Sir Syed University of Engineering & Technology

ANSWER SCRIPT

Date:	21 june 2021
Roll Number:	SE20F-003
Section:	A
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Course Name:	Applied Physics
Degree Program:	SOFTWARE ENGINEERING
Total number of pages being submitted:	

ANSWER # 1 D:

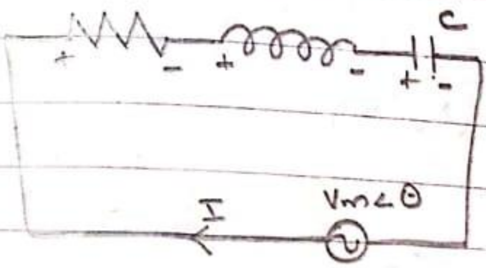
When an emf is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced emf is such that it produces a current whose magnetic field opposes the change which produces it. The induced magnetic field inside any loop of wire always acts to keep the magnetic flux in the loop constant.

ANSWER # 1 E:

The magnetic fields produced by the individual atoms therefore cancel each other. ... When a piece of ferromagnetic material is placed into an external magnetic field, two things happen. The spins in each domain shift so that the magnetic moments of the electrons become more aligned with the direction of the field.

ANSWER # 1 F:

RLC Series In AC Field:



Apply KVL,

$$E = V_R + V_L + V_C \longrightarrow (i)$$

Since

$$V_R = i_m R \sin(\omega t - \phi)$$
$$V_L = i_m X_L \cos(\omega t - \phi)$$
$$V_C = -i_m X_C \cos(\omega t - \phi)$$
$$E = E_m \sin \omega t$$

putting values in eq (i)

$$E_m \sin \omega t = i_m R \sin(\omega t - \phi) + i_m X_L \cos(\omega t - \phi) - i_m X_C \cos(\omega t - \phi)$$

Taking (i_m) common from R.H.S

$$E_m \sin \omega t = i_m [R \sin(\omega t - \phi) + X_L \cos(\omega t - \phi) - X_C \cos(\omega t - \phi)$$

$$E_m \sin t = i_m [R \sin(\omega t - \Phi) + \cos(\omega t - \Phi)$$

(Simplify it using tringnometry) $- X_c$

$$E_m \sin \omega t = i_m \sqrt{R^2 + (X_L - X_c)^2} \sin \omega t \rightarrow (i$$

$$E_m = i_m \sqrt{R^2 + (X_L - X_c)^2}$$

$$i_m = \frac{E_m}{\sqrt{R^2 + (X_L - X_c)^2}}$$

Term

$\sqrt{R^2 + (X_L + X_c)^2}$ is called independence represented by Z, so

$$i_m = \frac{E_m}{Z}$$

Independence:

"Sum of all the reactances offered by a resistor, an inductor and a capacitor in a RLC circuit". unit (ohm).

Current has it max value (i_m) when Z is equal to R, only which occurs when

$$\boxed{X_L = X_C \rightarrow \text{Resonance condition}}$$

$$\omega L = \frac{1}{\omega C} \Rightarrow \omega^2 = \frac{1}{LC} \Rightarrow \omega = \frac{1}{\sqrt{LC}}$$

$$\boxed{\omega = \frac{1}{\sqrt{LC}}}$$ Angular freq at resonance condition

ANSWER # 2 C:

SOLENOID

Definition:

"A long-insulated wire wound in a closed packed helix and carrying a current is called a solenoid".

Solenoidal Field:

When a current is passed through solenoid field is produced. The lines of induction are parallel and closely packed inside the solenoid indicating strong uniform field. Outside the solenoid field is weak to calculate B inside solenoid, consider an Ampreian loop "abcda" with side ab ' along the axis Now calculate the products of 'B' and elements L_1 L_2 L_3 and L_4

i. $B.\ L_1 = BL_1 \text{ Cos } \theta$ B is parallel to L_1

$= BL_1$ Cos 0 = 1

ii. $B.\ L_2 = BL_2 \text{ Cos } \theta$ B is perpendicular to L_2

$= 0\ BL_1$ Cos $90^0 = 0$

iii. $B.\ L_3 = BL_2 \text{ Cos } \theta$ B is perpendicular to L_2

$= BL_3$ Cos 0 = 1

$= 0$ Here B = 0

iv. $B.\ L_4 = BL_2 \text{ Cos } \theta$ B is perpendicular to L_4

$= 0$ Cos $90^0 = 0$

Adding all these products we get:

