وزارة التعليم العالي والبحث العلمي
الجامعة التقنية الجنوبية
المعهد التقني التكنلوجي/قسم التقنيات الالكترونية

ELECTRICAL CIRCUITS AND MEASURMENTS

الدوائر الكهربائية والقياسات

اعداد : م.م. مي عدنان فالح

ماجستير هندسة السيطرة والحاسبات

المنهاج الدراسي لمادة الدوائر الكهربائية

قسم التقنيات الالكترونية

المرحلة الأولى

للعام الدراسي 2024/2025

بسم الله الرحمن الرحيم

"ربي اشرح لي صدري ويسر لي امري واحلل عقدة من لساني يفقهوا قولي"

صدق الله العظيم

عنوان الحقيبة : الدوائر الكهربائية والقياسات

الفئة المستهدفة : طلبة المرحلة الأولى قسم التقنيات الالكترونية

المؤسسة التعليمية : الجامعة التقنية الجنوبية /المعهد التقني التكنلوجي قسم التقنيات الالكترونية

الأنشطة التدريبة :حضوري + أنشطة تفاعلية + أنشطة الكترونية

وصف الحقيبة

حقيبة دراسية لمدة ثمانية أسابيع بواقع ساعة ونصف في الأسبوع لطلبة المرحلة الأولى من قسم التقنيات الالكترونية . سيكتسب الطالب من خلال هذه الحقيبة التعليمية العديد من المهارات التي سيستفاد منها خلال مسيرته الدراسية للسنوات القادمة .

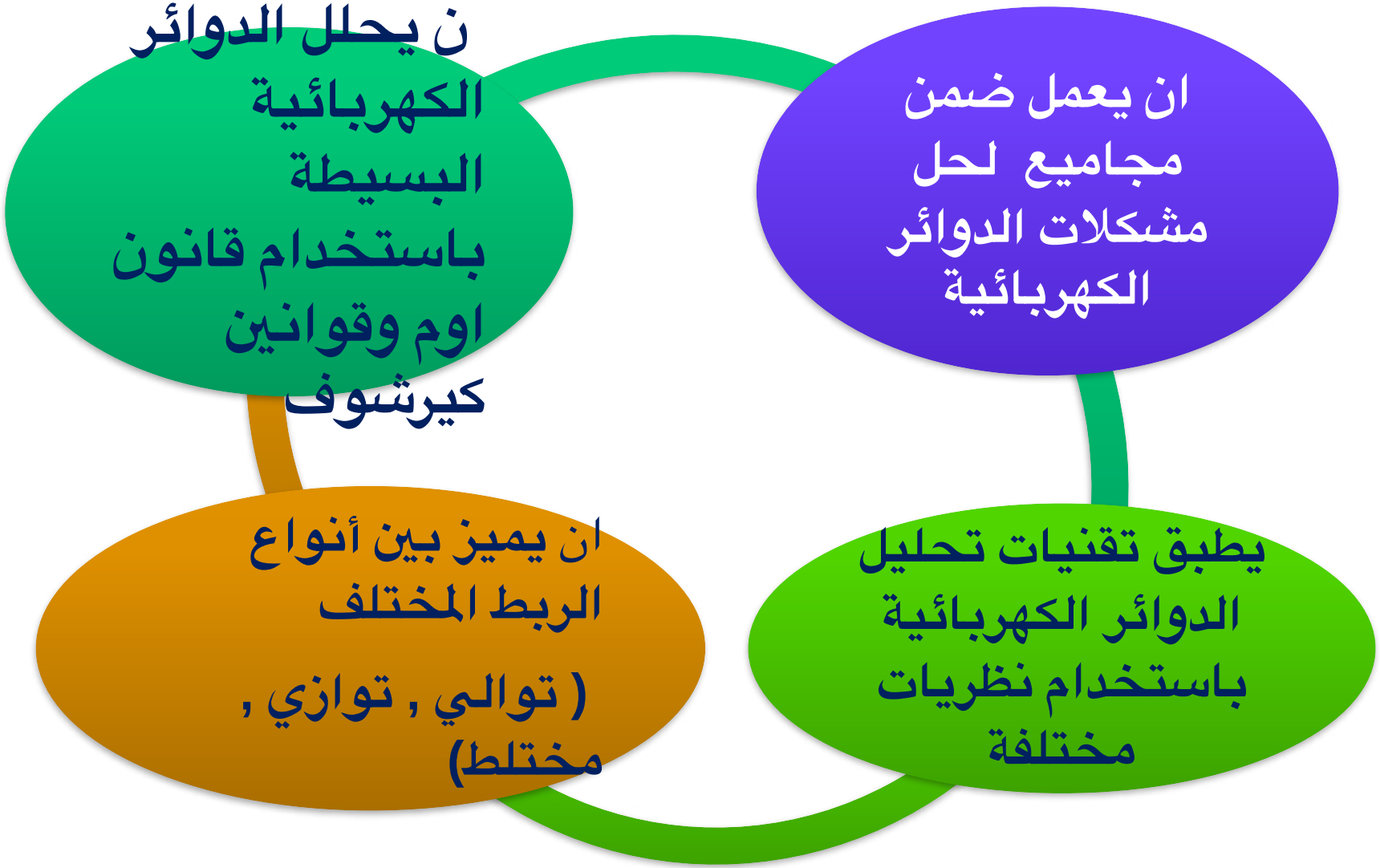
تضمنت الحقيبة بعض وسائل الايضاح ومقاطع الفيديو التوضيحية والمهام والنشاطات والواجبات التي ستعزز من مقدرة الطالب في تحليل الدوائر الكهربائية وتعزز من امكانياته العقلية والرياضية والعصف الذهني من خلال حل العديد من المعادلات الرياضية.

الأهداف العامة :

- فهم المبادئ الأساسية للدوائر الكهربائية
- تحليل الدوائر الكهربائية البسيطة والمعقدة
- دراسة عناصر الدوائر الأساسية
- فهم استجابة الدوائر الكهربائية
- تمكين الطلبة من استخدام برامج المحاكاة
- تعزيز التفكير المنطقي والتحليلي لدى الطالب

المخرجات التعليمية لمقرر مادة الدوائر الكهربائية

في نهاية هذا المقرر يتوقع ان يكون الطالب قادرا على :

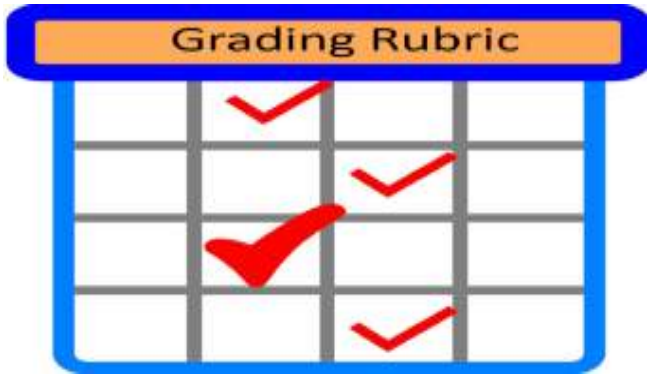


الفهرست

الاسبوع	عنوان المحاضرة	
الأسبوع الأول	قانون اوم وأنواع الربط	
الأسبوع الثاني	الربط المختلط	
الأسبوع الثالث	ربط دلتا ستار	
الأسبوع الرابع	قوانين كيرشوف	
الأسبوع الخامس	نظرية ثيفنن	
الأسبوع السادس	نظرية نورتن	
الأسبوع السابع	نظرية تحويل المصادر	
الأسبوع الثامن	نظرية التراكب	

الجدول الزمنى

تسلسل المحاضرة	الاسبوع	طريقة التدريس	المدة الزمنية (ساعة)	رقم القاعة
المحاضرة الأولى(قانون اوم)	الأول	حضوري +نشاط تفاعلي +اختبار الكتروني(مهمه جماعية)	ساعة ونصف	ق 1
المحاضرة الثانية(أنواع الربط)	الثاني	حضوري+ نشاط تفاعلي+ مقطع فديو توضيحي + واجب الكتروني	ساعة ونصف	ق1
المحاضرة الثالثة(ربط دلتا-ستار)	الثالث	تفاعلي+ واجب الكتروني+ رابط الكتروني لفيديو تعليمي	ساعة ونصف	ق2
المحاضرة الرابعة(قوانين كيرشوف)	الرابع	حضوري +نشاط تفاعلي + رابط فيديو توضيحي +اختبار الكتروني	ساعة ونصف	القاعة المركزية
المحاضرة الخامسة(نظرية ثيفنن)	الخامس	حضوري +نشاط تفاعلي + مقطع فيديو توضيحي +اختبار الكتروني	ساعة ونصف	القاعة المركزية
المحاضرة السادسة(نظرية نورتن)	السادس	حضوري +نشاط تفاعلي +اختبار الكتروني	ساعة ونصف	القاعة المركزية
المحاضرة السابعة(تحويل	السابع	حضوري +نشاط تفاعلي+اختبار	ساعة ونصف	ق2



المنهاج التقويمي :

يعتبر تقويم البرنامج التعليمي لمادة الدوائر الكهربائية مهم جدا لنجاح برنامج الحقيبة والوصول الى الأهداف المطلوبة ويبين مدى اكتساب المتدربين للمهارات العلمية في تحليل الدوائر الكهربائية

اختبار قبلي

أنشطة اثناء التدريب

اختبار بعدي

دليل الفيديوهات

:

اسم الفيديو	اسم ورقم المحاضرة
فديو قصير + رابط الفيديو على اليوتيوب لتوضيح قاعدة مقسم التيار	ص 10 المحاضرة رقم 2 / الربط المختلط
رابط فديو توضيحي لمحاضرة دلتا - ستار	المحاضرة رقم 3 / الربط النجمي المثلثي (دلتا-ستار)
رابط فديو توضيحي لتحليل الدوائر الكهربائية باستخدام تيارات ماكسويل الدوارة	المحاضرة رقم 4 / قوانين كيرشوف
فديو قصير + رابط الفيديو على اليوتيوب شرح مختصر لنظرية ثفنن	المحاضرة رقم 5/ نظرية ثفنن
رابط المحاضرة على منصة النيربود	المحاضرة رقم 8 / نظرية التراكب


المحاضرة الأولى
Unit system

Rational :

- its very important to study units system

-also to study the elements effects of a .resistance

:Central idea

- Define voltage , current and resistance
- Define unit system
- The element effect at resistance

:Aim of lecture

To let the student be able to to identify and analysis different elements effects at .resistance value

:Pretest

define : current , potential difference -1

write Ohm`s law -2

Unit system

Quantity	unit	symbol
Length	meter	M
Mass	Kilogram	Kg
Time	Second	S
Current	Amper	A
درجة الحرارةTemperature	Kelvin	K
Luminous intensity شدة الإضاءة	candela	cd

:From the basic quantity we can derive

Quantity	unit	symbol
Electric charge	Coulomb	C
Electric potential	Volt	V
Resistance	Ohm	Ω
Capacitance	Farad	F
Inductance	Henry	H
Conductance	Siemens , mho	S
Frequency	Hertz	HZ
Power	watt	W

:nations

$1=10^0$	
$10=10^1$	$1/10=0.1=10^{-1}$
$100=10^2$	$1/100=0.01=10^{-2}$
$1000=10^3$	$1/1000=0.001=10^{-3}$

Power of 10	**prefix**	symbol
10^6	Mega	M
10^3	Kilo	K
10^{-3}	mille	m
10^{-6}	Micro	µ
10^{-9}	Nano	n
10^{-12}	pico	p
10^9	gaga	G

:The elements effect at rssistance value

. Resistance varies directly with (Length) { L }

. It varies inversely with (the cross section area) { A } -2

.It depends on the nature of the material { specificin (p) } -3

. It also depends on the temperature of the conductor { T } -4

m Ω = 2 .m Ω = = R. A / L ρ ,) Ω . l/A (ρ :. R = R Œ L/A .

m

.When R: resistance, p= specificin or resistivity , L= length

A =cross section area

Ex1: A rectangular carbon block has dimensions (1 cm ,1 cm ,50 cm) .

1- what is the resistance measured between the two square ends .

