UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	PHYSIC 3
COURSE CODE	:	DAS 24603
PROGRAMME	:	2 DAU
EXAMINATION DATE	:	JUNE 2014
DURATION	:	2 ½ HOURS
INSTRUCTION	:	

A) ANSWER **ALL** QUESTIONS ONLY

B) ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) Hydrogen's line spectrums are formed by a series of lines and each line in a given series corresponds to a different value of $\boldsymbol{n}$. An electron in a hydrogen atoms is in the initial state $\boldsymbol{n_i} = 4$.

(i) List the common spectral series of Hydrogen.

(5 marks)

(ii) Calculate the wavelength of the photon emitted by this electron if it jumps from $\boldsymbol{n_i} = 4$ to the final stage: $n_f = 3$; $n_f = 2$; $n_f = 1$, respectively.

(8 marks)

(b) A beam of neutrons moving with a speed of 1450 ms^{-1} is diffracted from a crystal of table salts, which has an interplanar spacing of d = 0.282 nm.

(i) Define de Broglie wavelength.

(3 marks)

(ii) Determine de Broglie wavelength of the neutrons.

(3 marks)

(iii) Find the angle of the first interference maximum.

(6 marks)

Q2 (a) A set up transformer has 25 turns on the primary coil and 750 turns on secondary coils. Define transformer and if the transformer is to produce an output of 4500 V with a 12 mA current on secondary coils, find voltage and input current are needed.

(10 marks)

(b) A bar magnet is moved rapidly toward a 40 turn circular coil of wire. As the magnet moves, the average value of $B \cos \theta$ over the area of the coil increases from 0.0125 T to 0.450 T in 0.250 s. If the radius of the coil is 3.05 cm and the resistance of its wire is 3.55Ω. Define magnetic flux and determine the magnitude of the induced electromotive force (emf) and induced current.

(15 marks)

SECTION B

Q3 (a) Define the word below :-

(i) Ampere's Law

(3 marks)

(ii) Magnetic Poles

(2 marks)

(iii) Paramagnetism

(2 marks)

(iv) Diamagnetism

(2 marks)

(b) Two wires with length are the same and 1.0 m distance from each other. Both wire can carry current with 8A and 10 A as shown in **FIGURE Q3 (b)**

(i) Force between the two wires.

(4 marks)

(ii) Determine the magnitude of the magnetic flux through at the center of each two sides wire if the current flow in the same directions.

(4 marks)

(iii) Determine the magnitude of the magnetic flux through at the center of each two sides wire if the current flow in the opposite directions.

(4 marks)

(iv) Determine the new force that act on wire of 8A if the wire 10 A is replace with the wall.

(4 marks)

Q4 (a) **FIGURE Q4 (a)** shows a circuit with three resistors. Find R_T.

(10 marks)

(b) A copper wire has a diameter of 2.00 mm^2 and carries current of 3.0 A in the wire. There are 10^{29} conduction electrons per cubic meter in copper and given electron charge is – 1.6 X 10^{19} C.

(i) Define critical current density, J_c

(3 marks)

(ii) Determine the drift velocity in the wire υ.

(4 marks)

(iii) Determine current density, J_c

(4 marks)

(iv) If given the drift velocity in the wire with 2.0m length is 3.0 X 10^{-8} ms^{-1}, find the critical density in the wire, J_c.

(4 marks)

Q5 (a) The series combination of three capacitors is shown in **FIGURE Q5 (a)** is connected across 44V power supply.

(i) Define Capacitors.

(2 marks)

(ii) Determine the equivalent capacitance of the capacitors.

(2 marks)

(iii) Determine the magnitude of the charges on the capacitors.

(2 marks)

(iv) Determine the potential difference across the capacitors.

(6 marks)

(v) Determine the energy stored in the capacitors.

(7 marks)

(b) **FIGURE Q5 (b)** shows a metal plates capacitors with potential difference of 40.0 V. Determine how much work must be done to carry a + 3.0 C charge from A to B and if the separation is 5.0 mm and find the magnitude of ***E***.

(6 marks)

Q5 (a) An engineer wishes to determine the specific heat of a new metal alloy. A 0.150 kg sample of the alloy is heated to 540.0°C. It is then quickly placed in 0.400 kg of water at 10.0°C, which is contained in a 0.200 kg aluminum calorimeter cup. The final temperature of the system is 30.5°C. Define heat capacity and ignoring the small amount of heat gained by the thermometer, find the specific heat capacity, *c* of the alloy.