- ⇨ $(B.L_1 + B.L_2 + B.L_3 + B.L_4)$
- ⇨ $BL_1 + 0 + 0 + 0$
- ⇨ $\sum (B.\ L_n)$
- ⇨ $\mathbf{BL_1}$

Let n = Turns Density (# of turns per unit length)

I = Current in each turn

nL_1 = Current enclosed by Amperian Loop.

For Ampere Law:

- ⇨ $\sum B.L_n = \mu_0$ (current Enclosed)
- ⇨ $\sum B.L_n = \mu_0 n L_1 I$
- ⇨ $B.L_1 = \mu_0 n L_1 I$

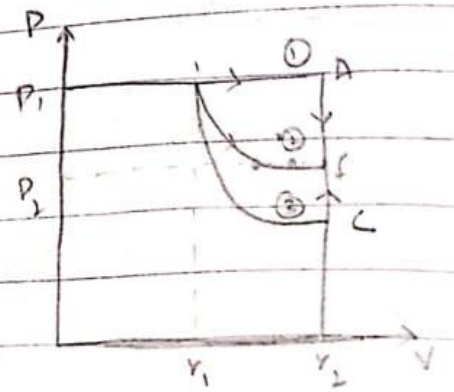
Therefore, => $BL_1 = \mu_0 n L_1 I$

⇨ $B = \mu_0 n I$

This is the equation representing magnitude flux density due to solenoid along its axis.

ANSWER # 2 D:

First Law Of Thermodynamics.



7) Constant pressure process A, constant volume process. An isothermal process B, constant pressure process. An adiabatic process C, followed by a constant volume process

RESULT.

The heat Q, transferred and the work done W are different for each path but the Q+W has the same value for every path between i n f.

$$\therefore \Delta E_{int} = E_{int f} - E_{int i}$$

$$\Delta U = E_{int f} - E_{int i}$$

In any thermodynamic process between equilibrium states i & f the quantity Q+W has the same value for any path between i & f. This quantity is equal to the change in the value of a static function called the internal energy.

$$\boxed{\Delta U = Q + W}$$

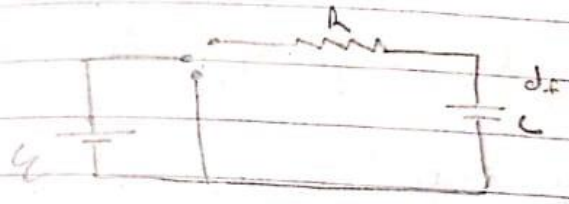
OR

$$\boxed{\Delta E_{int} = Q + W}$$

"Heat can neither be created nor it can be destroyed".

ANSWER # 3 C:

RC CIRCUIT:



In direct circuit current does not change direction.

The RC circuit with D.C field is shown in figure. In this circuits when switch "a" is closed capacitor "c" will get charged by emf "ε" through "R". After the capacitor is fully charges the switch "a" is openand b is closed the capacito now will get discharged through "R".

$$\varepsilon = iR + \frac{q}{c}$$

Differentiant w.r.t "t"