2- Between two opposing rectangular faces if P = 3.5x10-5 Ω. m

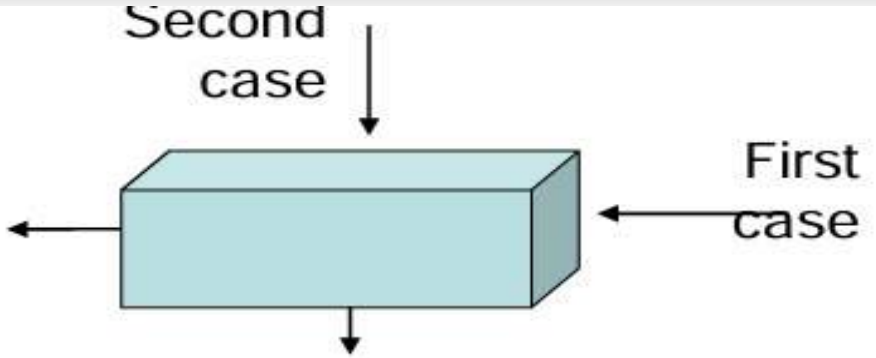
Solution:

1- $R = P \cdot L / A \ (\Omega) = 3.5 \times 10^{-5} \times 0.5 / (1 \times 10^{-2} \times 1 \times 10^{-2})$

$\therefore R = 0.175\ \Omega$

2- $R = P \cdot L / A \ \Omega = 3.5 \times 10^{-5}\ 1 \times 10^{-2} / (1 \times 10^{-2} \times 50 \times 10^{-2})$

$\therefore R = 0.00007\ \Omega$

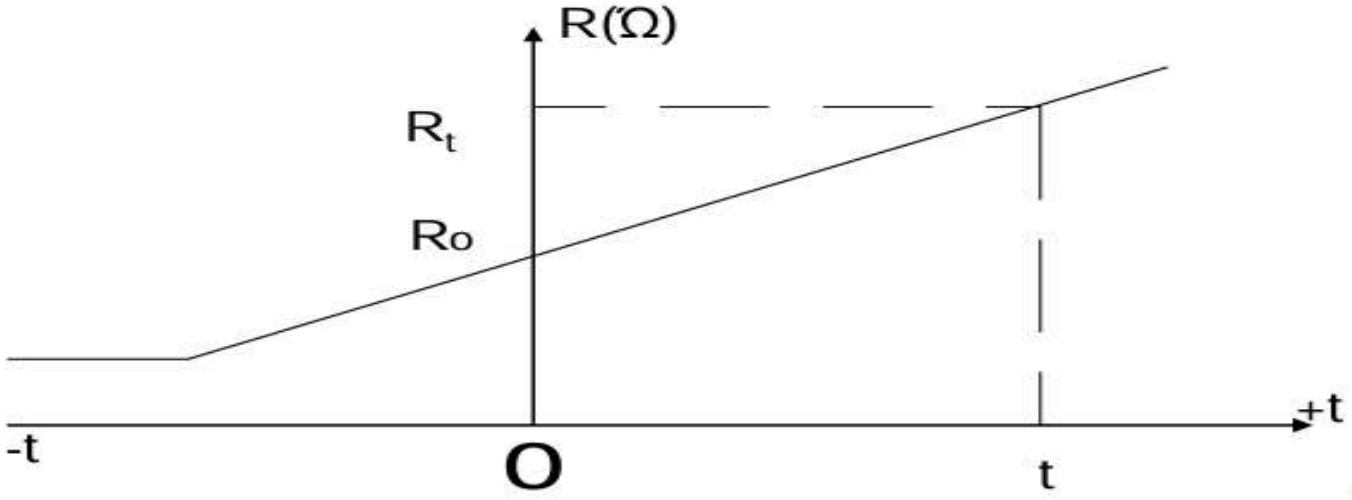


Ex 2: The wire resistance equal to (40 Ω) and length (1km) if the resistivity=2×10^{-8} Ω.m , calculate: the diameter of the circular type wire.

Solution : $Area = (r^2/2).\pi$, $R = P \cdot L / A\ \Omega$ $\therefore A = P \cdot L / R = (2 \times 10^{-8} \times 1 \times 10^{3}) / 40$

$= 0.5 \times 10^{-6}\ m^2$

The temperature effects at the resistanceThe resistance of the material depends on the temperature, When (T) increased, R also :increased



Let the resistance of a conductor at 0Ċ=RoΩ
Let the resistance of a conductor at tĊ=Rt Ω
Let the temperature cofficient of material at 0Ċ=œo / k
Let the temperature cofficient of material at tĊ=œt / k

1- Rt=Ro(1+œot)
2- R2=R1(1+œe1(t 2-t1))
3- œt =œo/(1+œo.t
4- œt=(Rt-RO)/Rt.t

Ex.3: A lamp of (100 watt) power, (240 volt) reaches(2000Ċ) if the temperature coefficient of the lamp at (15Ċ) is œ=$5x10^{-3}$ /k calculate the current through the lamp

Solution: $p=v^2/R$:. $R=(240)^2/100=576\Omega$

$R_2=R_1(1+œ_1(t_2-t_1))$:. $576=R_1[1+5x10^{-3}(2000-15)]$

$576=R_1(1+9.92)$, $R_1=576/10.92=52.7\ \Omega$:. $I=v/R=240/52.7=4.55A$

:.

Ex.(4): Palatine coil of resistance(3.717Ω) at (100Ċ). Calculate 1-The resistance at zero degree. 2- the temperature coefficient of resistance at 40Ċ **(H .W)**

Notes: 1- Ro= 2.781 Ω
2-œt= 0.00284/k

Ex5 : **A(1A) pass through a copper conductor the Potential difference through it is (10 v) at (20Ċ) after Sam times the current decrease to** (0.95A) , (**Potential difference** not changed) , Find the temperature of the conductor if the temperature coefficient of the copper at zero **Ċ** **(α_o)= 4.28×10^{-3}/k**

Solution: $R1=v/I_1=10/1=10\Omega$, $R2=v/I_2=10/0.95=10.53\ \Omega$,

$R_t=R_o(1+\alpha_o t)$ $\therefore R_1/R_2=R_o(1+\alpha_o t1)/R_o(1+\alpha_o t2)$

$\therefore 10/10.53=(1+4.28\times10^{-3}\ x2o)/(1+4.28\times10^{-3}\ x\ t_2)$ $\therefore t_2=33.4Ċ$

Posttest ألاختبار ألبعدي

Ex:(7) An electric heater takes a current of (15A) from a (115v) source. The cables connecting the heater to the supply are each (43m) long. If the voltage drop along the cables is not exceed (12v) .Determine the diameter of suitable copper wire and select p=1.72x10-8 Ω.m

Solution

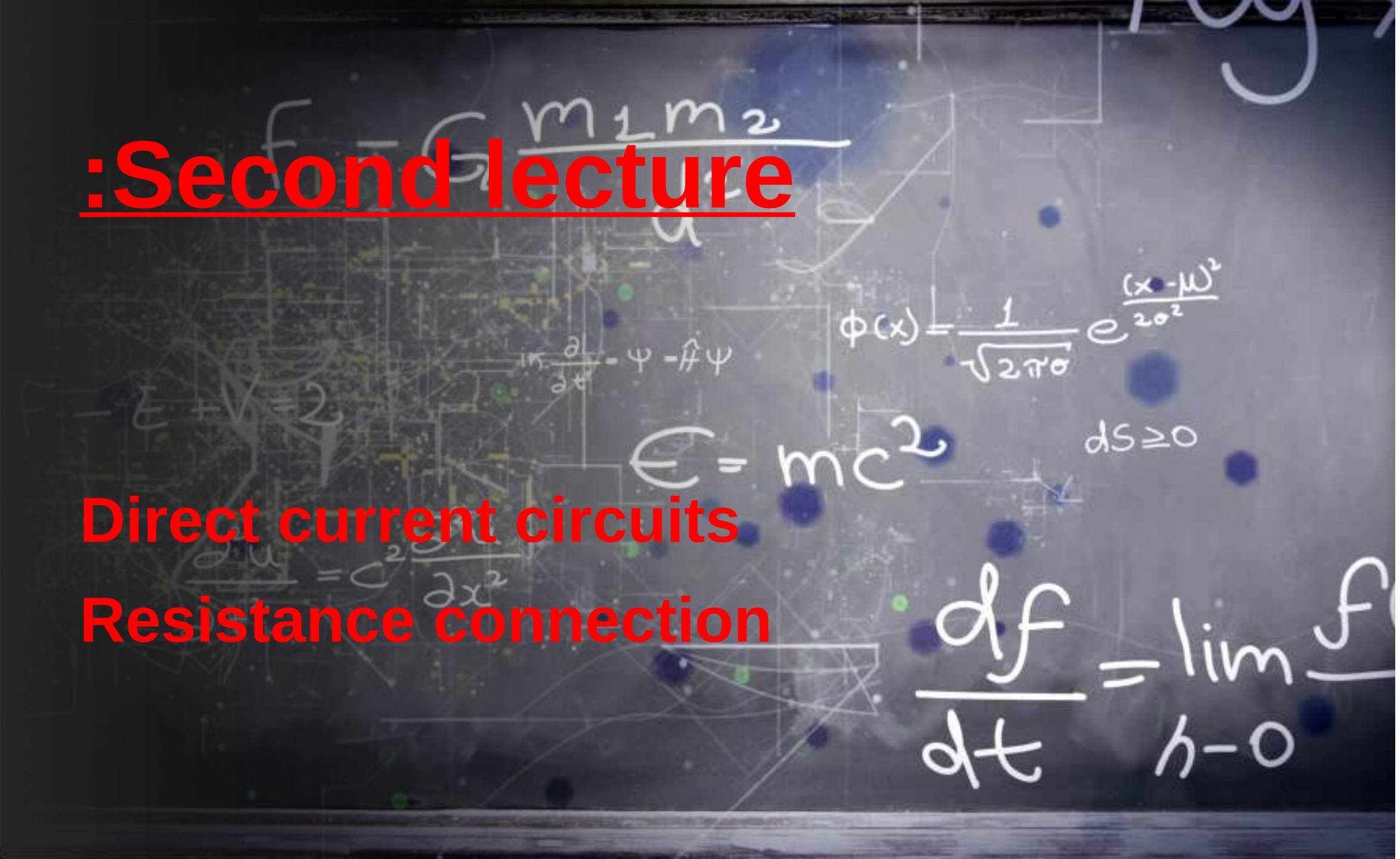
$R=E/I=12/15=0.8\Omega$, total length of wire $=2x43=86m$

$R=p.L/A$:. $A=p.L/R = (1.72x10^{-8}x86) / 0.8 =1.849x10^{-6}\ m^2$

$A=[(1/2).d]^2.\pi$

$A=(d^2/4).\pi$:. $d^2= 4A/\pi$:. $d=\sqrt{4A/\pi}$

$d=\sqrt{(4x\ 1.849x10^{-6}\ /\pi} =1.5mm$



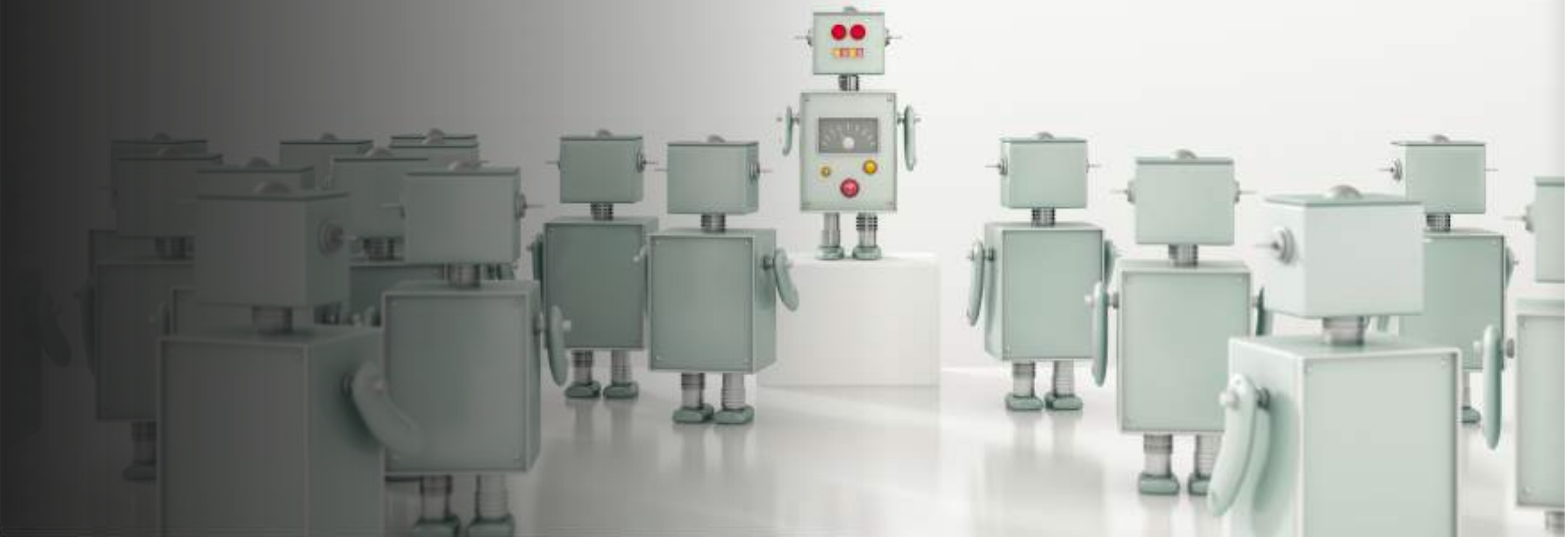
:Second lecture

Direct current circuits

Resistance connection

الاختبار القبلي :

ماذا تعرف عن ربط التوالي؟



B –Rationale مبررات الوحدة

- It is very important to study

Resistances connect ion:

Series circuit, Parallel circuits and complex connection

- Also to study Voltage divider rule ,

the current divider rule and Ohms· law

:Central idea

connect the resistance as series -

.parallel and complex,

.Ohms, law •

.

