Marks)

a) State two conditions for interference to occur in light waves (2 Marks)

b) Distinguish between constructive and destructive interference (2 Marks)

c) What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations?

i) the screen is moved away from the plane of the slits (1 Mark)

ii) the (monochromatic) source is replaced by another (monochromatic) source of shorter wavelength (1 Mark)

iii) the separation between the two slits is increased (1 Mark)

d) A viewing screen is separated from a double-slit source by1.2 m. The distance between the two slits is 0.030 mm. The second-order bright fringe (m = 2) is 4.5 cm from the center line.

i) Determine the wavelength of the light. (2 Marks)

ii) Calculate the distance between adjacent bright fringes. (3 Marks)

Question Six (12 Marks)

a) Define the following terms as used in radioactivity

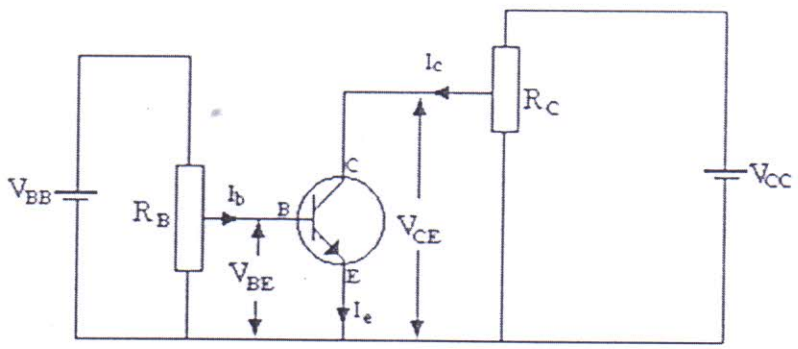
i) Ionisation energy (1 Mark)

ii) Half life (1 Marks)

b) (i) Derive an expression for the number of nuclides present at any time in a sample of radioactive element if its decay constant is λ. (3 Marks)

(ii) How long does it take for 60% of a sample of radon to decay given that its half-life of radon is 3.8days (3 Marks)

c) Sketch a curve of the input and output characteristics of a common emitter transistor circuit in active mode shown below. (4 Marks)



Question Seven (12 Marks)

a) Does the phase angle in an RLC series circuit depend on frequency? What is the phase angle when the inductive reactance equals the capacitive reactance? (2 Marks)

b) A series AC circuit contains a resistor, an inductor of 150 mH, a capacitor of 5.00 μF, and a source with ΔV_{max} = 240 V operating at 50.0 Hz. The maximum current in the circuit is 100 mA. Calculate

i) The inductive reactance (2 Marks)

ii) The capacitive reactance (2 Marks)

iii) The impedance (2 Marks)

iv) The resistance in the circuit (2 Marks)

v) The phase angle between the current and source voltage. (2 Marks)

****