$$\frac{d}{dt}\left(\varepsilon - iR - q/c\right)$$

$$0 - R\frac{di}{dt} - \frac{1}{c}\frac{dq}{dt} = 0$$

$$R\frac{di}{dt} + \frac{1}{C}\frac{dq}{dt} = 0$$

dividing by R and put $\frac{dq}{dt} = i$

$$\frac{di}{dt} + \frac{1}{RC} i = 0$$

$$\frac{di}{dt} + \frac{1}{RC} i = 0$$

$$\frac{di}{dt} + \frac{1}{RC} dt = 0$$

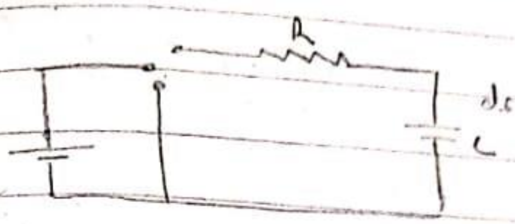
$$\frac{di}{dt} = -\frac{1}{RC} dt$$

Since R and C are constant so we ~~key~~ integrate

$$\int_{i}^{i} \frac{1}{i} di = \frac{-1}{RC} \int_{df}^{t}$$

$$\ln |i/i_0| = \frac{-1}{Rc} (t)$$

RC CIRCUIT.



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Since R and C are constant so we ~~??~~ integrate

$$\int_i^i \frac{1}{i} di = \frac{-1}{RC} \int_{d}^{t} f$$

$$\ln \left| i / t_0 \right| = \frac{-1}{Rc} (t)$$

Taking exponent for both sides

$$\frac{i}{i_0} = e^{-t/RC}$$

$$i = i_0 e^{-t/RC}$$

$$\frac{dq}{dt} = \frac{\mathcal{E}}{R} e^{-t/RC}$$

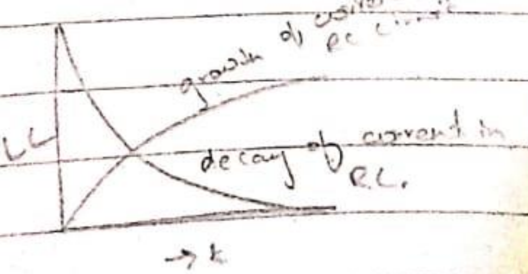
$$\int_0^q dq = \frac{\mathcal{E}}{R} \int_0^t e^{-t/RC}$$

looking the above expression

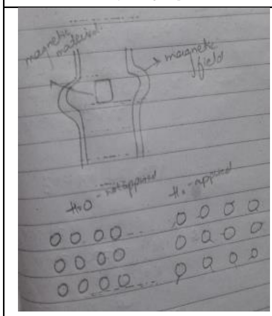
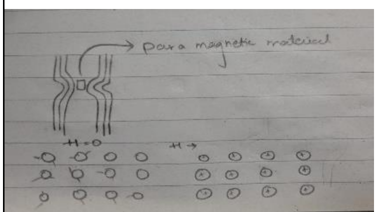
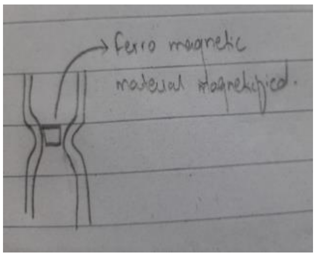
$$q = \mathcal{E}C\left(1 - e^{-t/RC}\right)$$

Similarly discharging of capacitor with can write.

$$i = \frac{\mathcal{E}}{R} e^{-t/RC}$$



ANSWER # 3 D:

Dia magnetic	***Para magnetic***	***Ferro magnetic***
Diamagnetic materials are repelled by a magnetic field; an applied magnetic field creates an induced magnetic field in them in the opposite direction, causing a repulsive force.	*Paramagnetism is a form of magnetism whereby some materials are weakly attracted by an externally applied magnetic field, and form internal, induced magnetic fields in the direction of the applied magnetic field.*	*Ferromagnetism is the basic mechanism by which certain materials form permanent magnets, or are attracted to magnets.*
The orbital motion of electrons is an atom is analog to a current carrying coil. *When a magnetic field as applied to an atom motion of the orbital electrons get modification such a way that a weak magnetic force opposing the field in induced.* *In dia magnetic lines of force due to applied one rippled.*	*Some atoms or molecules posses intermix permanent magnetic moments. In the absence of external field the magnetic moment of theatom in the solid are randomly oriented ith respect to each other on the solid looks as if it is neutral . If an external field is applied the magnetic moment tend to align themselves parallel to applied field.*	*Feromagnetic material are those in which permanent magnetic movement are already aligned due binding forces.*
• ***FORMULA:*** *Susceptibility* = $X = M/H \gtrsim 10^{-5}$	• ***FORMULA:*** *Susceptibility* = $X = M/H \gtrsim 10^{-3}$	• ***FORMULA:*** $X = M/H = 10^{-5}$
		