.Voltage divider rule, the current divider rule •

: Aim of lecture

To let the student be able to identify the analyses different kind of resistance connection (series, parallel ,complex)

Pretest ألاختبار القبلي

1): If number of resistances connection in series write total voltage , current laws .

2) If number of resistances connection in Parallel wrights total voltage , current laws .

solution

1) $V_T = V_1 + V_2 + \ldots + Vn$, $I_T = I_1 = I_2 = I_n$

2) $I_T = I_1 + I_2 + \ldots + In$, $V_T = V_1 = V_2 = V_n$

:CLASSIFICATION OF ELECTRIC CIRCUIT

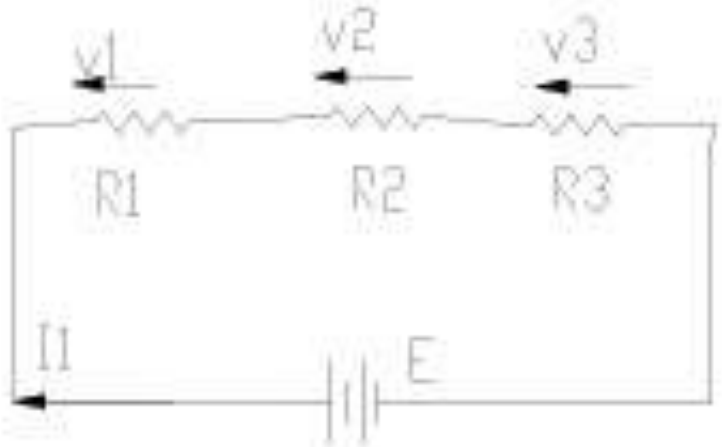
.Series Circuit-1

.Parallel Circuit-2

.Series Parallel Circuit-3

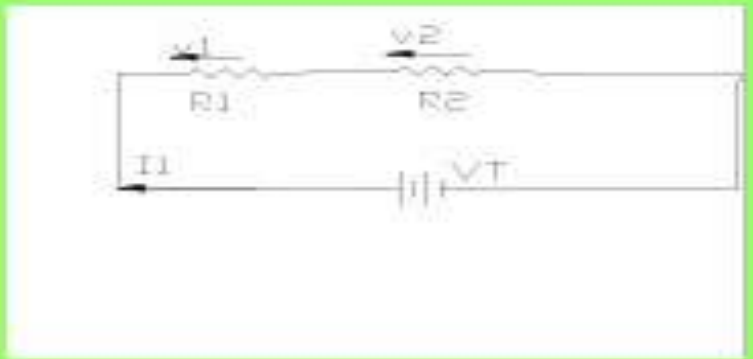
.Mesh or Network Circuit-4

1 Series circuit



$I = I_1 = I_2 = I_3 = \text{--------} = I_n$ $V_T = V_1 + V_2 + V_3 + \text{-------} + V_n$

Voltage divider rule قانون تقسيم الفولتية

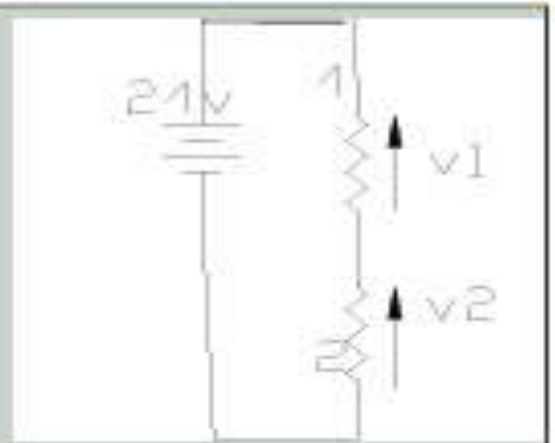


$V_1 = I.R_1 = V_T.R_1/(R_1 + R_2)$ $V_2 = I.R_2 = V_T.R_2/(R_1+R_2)$

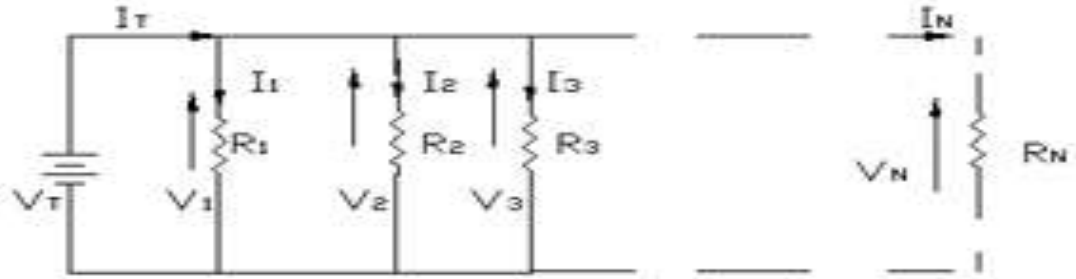
Ex: By using V.d. r. Find V1,V2

V1=VT.R1/R1+R2
=4x24/(4+2) =16v

V2=VT.R2/R1+R2
=2x24/(4+2)=8v



2 Parallel circuits دوائر التوازي



$V_T=V_1=V_2=V_3=V_n$

$I_T=I_1+I_2+I_3+ \text{---}+I_n$

$1/R_T=1/R_1+1/R_2+1/R_3+ \text{----}+ 1/R_n$

$G_T=G_1+G_2+G_3+ \text{------}+ G_n$, {G=1/R}

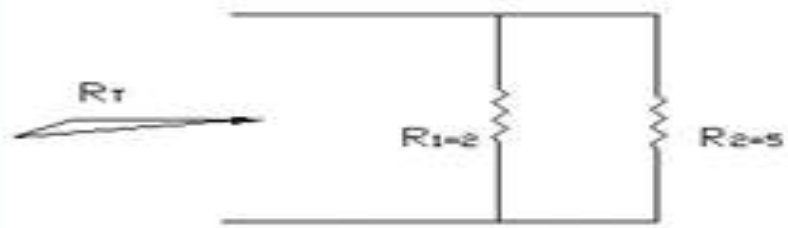
G : conductance الموصلية (مو)

For two resistance parallel connected as shown in fig.

$1/R_T=1/2 +1/5 =7/10 :.R_T=10/7=1.4\Omega$

OR: **RT=R1.R2/(R1+R2)**

=2x5/(2+5)=10/7=1.4Ω

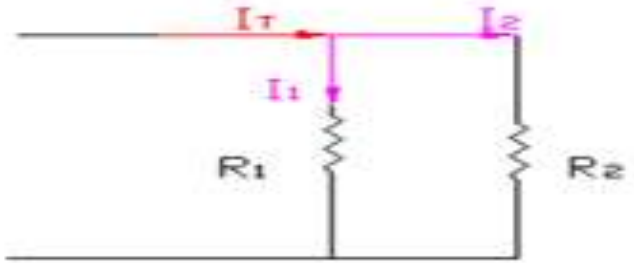


The current divider rule (قانون تقسيم التيارات)

$$I_1 = V/R_1 = I_T \times \frac{R_1 . R_2}{R_1}$$

$$\therefore I_1 = \frac{R_2}{R_1 + R_2} . I_T$$

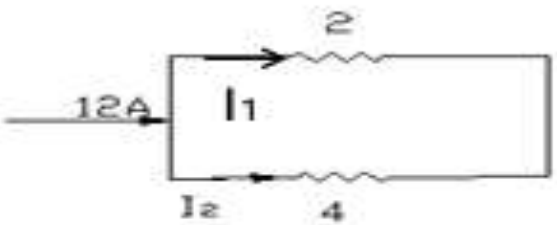
Also: $I_2 = \frac{R_1}{R_1 + R_2} . I_T$



EX(1) :Find I_1, I_2 For the cct. Shown ;

Solution; $I_1 = \frac{R_2}{R_1 + R_2} \times I_T = \frac{4}{2+4} \times 12 = 8A$

$$I_2 = \frac{2}{2+4} \times 12 = 4A$$

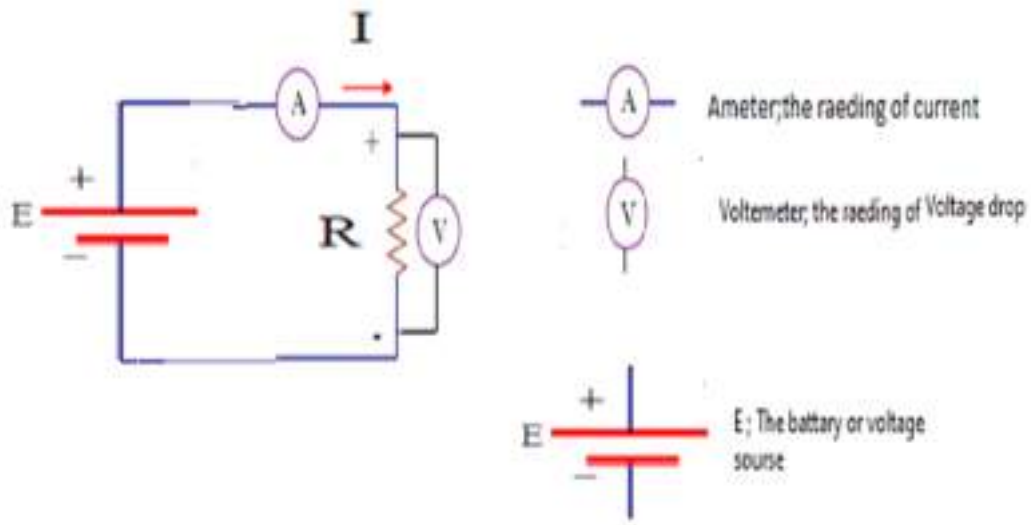


قانون اوم :OHM`s LAW

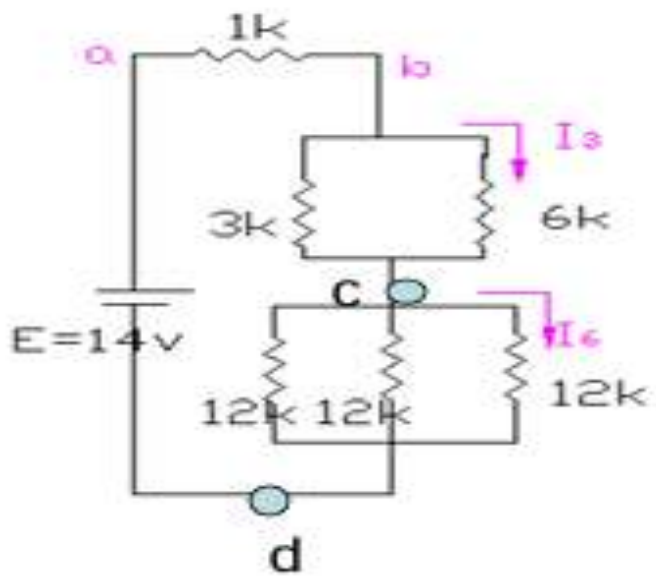
At a constant temperature; the current flowing through the circuit is directly" ."proportional to the voltage and inversely proortional to the resistance

Current = Voltage/ Resistance

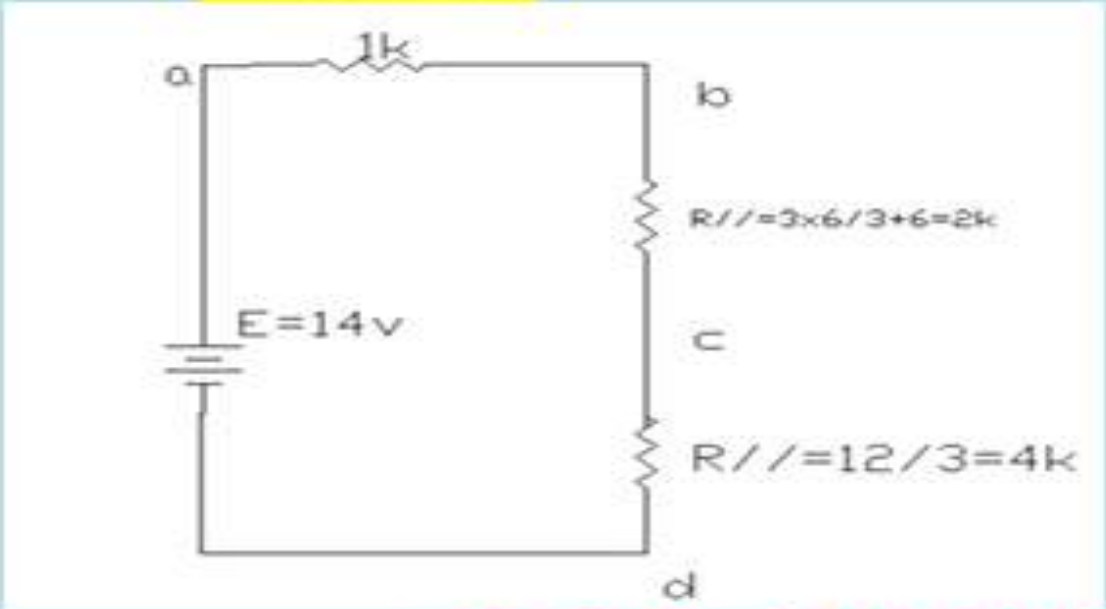
or: ***I***=V/R (A)



