COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Basic and Applied Science
Lecturers : Physics Staff
Course : Physics 1
Course Code : BA113   **Marks: 40**
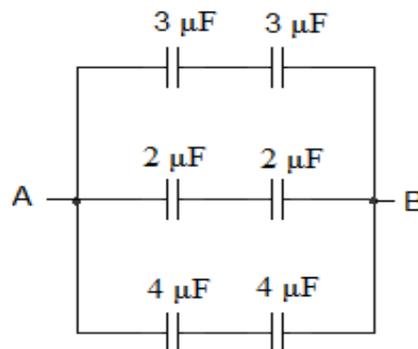**Date : 12 / 1 /2013**   **Time : 2 hours**

Final Exam

Answer the following Questions

1. a) Two parallel wires separated by 7.5 cm. The first wire carries a current $I_1= 4$ A, and the second wire carries current $I_2=6$ A in the same direction of the first. Find the force per unit length acting between the wires.   [4]
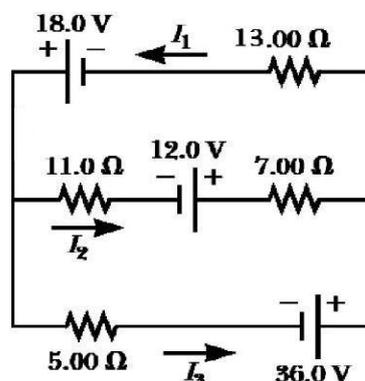
b) In the following figure, if $V_{AB} =20$V. Find the charge in each capacitor.   [4]

c) If a copper wire with $\alpha = 3.9 \times 10^{-3}$ $^{\circ}C^{-1}$, has a resistance of 18 Ω at 20°C. Find its resistance at 60°C.   [2]

[Total 10 marks]

2. a) Using Kirchhoff's rules, determine the current through each resistor.   [6]

b) The following figure shows a top view of a bar that can slide on two frictionless rails. The resistor is $R = 6.00\ \Omega$ and a 2.50-T magnetic field is directed perpendicularly downward, into the paper. Let $\ell = 1.20$ m. Calculate the applied force required to move the bar to the right at a constant speed of 2.00 m/s. [4]
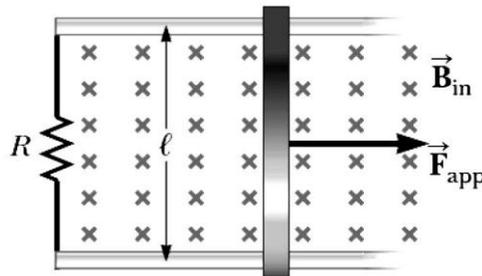
[Total 10 marks]

3. a) A parallel plate capacitor has an area of $0.05\ \text{m}^2$ and a plate separation of 0.18 mm. If a sheet of polyethylene is inserted between the capacitor plates (dielectric constant = 2.30), When a potential difference of 5 kV is applied to the capacitor, Find:
   a. The capacitance,
   b. The electric field,
   c. The charge,
   d. The energy stored. [5]

   b) The current in a 90.0-mH inductor changes with time as $I = 1.00t^2 - 6.00t$, where I is in Amperes and t is in seconds. Find the magnitude of the induced emf at $t = 1.00$ s? [2]

   c) A Young's interference experiment is performed with a blue-green argon laser light. The separation between the slits is 0.500 mm, and the screen is located 3.30 m from the slits. The first bright fringe is located 3.40 mm from the center of the interference pattern. What is the wavelength of the argon laser light? [3]

   [Total 10 marks]

4. **Choose the correct answer:**

a) If two parrallel wires in which currents are flowing in the same direction and close to each other then they will
   i) Repel each other
   ii) Attract each other
   iii) Neither attract nor repel each other [1]

b) In a magnetic field, the charge at rest experiences:
   i) Maximum force   ii) No force   iii) Minimum force [1]

c) The SI units of the magnetic flux is
   i) T.m^2 ii) T/m^2 iii) wb/m^2 [1]

d) The conditions to obtain interference
   i) The intensity of the two sources is high
   ii) Two coherent sources
   iii) Two sources are of different intensities [1]

e) The magnetic field strength *B* within a solenoid with n turns per unit length (length = ℓ) and current I has magnitude *B* equal to

    i) $\mu_0 n I \ell$.
    ii) $\mu_0 n I$
    iii) $\lambda_0 \dfrac{nI}{\ell}$.
    [1]

Show your working and chose the right answer:

f) A circular loop of cross-section area 10^{-5} m^2 is placed in a uniform magnetic field of 0.1 T normal to the plane of the coil. If the current in the coil is 5A, then the torque on the coil is:

    i) 5×10^{-6} Nm
    ii) 0.5×10^{-6} Nm
    iii) 50×10^{-5} Nm
    [1]

h) What is the speed of a proton that has been accelerated from rest through a potential difference of 4.0 kV?

    i) 1.1×10^{6} m/s
    ii) 9.8×10^{5} m/s
    iii) 8.8×10^{5} m/s
    [1]

Solve:

i) In a series *R-C* circuit $\varepsilon = 9$ V, $C = 20$ μF and $R = 100$ kΩ, find the charge in the capacitor after closing the switch by 3 seconds?
    [3]

[Total 10 marks]

Some useful constants:

Quantity	Symbol	Constants
Electron charge	e	1.6×10^{-19} C
Coulomb constant	k	9×10^{9} N.m^2/C^2
Electron mass	m_e	9.109×10^{-31} Kg
Proton mass	m_p	1.673×10^{-27} Kg
Neutron mass	m_n	1.675×10^{-27} Kg
Permittivity of free space	ε_o	8.85×10^{-12} C^2/ N.m^2
Permeability of free space	μ_0	$4\pi \times 10^{-7}$ T.m/A

Good Luck

Members of Course Examination Committee	Signature	Date