



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Basic and Applied Science

Lecturers : Physics Staff

Course : Physics 1

Course Code : BA113

Date : 12 / 1 / 2012

Marks: 40

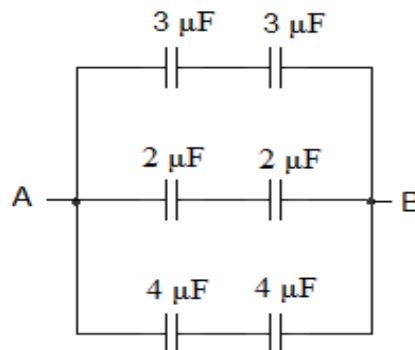
Time : 2 hours

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]

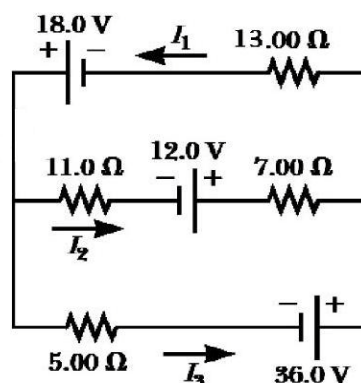
- b) In the following figure, if $V_{AB} = 20$ V. Find the charge in each capacitor. [4]



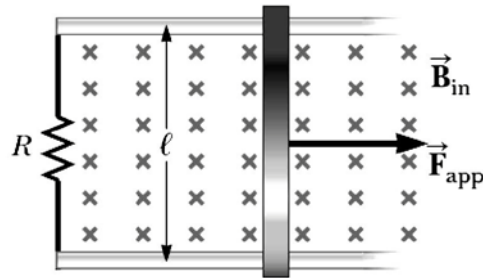
- c) If a copper wire with $\alpha = 3.9 \times 10^{-3} \text{ }^\circ\text{C}^{-1}$, has a resistance of 18Ω at $20 \text{ }^\circ\text{C}$. Find its resistance at $60 \text{ }^\circ\text{C}$. [2]

[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 $\ell = 1.20 \text{ m}$. 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 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:
- The capacitance,
 - The electric field,
 - The energy stored. [3]
- 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 $t = 1.00 \text{ s}$? [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 8 marks]

4. **Choose the correct answer:**

- a) If two parallel wires in which currents are flowing in the same direction and close to each other then they will
- Repel each other
 - Attract each other
 - Neither attract nor repel each other [1]
- b) In a magnetic field, the charge at rest experiences:
- Maximum force
 - No force
 - Minimum force [1]
- c) The SI units of the magnetic flux is
- $\text{T}\cdot\text{m}^2$
 - T/m^2
 - wb/m^2 [1]
- d) The conditions to obtain interference
- The intensity of the two sources is high
 - Two coherent sources
 - 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) $\lambda_0 \frac{nI}{\ell}$. [1]

Show your working and choose 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) $5 \times 10^{-6} \text{ Nm}$ ii) $0.5 \times 10^{-6} \text{ Nm}$ iii) $50 \times 10^{-5} \text{ Nm}$ [2]

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

- i) $1.1 \times 10^6 \text{ m/s}$ ii) $9.8 \times 10^5 \text{ m/s}$ iii) $8.8 \times 10^5 \text{ m/s}$ [2]

i) In a series R - C circuit $\varepsilon = 9 \text{ V}$, $C = 20 \mu\text{F}$ and $R = 100 \text{ k}\Omega$, find the charge in the capacitor after closing the switch by 3 seconds?

- i) $140 \mu\text{C}$ ii) 140C iii) $14 \mu\text{C}$ [3]

[Total 12 marks]

Some useful constants:

Quantity	Symbol	Constants
Electron charge	e	$1.6 \times 10^{-19} \text{ C}$
Coulomb constant	k	$9 \times 10^9 \text{ N.m}^2/\text{C}^2$
Electron mass	m_e	$9.109 \times 10^{-31} \text{ Kg}$
Proton mass	m_p	$1.673 \times 10^{-27} \text{ Kg}$
Neutron mass	m_n	$1.675 \times 10^{-27} \text{ Kg}$
Permittivity of free space	ε_0	$8.85 \times 10^{-12} \text{ C}^2/\text{N.m}^2$
Permeability of free space	μ_0	$4\pi \times 10^{-7} \text{ T.m/A}$

Good Luck

Members of Course Examination Committee	Signature	Date