Ex(2); Find Vad, Vab, Vbc ,Vcd ,I3 ,I6



solution



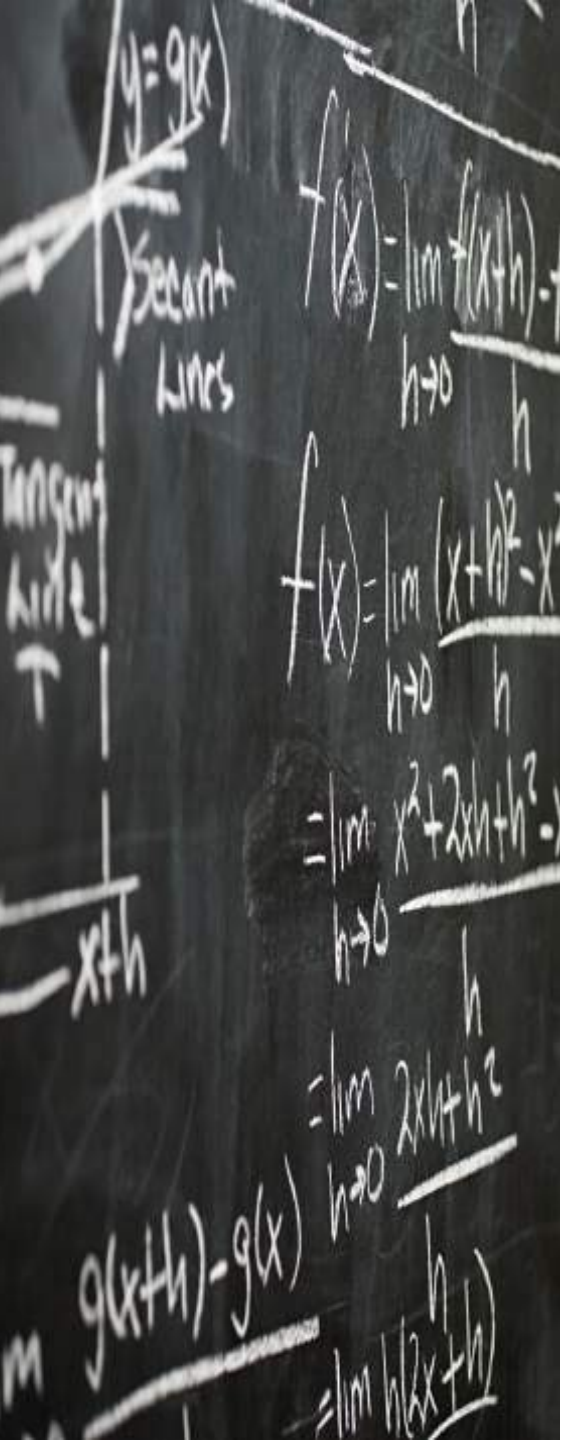
:. RT=7k Ω:. I_T=14/7k=2mA

:. V_{ab}=2mAx1k=2v V_{bc}=2mAx2K=4V

V_{cd}=2mAx4k=8v

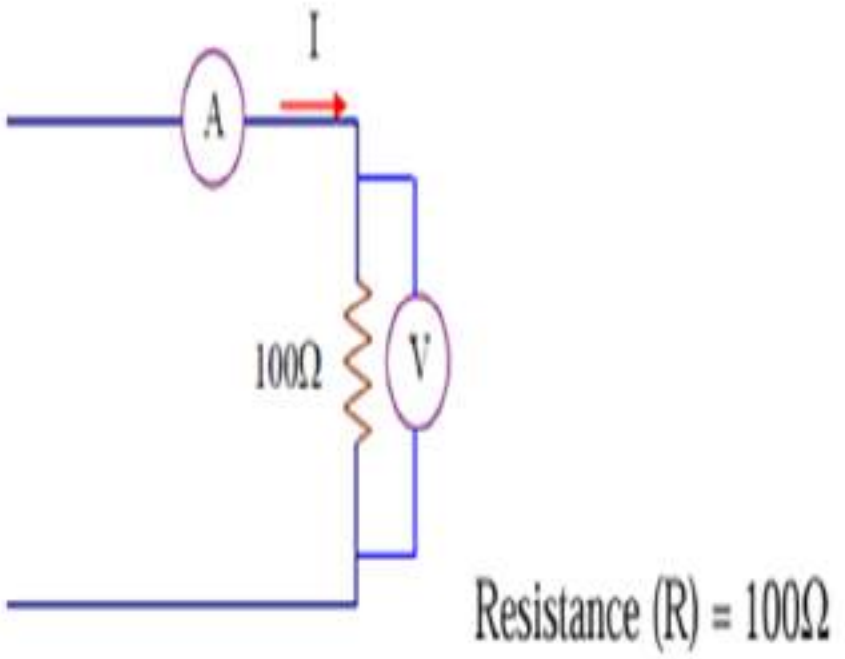
I_3=2mAx3k/3k+6k=0.666mA

I_6=8v/12k=0.666mA



EXAMPLE :

The supply voltage of the circuit is 50V (reading of voltemetr) and the resistance value is 100 Ω. Calculate the current flowing through this circuit
(reading of ameter).(V=50V)

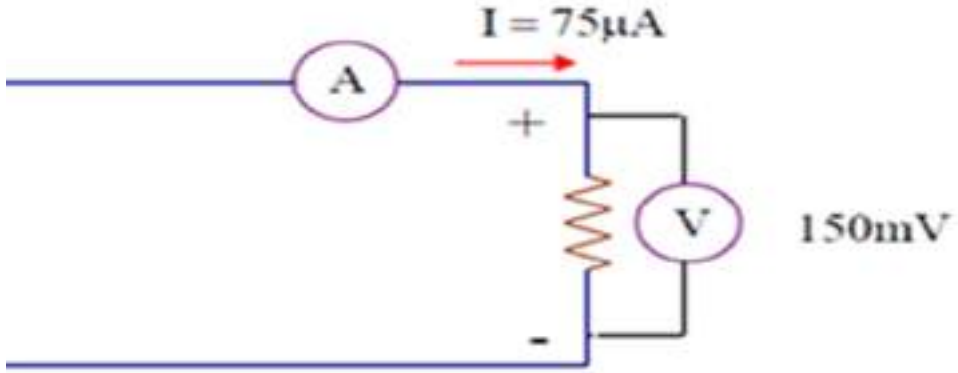


:SOLUTION

:By using ohms law

I=V/R

I=50/100=0.5 A



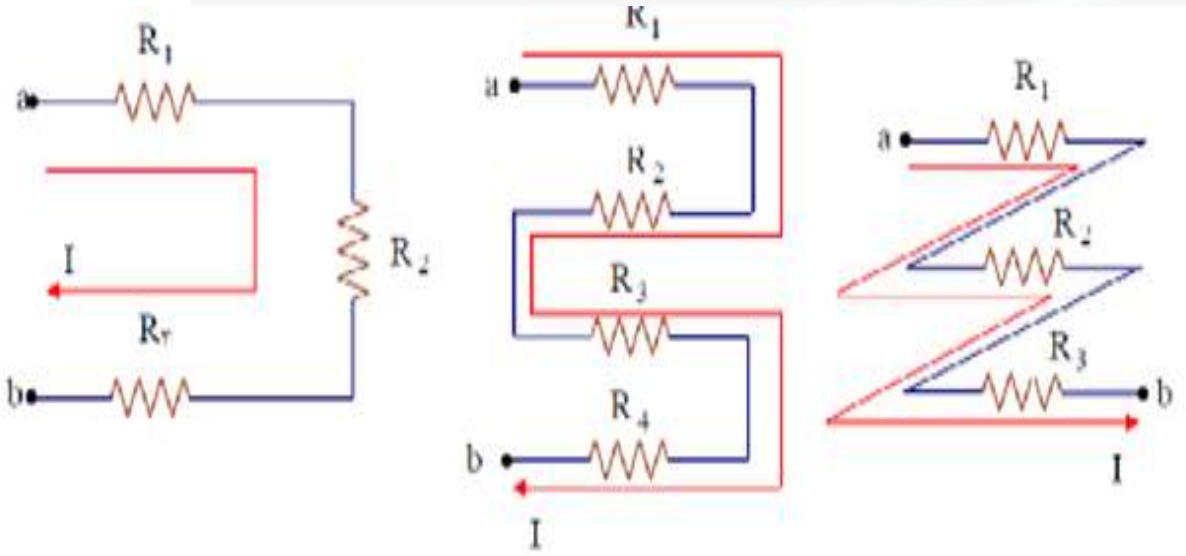
For a given circuit the reading of voltmeter is 150mV. and the reading of ammeter is 75µA . Calculate the .resistance value of the circuit

نشاط

نشاط تفاعلي داخل المحاضرة

:SEIRIES CIRCUITS

I" ampere current flows in all“ resistors" ,For agivin circuit (E)is electromotive force of power supply ,V is total voltage of source or (VS)



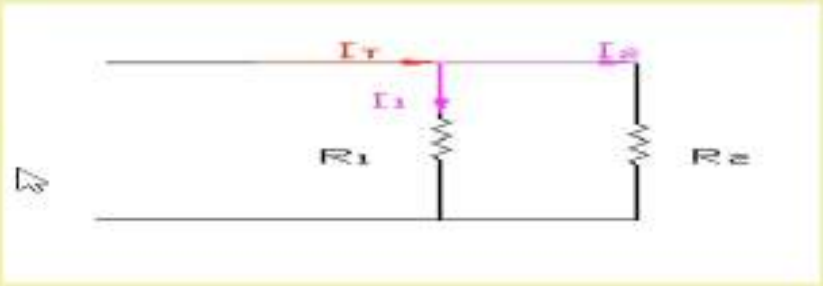
محاضرة فديويه قصيرة لتوضيح قانون مقسم التيار

https://youtu.be/g4GNb6TCZho?si=0vwPZWjSAuQMzK0l

$$I_1 = V/R_1 = I_T \times \frac{R_1.R_2}{R_1}$$

$$\therefore I_1 = \frac{R_2}{R_1+R_2} \cdot I_T$$

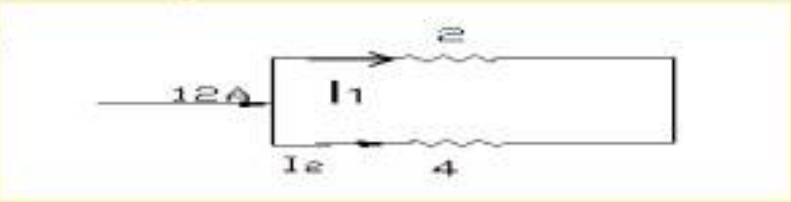
$$\text{Also: } I_2 = \frac{R_1}{R_1+R_2} \cdot I_T$$



EX(1) :Find I_1, I_2 For the cct. Shown ;

Solution; $I_1 = \frac{R_2}{R_1+R_2} \times I_T = \frac{4}{2+4} \times 12 = 8A$

$$I_2 = \frac{2}{2+4} \times 12 = 4A$$



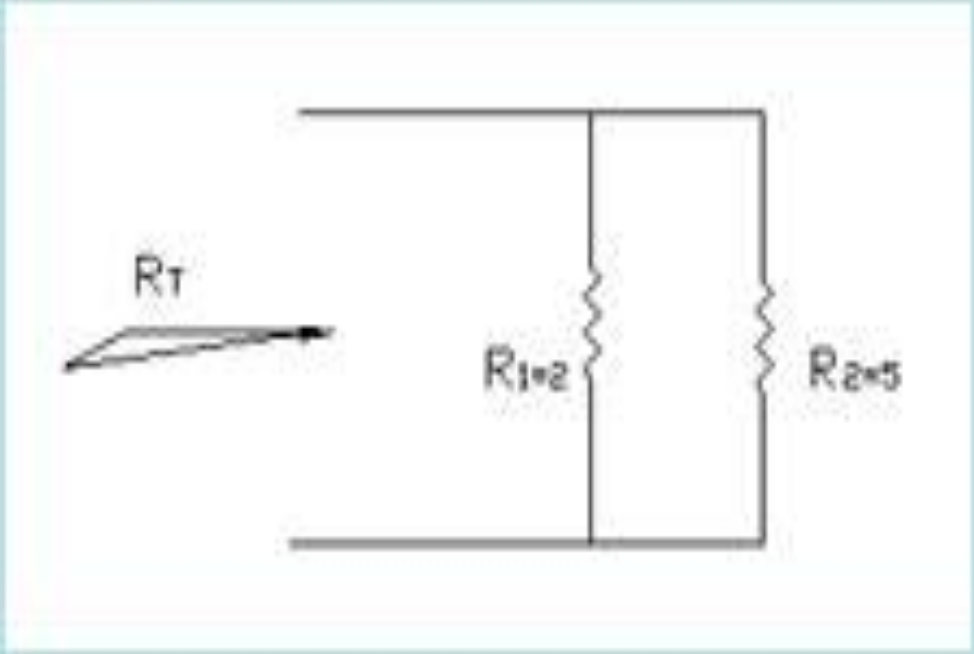
:EXAMPLE2

For two resistance parallel connected as shown in fig.