(14 marks)

(b) One wall of a house consists of plywood backed by insulation as shown in **Figure Q5 (b).** The thermal conductivities of the insulation and plywood are 0.030 J/(s·m·°C) and 0.080 J/(s·m·°C) respectively. If the area of the wall is $35m^2$. Define conduction and find the amount of heat conducted through the wall in one hour.

(11 marks)

Q6 (a) A student prepares a standing waves experiment. He is using a metal string under a tension of 88.2 N. Its length is 100.0 cm and its mass is 10 g. When the vibrator is turned on the string is found to rapidly develop a large, stable transverse standing waves consisting of four equal sections. Determine the velocity for transverse waves on the string and the frequencies of the first three harmonic.

(10 marks)

(b) The siren of a police car at rest emits at a predominant frequency of 1600 Hz. The police car is moving at a speed of 25 ms^{-1}.

(i) State the principle for Doppler Effect.

(4 marks)

(ii) Find the frequency in the sound that the observer hears if the police car moving away from stationary observer.

(3 marks)

(iii) Find the frequency in the sound that the observer hears if the police car moving towards stationary observer.

(3 marks)

(iv) If the source transmitted sound wave with an output power 80 W and an intensity level is measured as 100 dB by the listener, calculate the distance between the source and listener.

(5 marks)

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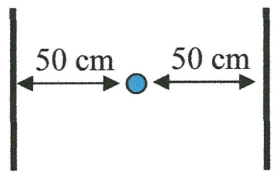

FIGURE Q3 (b)

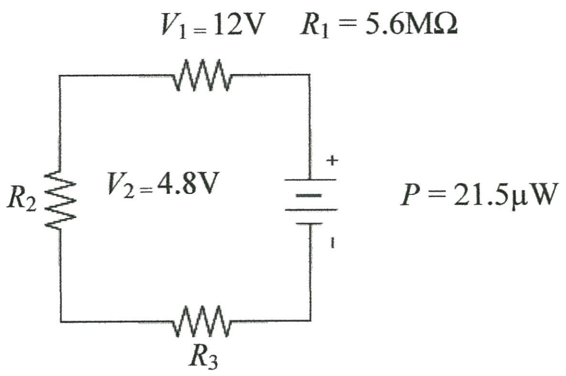

FIGURE Q4 (a)

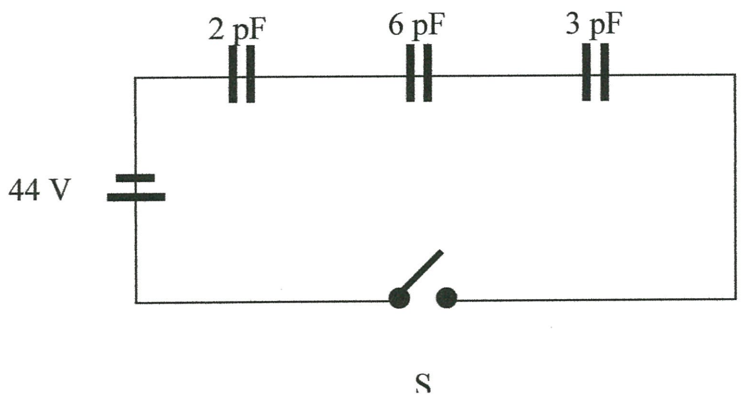

FIGURE Q5 (a)

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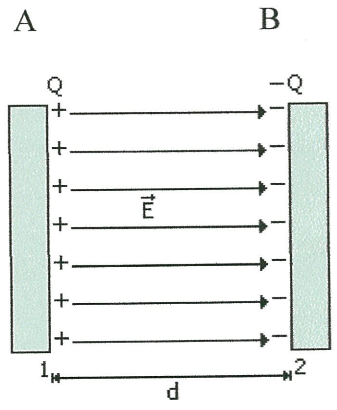

FIGURE Q5 (b)

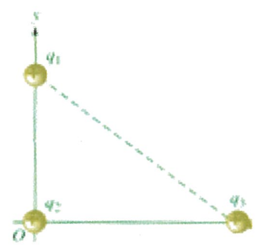

FIGURE Q6 (a)

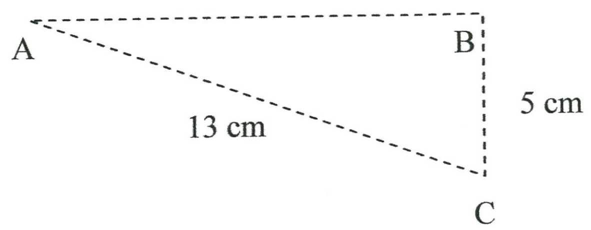

FIGURE Q6 (b)

