Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	PHYSICS III
COURSE CODE	:	DAS 24603
PROGRAMME	:	3 DAU
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS IN **PART A** B) ANSWER **TWO (2)** QUESTIONS ONLY IN **PART B**

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A

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

(a) State Bohr orbits for five (5) spectral series.

(5 marks)

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

(10 marks)

(c) Calculate the energy level, E of the photon emitted by this electron if it jumps from $n_i = 4$ to the final stage: $n_f = 3$; $n_f = 2$; $n_f = 1$, respectively.

(10 marks)

Q2 A bar magnet is moved rapidly towards a 500 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 3.55 Ω.

(a) Define magnetic flux and state its formulae.

(5 marks)

(b) Determine the magnitude of the induced electromotive force (*emf*) and induced current in the coil if the field is perpendicular to the plane of the coil.

(9 marks)

(c) Determine the magnitude of the induced electromotive force (*emf*) and induced current in the coil if the field makes an angle of 60° with the plane of the coil.

(7 marks)

(d) Give two (2) different ways to create induced current.

(4 marks)

PART B

Q3 **FIGURE Q3** shows two (2) wires of the same length and 1.0 m apart from each other carry current with I_1 and I_2, 8.0 A and 10.0 A respectively.

(a) State the right hand rule for fields.

(3 marks)

(b) Calculate the force between the two wires.

(4 marks)

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

(5 marks)

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

(5 marks)

(e) Determine the new force that act on wire of 10.0 A if the wire 8.0 A is replace with the wall.

(4 marks)

Q4 (a) **FIGURE Q4 (a)** shows an electric circuit with 6 resistors. The circuits connect with an *emf* equal to 100.0 V. Compute the magnitude of the current on the circuit.

(13 marks)

(b) A copper wire has a diameter of 2.00 mm and carries current of 3.0 A. There are 10^{29} conduction electrons per cubic meter in copper.

(i) Define critical current density, J_c

(4 marks)

(ii) Determine the drift velocity in the wire, v.

(4 marks)

(iii) Determine current density, J_c

(4 marks)

Q5 The series combination of five capacitors shown in **FIGURE Q5** is connected across 12.0 V power supply.

(a) Define capacitor and capacitance.

(4 marks)

(b) Determine the equivalent capacitance of the capacitors, C_{eq}.

(7 marks)

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

(6 marks)

(d) Determine the potential difference across the capacitors.

(4 marks)

(e) Determine the energy stored in the capacitors.

(4 marks)

Q6 Three charged particles with $q_1 = -50.0\ \mu C$, $q_2 = +50.0\ \mu C$ and $q_3 = +30.0\ \mu C$ are placed on the corner of the 5.0 cm × 10.0 cm rectangle as shown in **FIGURE Q6.**

(a) State Coulomb's Law and its formulae.

(5 marks)

(b) Calculate the magnitude of the net force on charge q_3 due to the other two charges.

(14 marks)

(c) Calculate and show the direction of the net force on q_3.

(6 marks)

~ END OF QUESTION ~

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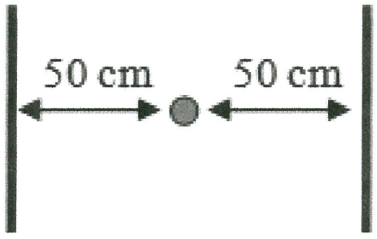

FIGURE Q3

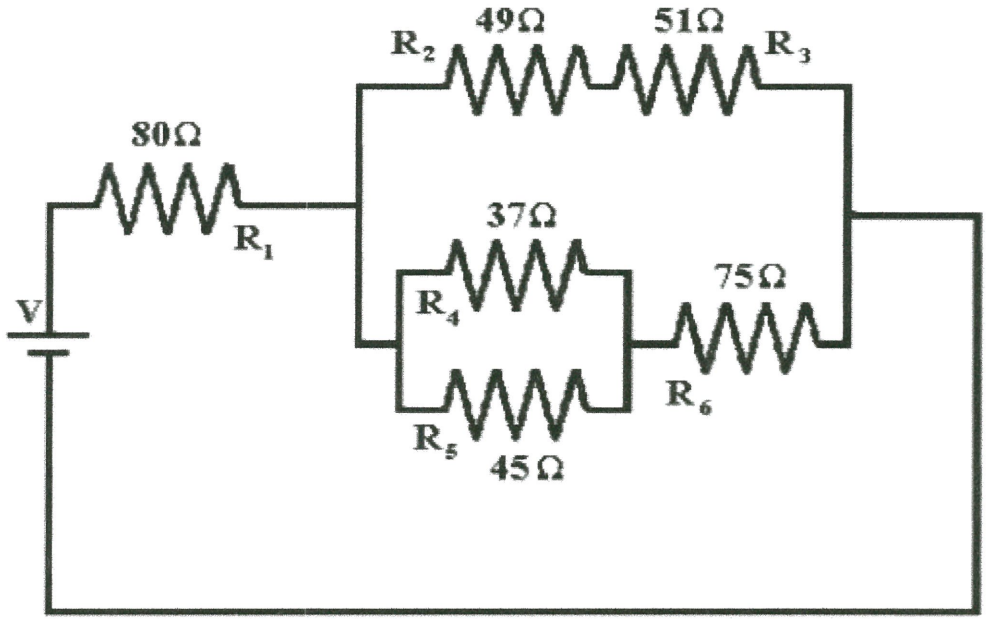

FIGURE Q4 (a)