$1/R_T = 1/2 + 1/5 = 7/10 \therefore R_T = 10/7 = 1.4\Omega$

OR: $RT = R1.R2/(R1+R2)$

$= 2x5/(2+5) = 10/7 = 1.4\Omega$



الاختبار البعدي:

قم باعداد تقريرعن ربط التوالي وربط التوازي والفرق بينهما معززا بالامثلة.الحل على مجاميع (كل خمس طلاب ضمن مجموعه)

ملاحظة : يسلم التقرير على رابط قناتنا على الكوكل كلاس روم

https://classroom.google.com/c/NzcxOTQ3MjE5MTc5

Google Classroom

يرجى فتح ال QR code ادناه لملء الاستبيان

رأيك يهمنا

شكرا لحضوركم وتفاعلكم

الأسبوع الثالث

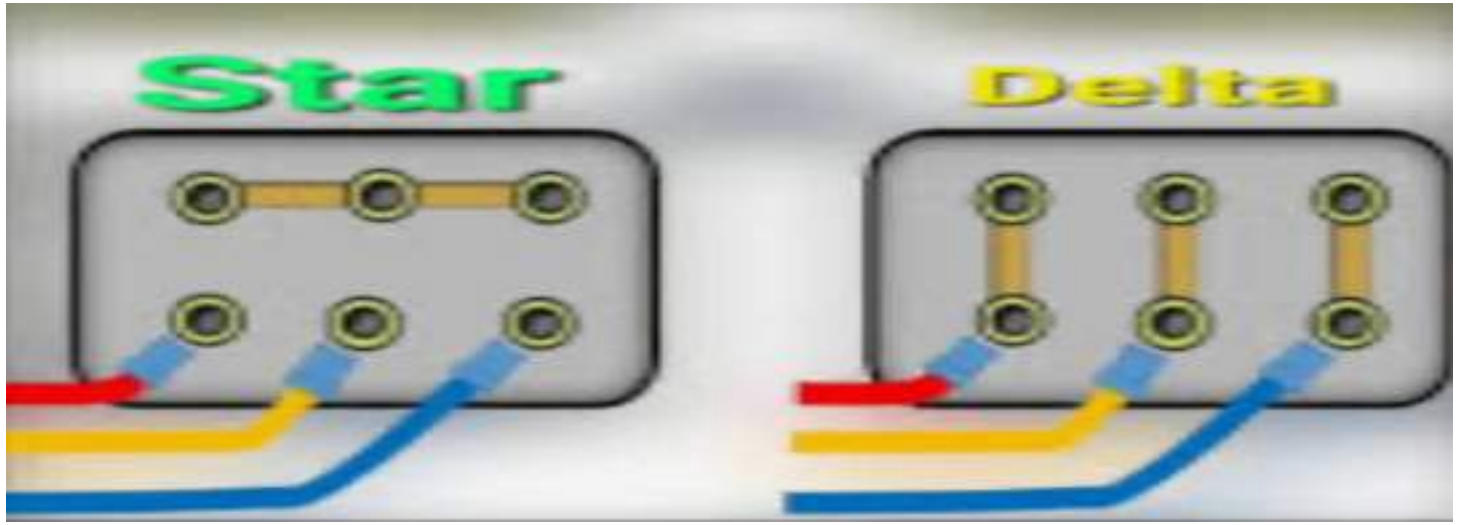
ربط دلتا-ستار

DELTA-STA CONNECTION

الأهداف السلوكية

- سيكون الطالب قادرا على تبسيط الشبكات ذات الربط دلتا او ستار
- سيكون الطالب قادرا على تحويل الربط من دلتا الى ستار والعكس بالعكس

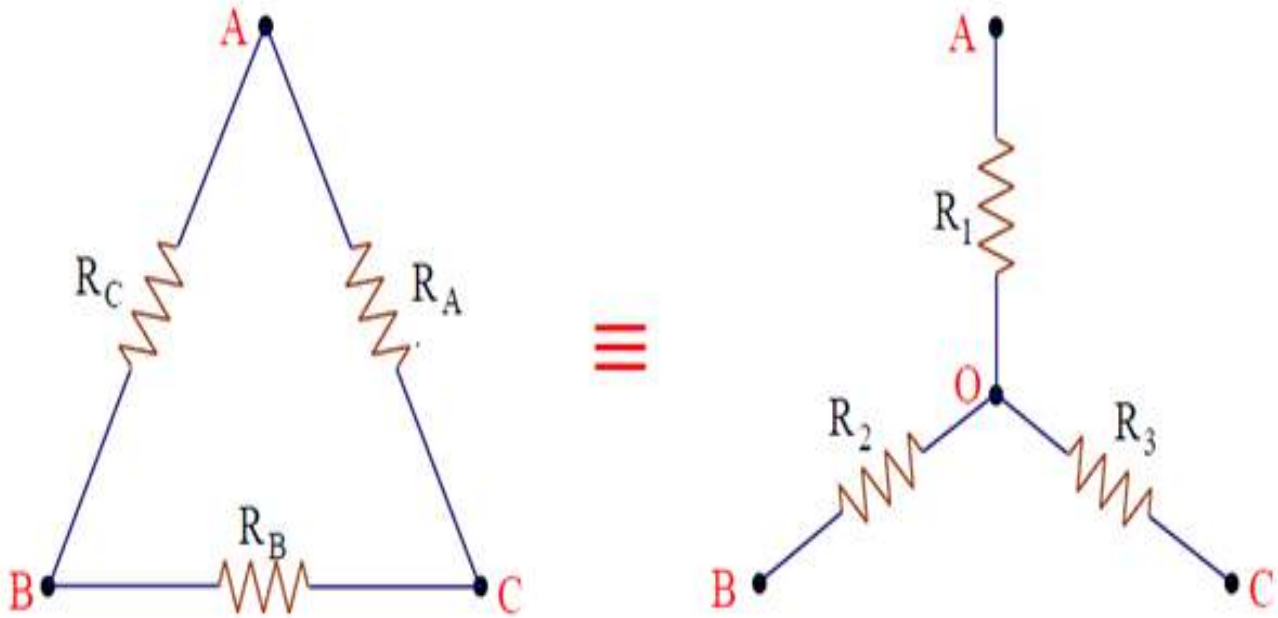
الاختبار القبلي



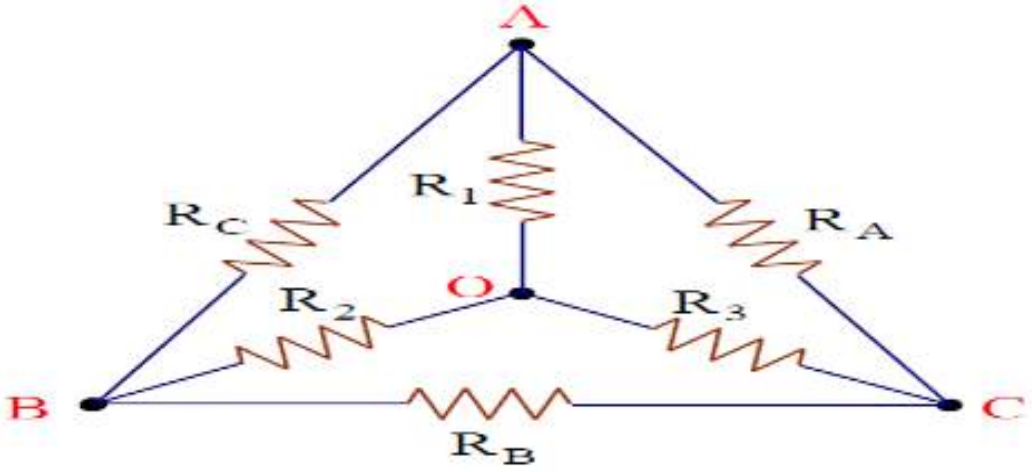
هل سألت نفسك يوما عن نوع الربط المستخدم في قاطع الدورة المستخدم في المنازل ؟ وهل توصلت الى إجابة ؟

DELTA-STAR CONNECTION

In solving networks having considerable number of branches; one same times due to a large number of equations that have to be solved. This complicated network can be simplified by



DELTA TO STAR CONNECTION



$$R_1 = \frac{R_A R_C}{R_A + R_B + R_C}$$

$$R_2 = \frac{R_B R_C}{R_A + R_B + R_C}$$

$$R_3 = \frac{R_C R_A}{R_A + R_B + R_C}$$

DELTA TO STAR CONVERSSION

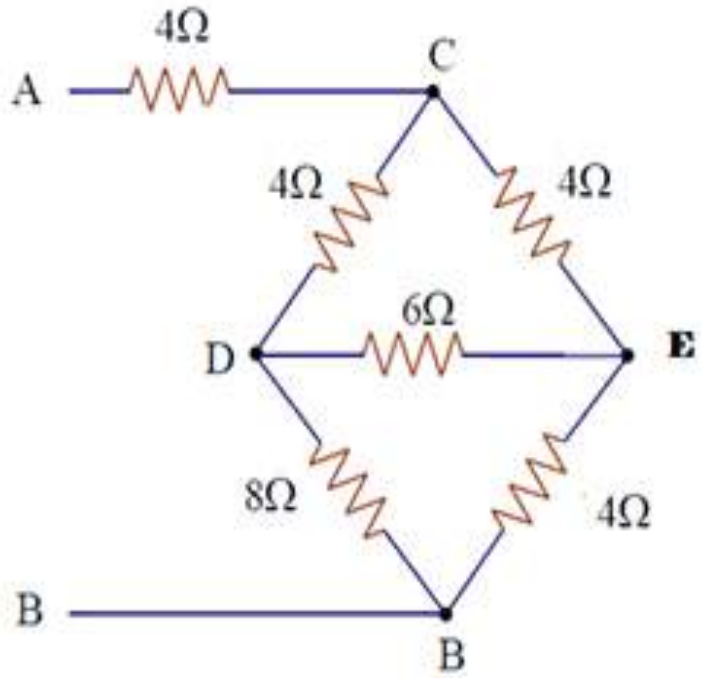
$$R_A = R_1 + R_3 + \frac{R_1 R_3}{R_2}$$

