$$V = I * R$$

C

芯片

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** EE 101 **

$$P = V * I * \cos(\varphi)$$

Ch 1: Lecture 1:

* Some important Electrical Units:

Quantity	Symbol الرمز	Unit وحدة القياس
current	I	A – ampere
Charge	Q	C – Coulomb
Voltage	V	V – Volt
Resistance	R	Ω – ohm
Power	P	W – Watt
Energy	W	J – Joule
Time	t	S – second

m ⟶ ملي ⟶ $\times 10^{-3}$

μ ⟶ ميكرو ⟶ $\times 10^{-6}$

n ⟶ نانو ⟶ $\times 10^{-9}$

k ⟶ كيلو ⟶ $\times 10^{3}$

M ⟶ ميجا ⟶ $\times 10^{6}$

G ⟶ جيجا ⟶ $\times 10^{9}$

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الإشتقاق

$2t \longrightarrow 2 \times 1$

$3t^2 \longrightarrow 3 \times 2t = 6t$

$\sin(2x) \longrightarrow 2\cos(2x)$

$\cos(2x) \longrightarrow -2\sin(2x)$

التكامل

$\int 2t \longrightarrow \frac{2t^2}{2} = t^2$

$\int 4 \longrightarrow 4t$

t

$m \xrightarrow{\times 60} s$

$hr \xrightarrow{\times 60} m \xrightarrow{\times 60} s$

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Example 1:

If it takes 35 J of energy to move a charge of 5 C from one point to another, what is the voltage between the two points?

$W = 35\ J$, $Q = 5\ C$ what

$V = ??$ How much

Find

Determine

Calculate

إحسب/أوجد

$\therefore V = \frac{W}{Q} = \frac{35}{5} = 7\ V$

$\therefore V = 7\ V$

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Example 2:

The voltage between two points is 19 V. How much energy is required to move 67×10^{18} electrons from one point to the other?

$V = 19\ V$, $W = ??$

67×10^{18} electrons

$\therefore Q = \dfrac{\text{No. of electrons}}{\text{electron charge}} = \dfrac{67 \times 10^{18}}{6.24 \times 10^{18}} = 10.73\ C$

حفظ

$\therefore Q = 10.73\ C$

$\therefore V = \dfrac{W}{Q} \longrightarrow W = V \cdot Q$

$\therefore W = 19 \times 10.73 = 204\ J$

$\therefore W = 204\ J$

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Question 1:

Find the current in an element when the charge entering the element is

$$q = 12\,t \quad C$$

where t is the time in seconds.

إذا السؤال يقول على فقط

I, Q

$I = \frac{dq}{dt}$ $\qquad$ $q = \int I\,dt$

$i = ??$

$q = 12t \quad c$

$$i = \frac{dq}{dt} = \frac{d}{dt}(12t) = 12 \times 1$$

$$i = 12\ A$$

#

Question 2:

Find the current in an element at t = 1 sec, when the charge

$q(t) = 3t^4 + 6t + 4 \quad c$

$i = ??$, $t = 1$ sec

$q(t) = 3t^4 + 6t + 4 \quad c$

$$\therefore\ i = \frac{dq}{dt} = \frac{d}{dt}(3t^4 + 6t + 4) = 3 \times 4t^3 + 6 \times 1$$

$$\therefore\ i = 12t^3 + 6 \quad A$$

$$\therefore\ i(1) = 12(1)^3 + 6 = 12 + 6 = 18\ A$$

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Question 3:

$i = i(t)$

Find the charge that has entered an element by time t when:

$$i(t) = 8t^2 - 4t \text{ A}, \quad t \geq 0$$

Assume $q(t) = 0$ for $t < 0$.

$i(t) = 8t^2 - 4t$ A $q = ??$

$$\therefore q = \int i(t)\, dt = \int (8t^2 - 4t)\, dt$$

$$\therefore q = \frac{8t^3}{3} - \frac{4t}{2}$$

$$\therefore q = \frac{8}{3}t^3 - 2t \quad C$$

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Question 4:

The total charge that has entered a circuit element is:

$q(t) = 4 \sin 3t$ C when $t \geq 0$, and $q(t) = 0$ when $t < 0$

Determine the current in this circuit element for $t > 0$.

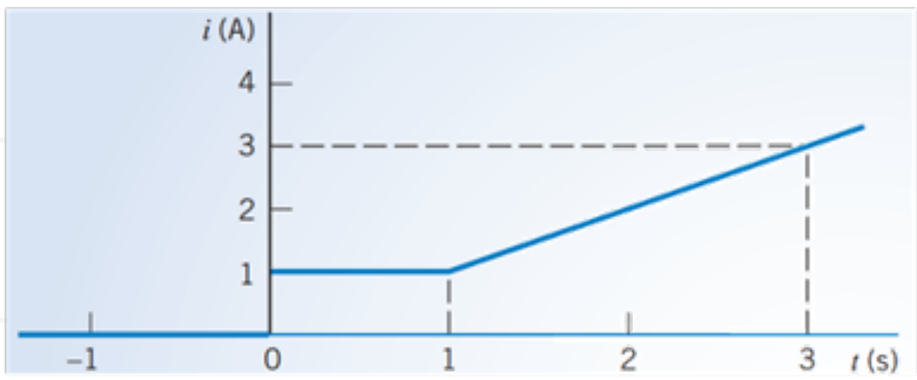
$q(t) = 4 \sin 3t$ $i(t)$

$$\therefore i = \frac{dq}{dt} = \frac{d}{dt}(4 \sin 3t)$$

$$\therefore i = 4 \times 3 \cos 3t = 12 \cos 3t \text{ A}$$

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Question 2: Find the **charge** that has entered the terminal of an element from **t = 0 s** to **t = 3 s** when the current entering the element is as shown in Figure.



$q = ??$

$t = 0 \longrightarrow t = 3\ s$

$$i(t) = \begin{cases} 0 & t < 0 \\ 1 & 0 \le t < 1 \\ t & t \ge 1 \end{cases}$$

خط مائل



$$\therefore q(t) = \int_{t_1}^{t_2} i(t)\ dt$$

$$= \int_0^1 1\ dt + \int_1^3 t\ dt$$

$$= t\Big|_0^1 + \frac{t^2}{2}\Big|_1^3 = (1-0) + \left(\frac{3^2}{2} - \frac{1^2}{2}\right)$$

$$\therefore q(t) = 5\ C$$

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