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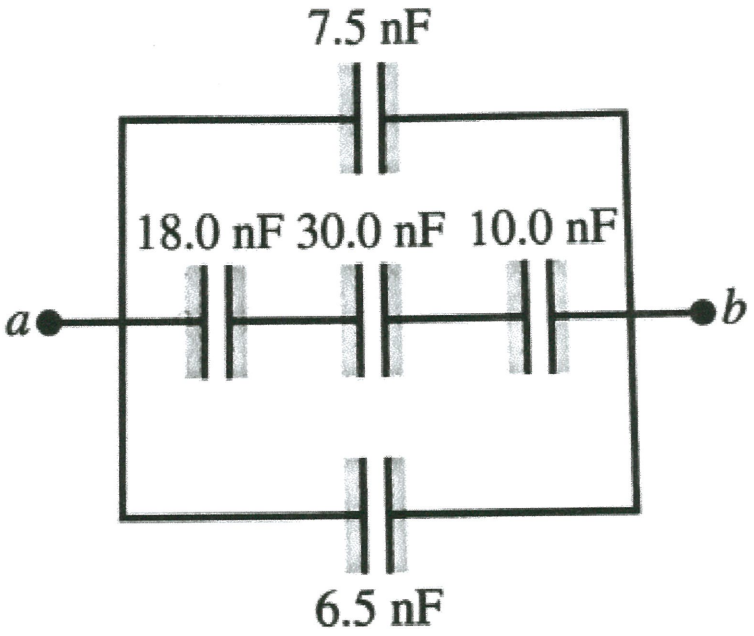

FIGURE Q5

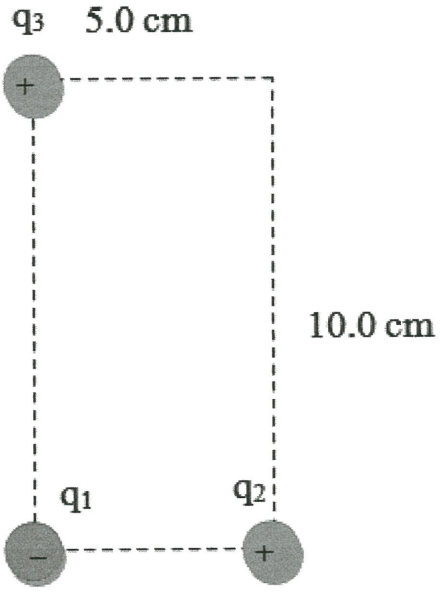

FIGURE Q6

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Appendix

$E = hf$	$V = IR$	$n = \frac{N}{L}$	$F = \frac{\mu_0}{2\pi}(\frac{I_1 I_2}{d})l$
$A = \pi r^2$	$U = mgh$	$\Delta K = -\Delta U$	$F = \frac{\mu_0}{2\pi}(\frac{I_1}{d})l$
$\phi = hf_o$	$L = mvr = \frac{nh}{2\pi}$	$W_n = \Delta K$	$F = Bqv \sin\theta$
$K = eV_s$	$R = \sqrt{R_x^2 + R_y^2}$	$W = F\Delta x$	$\varepsilon = Blv \sin\theta$
$hf = K_{max} + \phi$	$E = \frac{F}{q}$	$W = q\Delta V$	$B = \mu_o nI$
$LP = m \cdot v$	$J = \frac{I}{A}\theta$	$q = ne$	$\Delta\Phi = \Phi_2 - \Phi_1$
$K = \frac{ke^2}{2r}$	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$	$B = \frac{\mu_o I}{2\pi d}$	$E = \frac{q}{4\pi\varepsilon_o(r)^2}$
$E = \frac{kQ}{d^2}$	$C = \frac{\varepsilon_o A}{d}$	$K = \frac{1}{2}mv^2$	$f_o = \frac{\phi}{h} = \frac{hc}{h\lambda}$
$F = \frac{kq_1q_2}{d^2}$	$\varepsilon = -N\frac{d\Phi}{dt}$	$v = \frac{BI}{neA}$	$e = -1.6x10^{-19}\ C$
$P = I^2R$	$\varepsilon = -L\frac{dI}{dt}$	$E = \frac{\sigma}{\varepsilon}$	$\Phi = NBA \cos\theta$
$F = mv^2$	$\phi = \frac{hf_0}{e}$	$k = \frac{1}{4\pi\varepsilon_0}$	$\hbar = 6.63 \times 10^{-34}\ Js$
$v = \frac{L}{t}$	$v = \frac{LI}{ne}$	$v = \frac{I}{neA}$	$\varepsilon = BAN\ \omega \sin\omega t$
$F = \frac{ke^2}{r}$	$C = \frac{\varepsilon_r\varepsilon_o A}{d}$	$\Phi = BA$	$c = 3.0\ X\ 10^8\ ms^{-1}$
$I = \frac{Q}{t}$	$U = -\frac{ke^2}{r}$	$C = \frac{Q}{V}$	$\mu_o = 4\pi\ x10^{-7} Tm$

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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, $\rho_{cooper} = 1.67$ x 10^{-8} Ωm
10. Mass of electron, $e = 9.1 \, x \, 10^{-31} kg$
11. Mass of proton, $p = 1.673 \, x \, 10^{-27} kg$