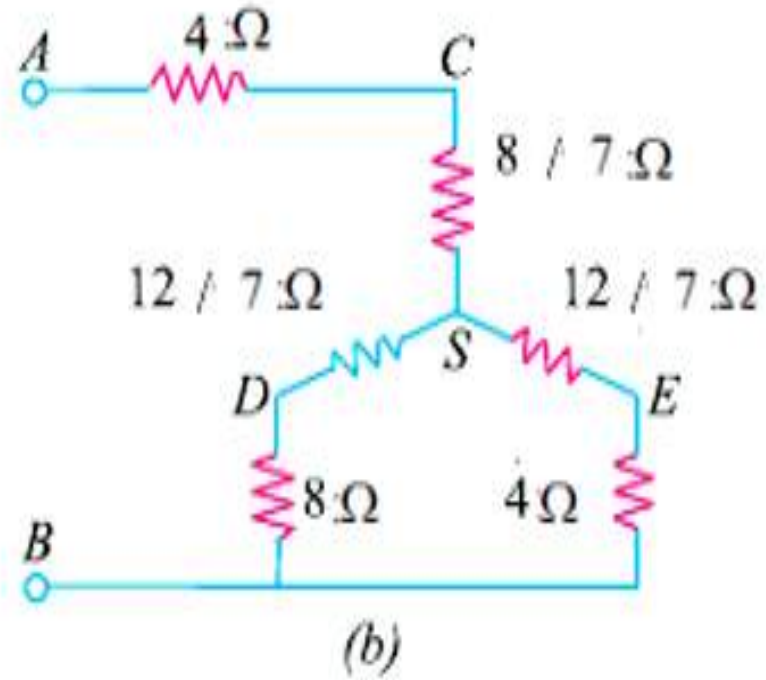
$$R_B = R_2 + R_3 + \frac{R_2 R_3}{R_1}$$

$$R_C = R_1 + R_2 + \frac{R_1 R_2}{R_3}$$

EXAMPLE 1: Find the total resistance .between the points A and B of figure below

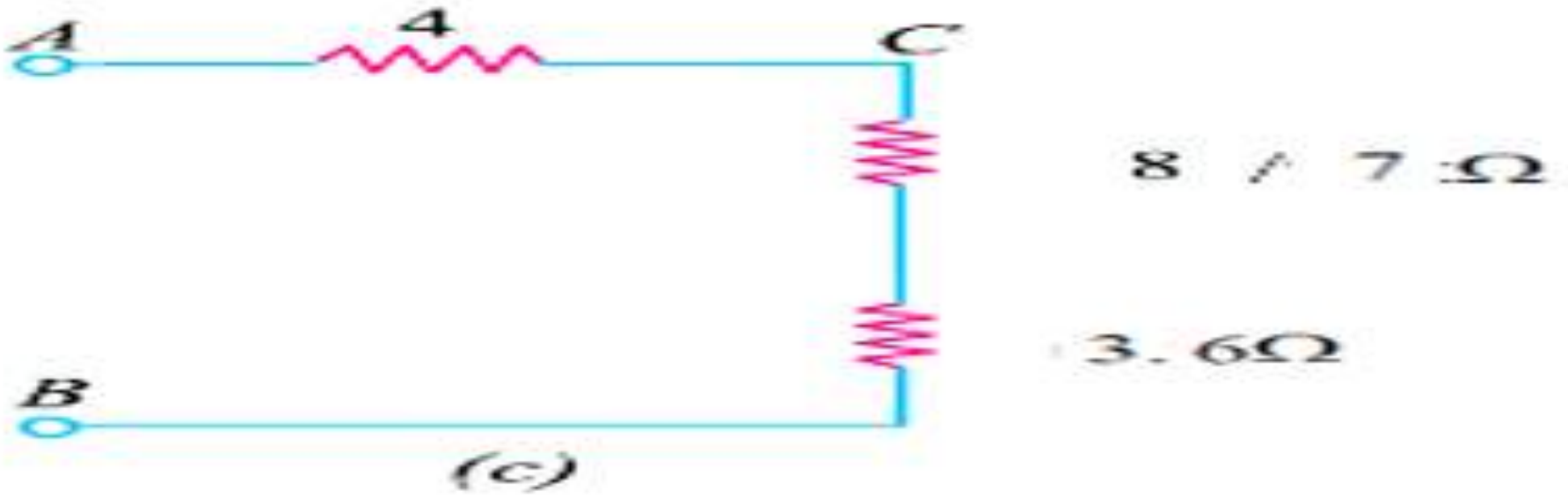
:SOLUTION



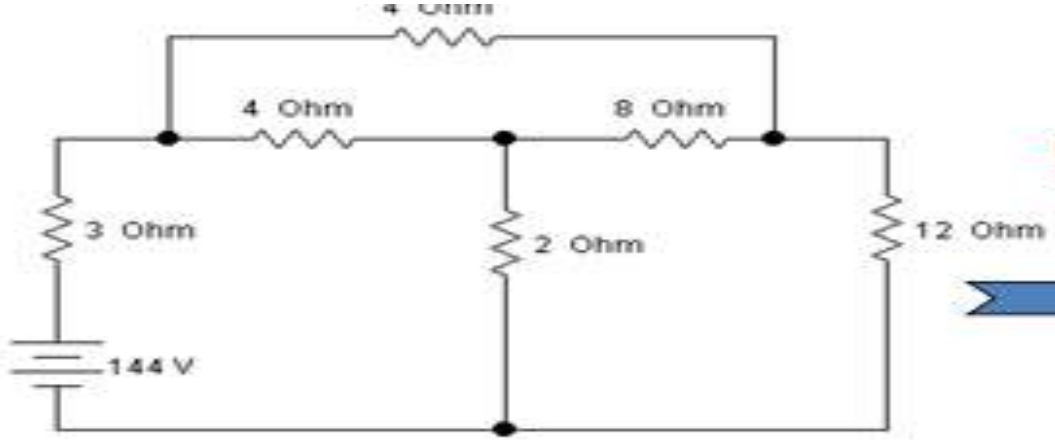


As seen from figure(c):

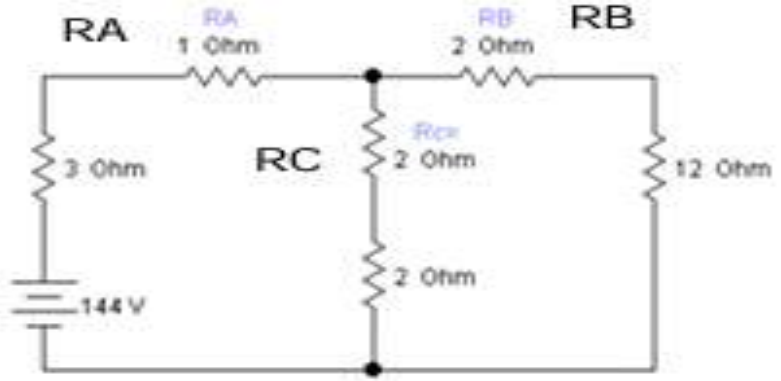
$R_{AB} = 4 + (8\ 7/) + (3.6) = 8.6\Omega$



Example 2: For the cct. shown below .calculate (IT)



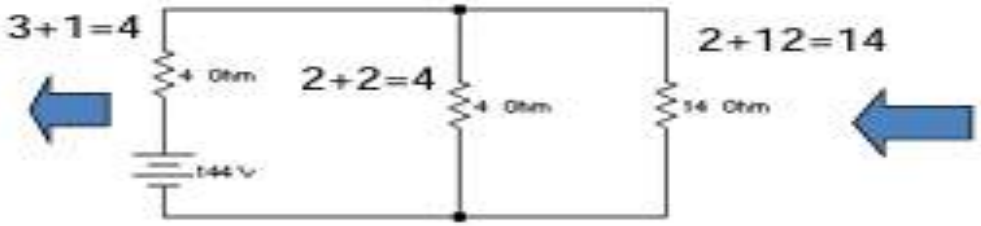
Solution ;



$$R_A = \frac{4x4}{16} = 1 \text{ ohm}$$

$$R_B = \frac{4x8}{16} = 2 \text{ ohm}$$

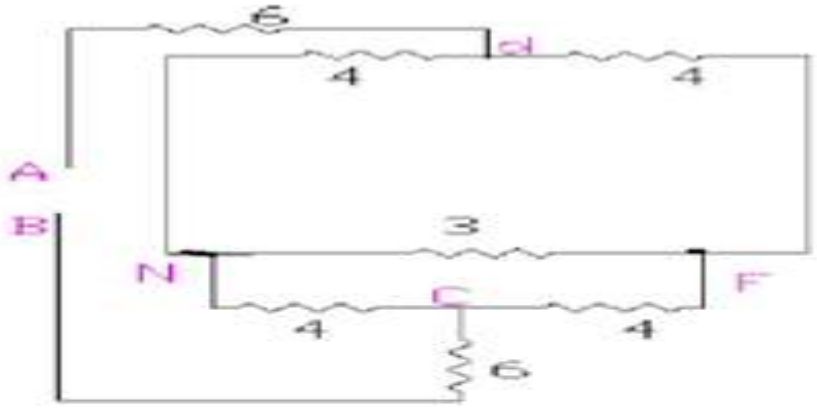
$$R_C = \frac{4x8}{16} = 2 \text{ ohm}$$

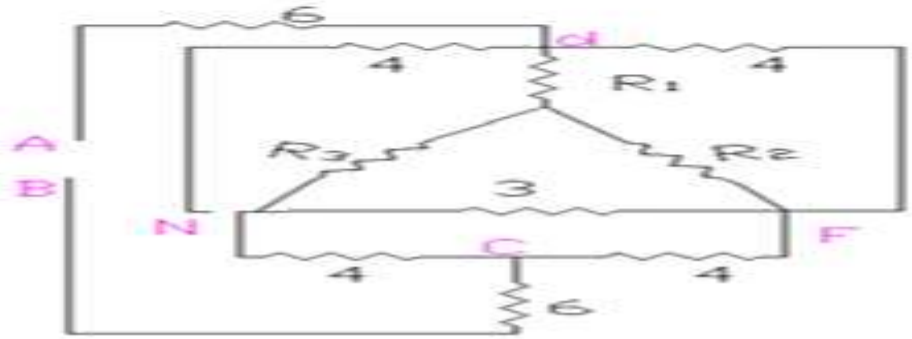


$$R_T = \frac{4x14}{4+14} + 4 = 7.111$$

$$I_T = 144/7.111 = 20.25 \text{ A}$$

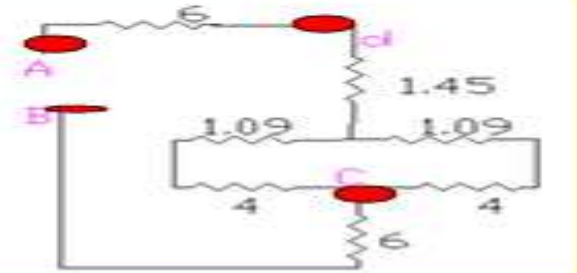
For the circuit shown below find Rt between A&B





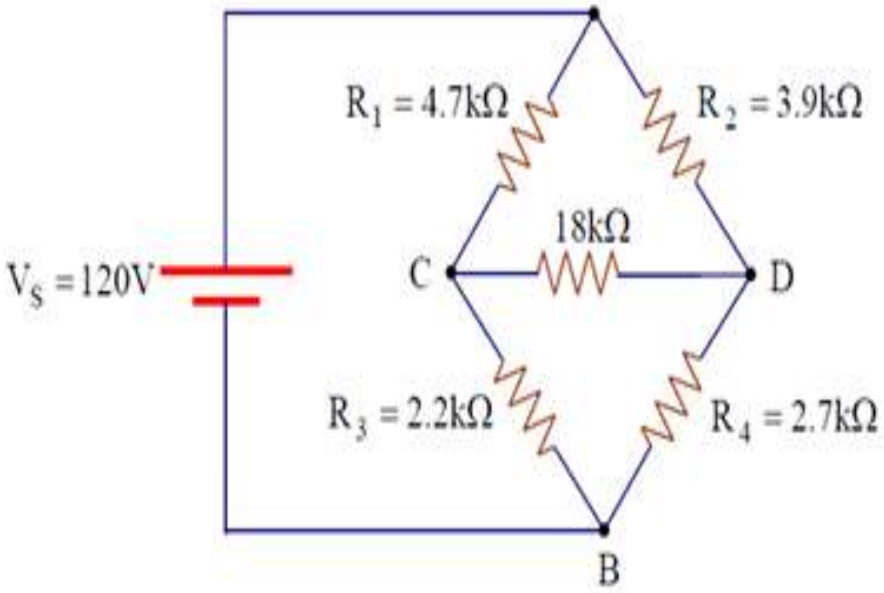
solution

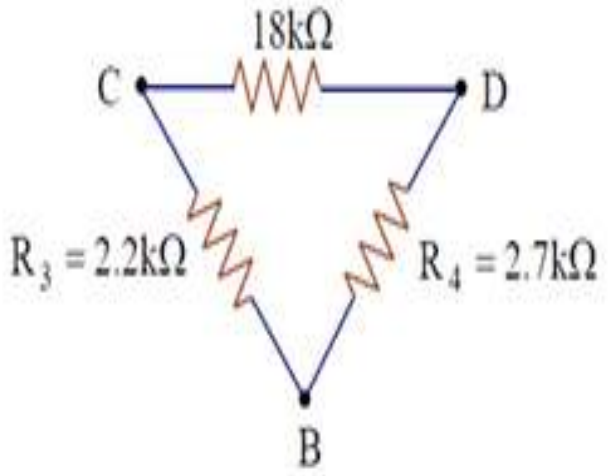
R1=4x4/(4+4+3)=1.45Ω
R2=4x3/(11)=1.09 Ω
R3=4x3/(11)=1.09 Ω
Rx=6+1.45= 7.45 Ω
Ry=1.09+4=5.09 Ω
Rz =1.09+4=5.09 Ω
R//=(5.09x5.09)/(5.09+5.09)
2.54Ω :.RT=16Ω