ANSWER # 4 C:

Q:4

Data:

$A = 4 + Y$, $Y = 0 + 0 + 3 = 3$

Roll number 2020F-BSE-003

λ $670 + A = 673$ nm

$= 673 \times 10^{-9}$ m

$\theta_3 = 30^\circ$

$m = 3$.

Req:

a = width of the slit = ?

$\theta_2 = ?$

Solution:

for a,

$a \sin\theta_3 = m\lambda$.

$$a = \frac{m\lambda}{\sin\theta_3}$$

$$a = \frac{(3)(673 \times 10^{-9})}{\sin(30)}$$

$a = -0.252183$

ANSWER # 4 D :

Q4 (D)

Data:

$QL = 10\,kJ - 10 \times 10^3 J$

$QH = 13\,kJ - 13 \times 10^3 J$

Req:

$\eta = ?$

$W = ?$

Solution:

$$\eta = \left(\frac{QH - QL}{QH}\right) \times 100$$

$$\eta = \left(\frac{(13 \times 10^3) - (10 \times 10^3)}{(13 \times 10^3)}\right) \times 100$$

$$\boxed{\eta = 23307\ \%}$$

$W = Q4 - QL$

$W = (13 \times 10^3) - (10 \times 10^3)$

$W = (13 - 10) \times 10^3$

$W = 3\,kJ$ m.

$$P(E) = \frac{1}{135.28}$$

$$P(E) = 7.391 \times 10^{-3}$$

below Fermi level:

$$\frac{E - E_f}{kT} = \frac{-0.26}{(823)(8.625 \times 10^{-5})}$$

$$= -4.83$$

$$P(E) = \frac{1}{1 + e^{-4.93}}$$

ANSWER # 5 C:

SE20f-003
Shaheer Khan Qureshi
Section A
21-06-2021.

Q5(e)

Data:

$A = U + Y = 3 + 4 = 7.$

$L = 530$

$D = 0.15$

$m = 80 \times A = 560$

Req:

$\Delta L = ?$

Solution:

$$\frac{F}{A} - \frac{L}{\Delta L} = Y$$

$$\frac{F}{A} - \frac{L}{Y} = \Delta L$$

Y is 5×10^9 $\therefore A = \pi r^2$

$F = mg.$

$$\Delta L = \frac{mg \cdot L}{\pi r^2 \cdot Y}.$$

$$\Delta L = \frac{(560)(9.8) \times (530\ cm)}{3.14(0.15)^2(5 \times 10^4)}$$

$$\boxed{\Delta L = 150809.90771}$$

ANSWER # 5 D:

Date

QNO:05 (D)

Roll number 003 = 3 A = 4+3 = 7.

Data:

$T = 350 + 273 = 623$

$K = 8.625 \times 10^{-5}\ eV/c.$

$E.Ef = +2\left(\frac{7}{100}\right)$ (above farmi level)

$= -2\left(\frac{7}{100}\right)$ (below farmi level)

$= 0$ (Equal to farmi level.

Req:

$P(E)?$

Solution:

Above farmi level

$$= \frac{E - Ef}{KT}$$

$$= \frac{0.26}{(623)(8.625 \times 10^{-3})}$$

$$= \frac{0.26}{0.053} \Rightarrow 4.90$$

$$P(E) = \frac{1}{1 + e^{E \cdot Ef / KT}}$$

$$= \frac{1}{1 + e^{4.90}}$$

Signature UNIQUE No.

$$P(E) = \frac{1}{135.28}$$

$$P(E) = 7.391 \times 10^{-3}$$

below Fermi level:

$$\frac{E - E_f}{kT} = \frac{-0.26}{(823)(8.625 \times 10^{-5})}$$

$$= -4.83$$

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