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LIST OF CONSTANTS

1. Gravity acceleration, $g = 9.81$ m/s^2
2. Rydberg constant, R = 1.097 x 10^7 m$^{-1.}$
3. Permeability of free space, $\mu_o = 4\pi\ x\ 10^{-7} Nm^{-1}$
4. Planck constant, $h = 6.63\ x\ 10^{-34} Js$
5. Speed of light in air, c = 3 x 10^8 m/s
6. Charge of electron, $e = 1.602\ x\ 10^{-19} C$
7. Permittivity of free space, $\varepsilon_o = 8.854\ x\ 10^{-12} (Nm)^{-2} C^2$
8. Coulomb constant, $k = 9\ x\ 10^{9} Nm^2 C^{-2}$
9. Resistivity of cooper, ρ_{cooper} = 1.67 x 10^{-8} Ωm
10. Mass of electron, $e = 9.1\ x\ 10^{-31} kg$
11. Mass of proton, $p = 1.673\ x\ 10^{-27} kg$

FORMULA

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$E = hf$	$V = IR$	$n = \frac{N}{L}$	$P = I^2R$
$A = \pi r^2$	$U = mgh$	$\Delta K = -\Delta U$	$K = \frac{ke^2}{2r}$
$\phi = hf_o$	$L = mvr = \frac{nh}{2\pi}$	$W_n = \Delta K$	$J = \frac{I}{A}$
$K = eV_s$	$R = \sqrt{R_x^2 + R_y^2}$	$W = F\Delta x$	$E = \frac{F}{q}$
$hf = K_{max} + \phi$	$\varepsilon = Blv \sin\theta$	$W = q\Delta V$	$B = \mu_o nI$
$LP = m \cdot v$	$F = Bqv \sin\theta$	$q = ne$	$\Delta\Phi = \Phi_2 - \Phi_1$
$F = \frac{\mu_0}{2\pi}(\frac{I_1}{d})l$	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	$B = \frac{\mu_o I}{2\pi d}$	$E = \frac{\sigma}{\varepsilon}$
$E = \frac{kQ}{d^2}$	$\varepsilon = BAN\,\omega \sin\omega t$	$K = \frac{1}{2}mv^2$	$I = \frac{Q}{t}$
$F = \frac{kq_1q_2}{d^2}$	$\varepsilon = -N\frac{d\Phi}{dt}$	$v = \frac{BI}{neA}$	$C = \frac{Q}{V}$
$F = \frac{\mu_0}{2\pi}(\frac{I_1I_2}{d})l$	$\varepsilon = -L\frac{dI}{dt}$	$E = \frac{q}{4\pi\varepsilon_o(r)^2}$	$C = \frac{\varepsilon_r\varepsilon_o A}{d}$
$F = mv^2$	$\phi = \frac{hf_0}{e}$	$k = \frac{1}{4\pi\varepsilon_0}$	$U = -\frac{ke^2}{r}$
$v = \frac{L}{t}$	$v = \frac{LI}{ne}$	$v = \frac{I}{neA}$	$C = \frac{\varepsilon_o A}{d}$
$F = \frac{ke^2}{r}$	$\Phi = NBA \, kos\,\theta$	$\Phi = BA$	$f_o = \frac{\phi}{h} = \frac{hc}{h\lambda}$
$c = 3.0 X 10^8 ms^{-1}$	$h = 6.63 x 10^{-34} Js$	$e = -1.6x10^{-19} C$	$\mu_o = 4\pi x10^{-7}Tm$

Q6 (a) A point charge $q_1 = +4.0\ \mu C$ is located on the positive y-axis at $y = 0.30$ m and an identical charge $q_2 = +4.0\ \mu C$ is at the origin as shown in **FIGURE Q6 (a).**

(i) Define Coulomb's Law

(2 marks)

(ii) Determine the magnitude and direction of the total force that these two charges exert on a third charge $= +8.0\ \mu C$ that is on the positive x-axis at $x = 0.40$ m.

(13 marks)

(b) Charges of -2.0 nC and $+2.0$ nC are placed at point A and B as shown in **FIGURE Q6 (b).** Determine the electric field at point C.
Given the law of cosines, $E^2 = E_1^2 + E_2^2 - 2\, E_1 E_2 \cos\theta$

(10 marks)

- END OF QUESTION -