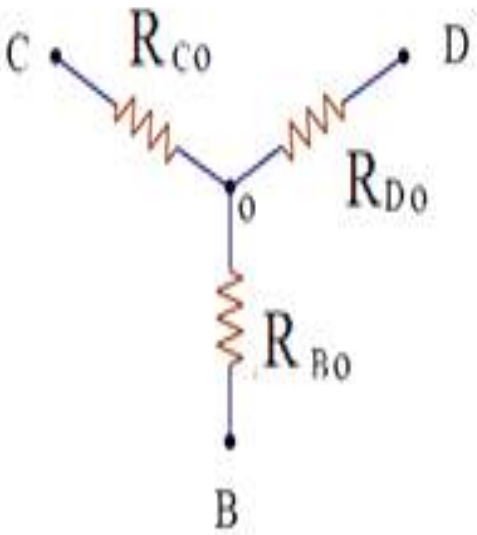
نشاط تفاعلي مع الطلبة

for the circuit shown in figure ; find the current passing through (R L = 18 KΩ)





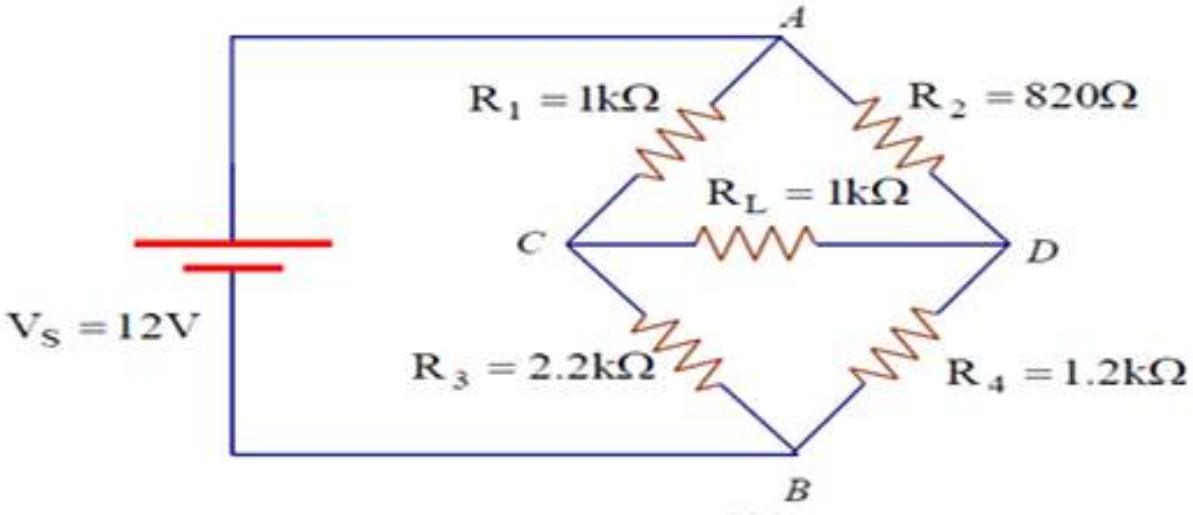
≡



الاختبار البعدي

H.W :For the circuit shown in figure find the current passing through (RL=1KΩ).

يرجى رفع الإجابة على الرابط ادناه (سيبقى الرابط مفتوحا لمدة 24 ساعة)



https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/a/NzY1NzE1MTAxMDc4/details

Google Classroom

لفهم المحاضرة اكثر يمكنك الاستفادة من رابط اليوتيوب المبين ادناه

https://youtu.be/YJlSmJp2wAw?si=V2-_2GtWNuSBrz3q

الأسبوع الرابع
قوانين كيرشوف

:RATIONAL

It is very important to study -

Kirchhoff's laws

.Also to study Maxwell's method -

:CENTRAL IDEA

- Definition Kirchhoff's current law in
. any electric point
- Definition Kirchhoff's voltage law in
. any electric closed circuit
- To learn Maxwell's loops by using
.Kirchhoff's voltage law

الأهداف السلوكية

AT THE END of this lecture the student be able to identify the analyses net work by using Kirchhoff's laws

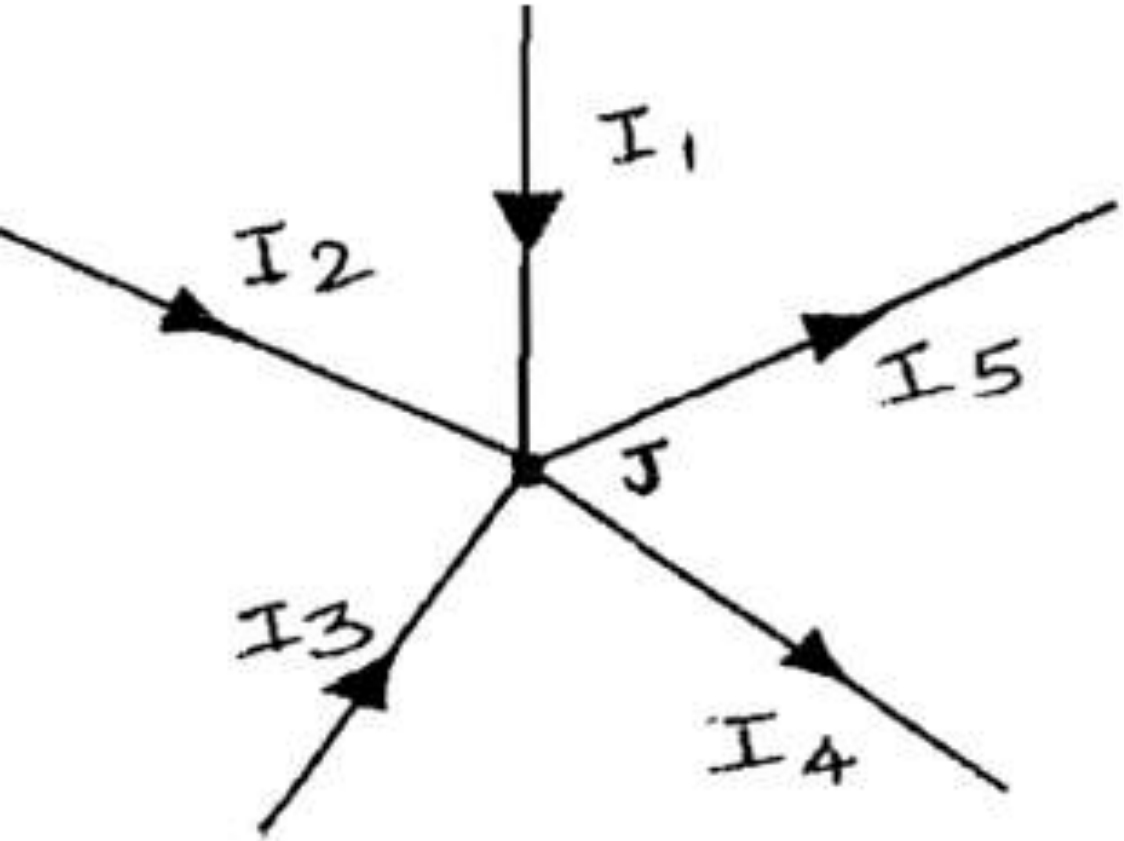
اللاختبار القبلي

ماذا تعني لك المعادلة ادناه؟

Kirchhoff's first law

$$\sum I_{in} = \sum I_{out}$$

:Kirchoff's law



Kirchoff's law is used to find out the current flow in the network circuits easily where Ohm's law is not applicable. It .is applicable both for DC an AC circuits

:Current law

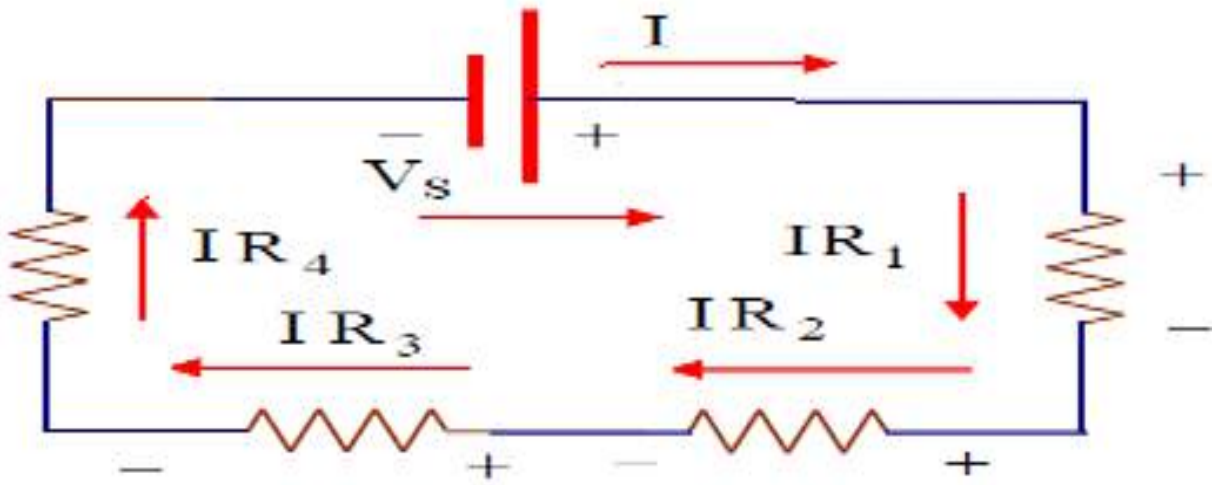
The sum of the current flowing towards a junction (node) is equal to the sum of the currents flowing away from it. This is called Kirchoff's current Law(K.C.L)

$I1+I2+I3-I4-I5=0$ (this is known KCL equation)

:Voltage Law

At any closed circuit the potential drop (IR) at each resistance is equal to the total voltage given to the circuit. In a closed circuit, the sum of the potential drop is equal .to the sum of the potential rises

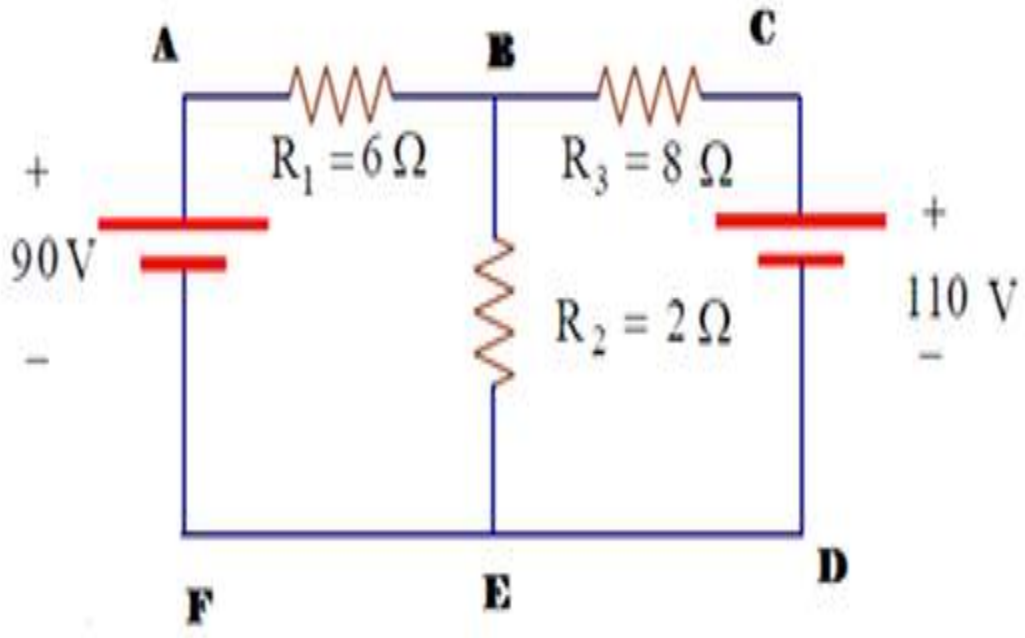
VS=IR1+IR2+IR3+IR4



Example: In the circuit of figure using Kirchoff's .laws, find the current in the various elements

:SOLUTION

According to Kirchoff's first law mark the direction of current flow. According to second law, Write down the KVL equation in the closed circuits



ABEFA forms a closed circuit (LOOP 1)

$6I1+2(I1+I2)=90$

$6I1+2I1+2I2=90$

$8I1+2I2=90$ ––– (1)

CBEDC forms another closed circuit(LOOP2)

$8I2+2(I1+I2)=110$

$8I2+2I1+2I2=110$

$2I1+10I2=110$ ––– (2)

.To solve, equation(2) is multiplied by 4

$8I1+40I2=440$ –––(3)

subtracted eq (1)from eq (3)

$8I1+2I2=90$ –––(1)

$8I1+40I2=440$

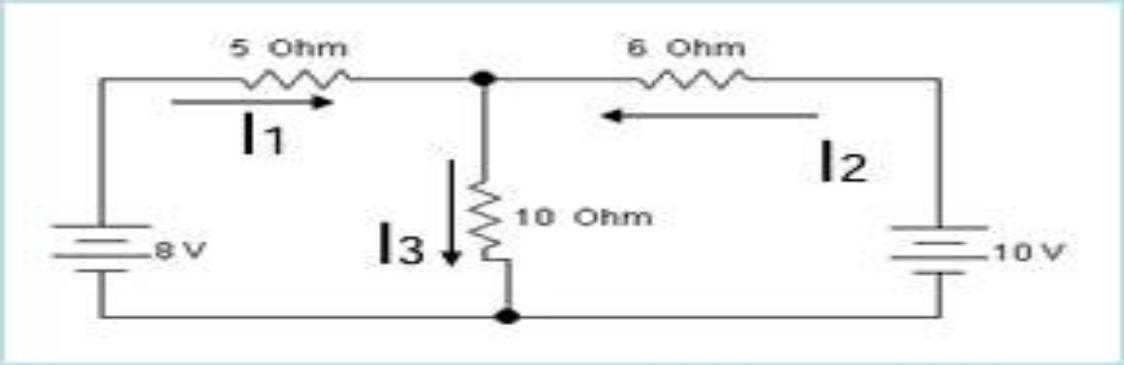
$38I2=-350-$

$8I2=350 \Longrightarrow I2=350\ 38\ =9.211A$ Substitute the I2 value in equation (1) $\therefore I1+2(9.211)=90$

$I1+18.422=90$

$I1=90-18.42$

For the circuit shown find the current through :each resistance



$I_1+I_2=I_3$....(1) $8= 5I_1+10I_3$...(2)

$10=10I_3+6I_2$....(3) then $8= 5I_1+10(I_1+I_2)$

$8=15I_1+10I_2$...(4) and at eq.(3)

$6I_2+10(I_1+I_2)=10$ $6I_2+10I_1+10I_2=10$

Then **$16I_2+10I_1=10$**.... (.. /2) , $5I_1 + 8I_2=5$,(x3) **$15I_1+24I_2=15$**

(الطرح)**$-15I_1+(-)10I_2=-8$..**

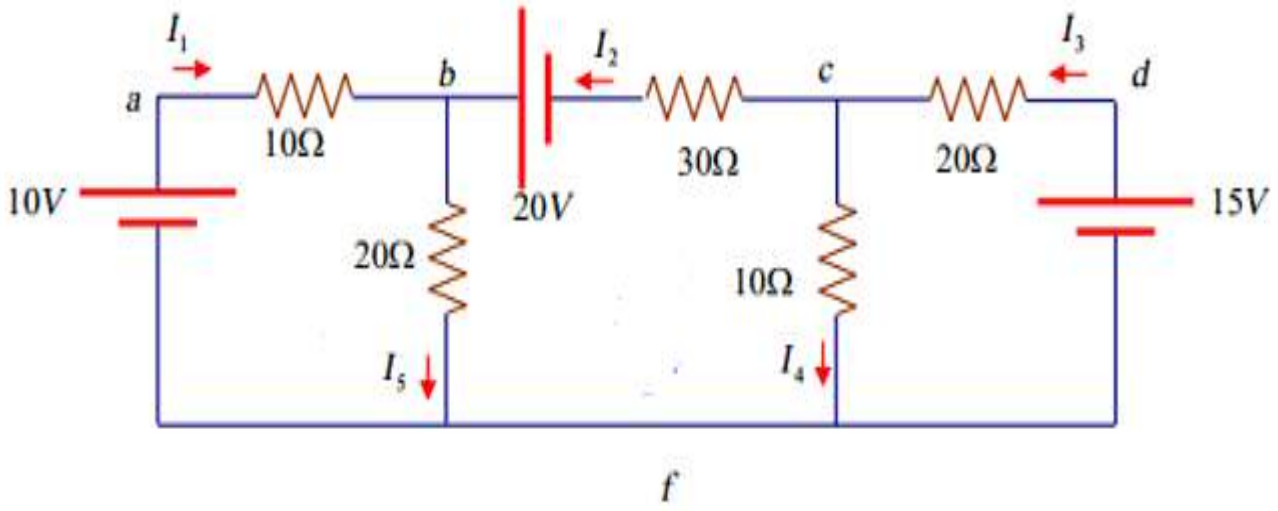
$14I_2=7$, $I_2=0.5A$ and in eq ..(4) $15I_1+5=8$, $I_1=0.2A$, $I_3=0.2+0.5=0.7A$

نشاط جماعي

3

نشاط تفاعلي داخل القاعةمدة النشاط
(3دقائق فقط)

by using Kirchoff's laws find the currents
. in each resistors for the circuit shown



2

Currents method

مدارات ماكسويل

طريقة التيارات

Aim of lecture : To let the student be able to identify the analyses net work by using Maxwell's method.

تيارات ماكسويل الدوارة

:Solution

:At loop(1)

I1-3I2=20-5 8I1-3I2=15……(1)(5+3)

:At loop (2)

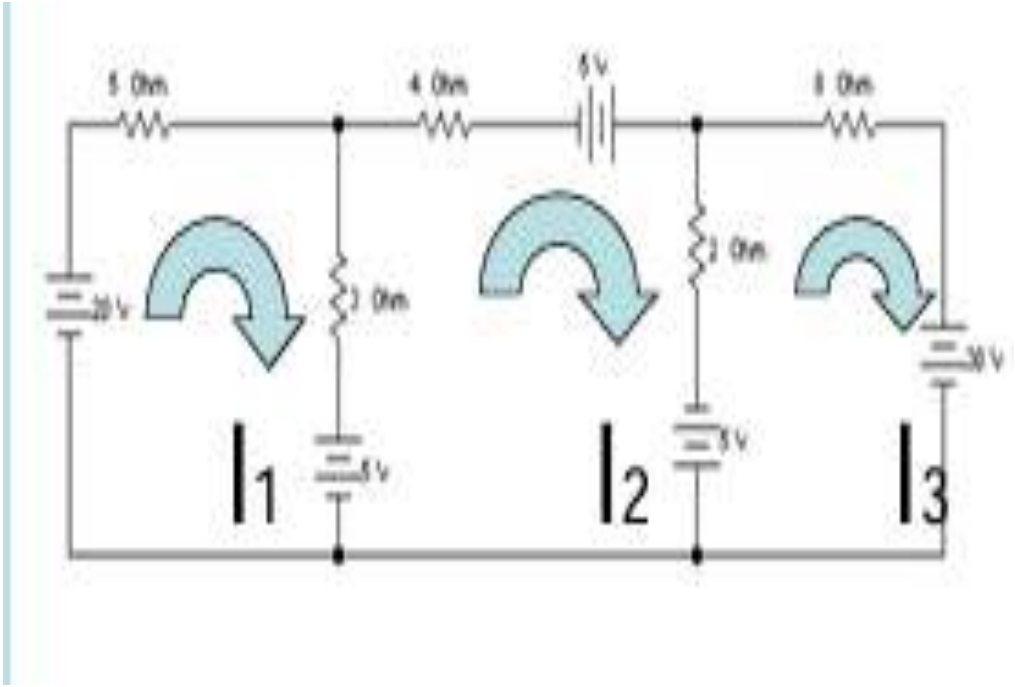
I2-3I1-2I3=5+5+5 -3I1+9I2-2I3=15…..(2)(3+4+2)

:At loop (3)

I3-2I2=-30-5 -2I2+10I3=-35…..(3)(2+8)

Then we find I1,I2,I3

I1=54.64A , I2=145.3A , I3=24.64A



(B) : For the circuit shown using Maxwell's loop to find (I_1, I_2, I_3)

Solution

$30I_1-10I_2-10I_3=100$ ...(1)

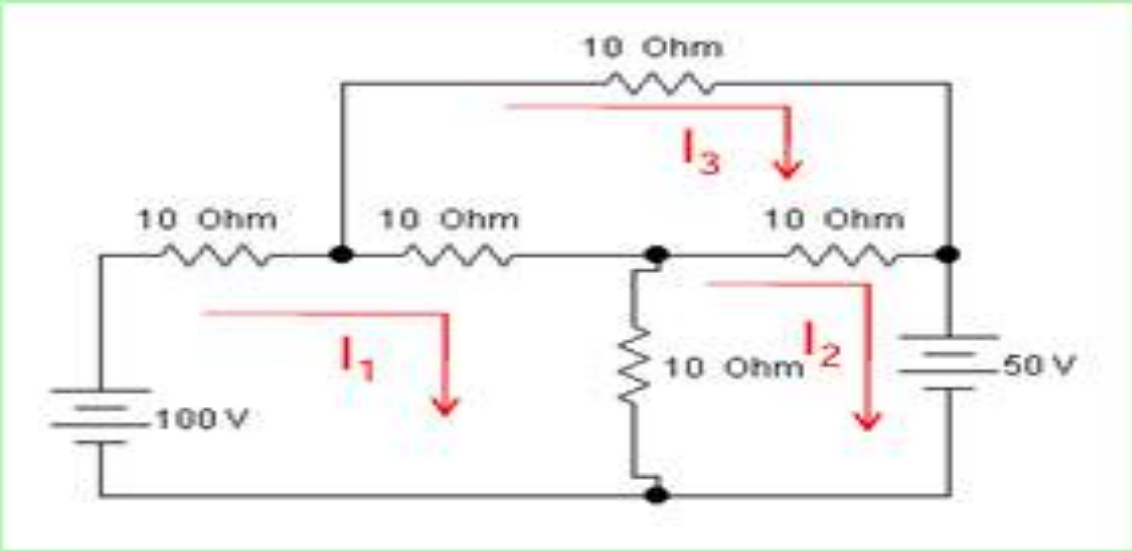
$20I_2-10I_1-10I_3=-50$ ....(2)

$30I_3-10I_1-10I_2=0$ ...(3)

$\therefore 10I_3-I_1-I_2=0$, (eq.2-eq.1);

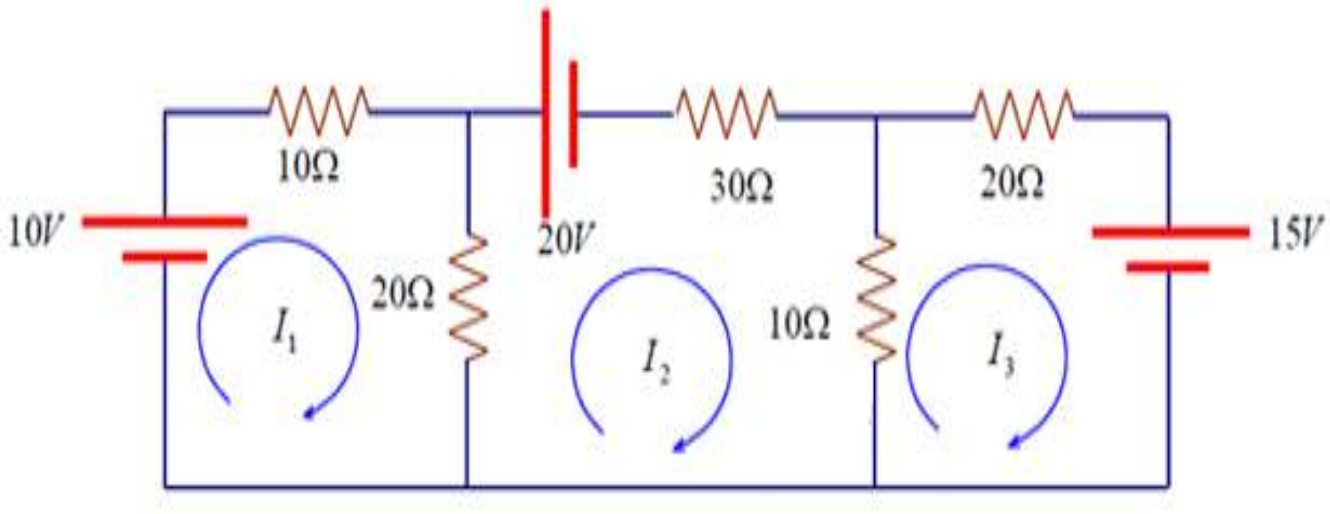
$40I_1-30I_2=150$

$\therefore 4I_1-3I_2=15$...(4) eq.(1)x3and the result + with eq.(3);



الاختبار البعدي

H.W. find the current in each resistor by using MAXWELL`s current loop.



ملاحظة : يرفع الحل على منصة الكلاسروم على الرابط أدناه خلال 24 ساعة

https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/a/NzgzOTI0NTUyMDk5/details

للاستفادة اكثر يمكنك الاطلاع على رابط اليوتيوب الموجود ادناه:

https://youtu.be/Swem4jghWZM?si=Eo0pJHPbedpVLU17

رابط توضيحي لتحليل الدوائر الكهربائية باستخدام تيارات ماكسويل الدوارة

المحاضرة الخامسة

نظرية ثيفنن

Thevenin theorem

:Rational

It is very important to study

.Thevinins theorem

Also to study how apply the three

. step to the save theorem

:Centeral idea

. Definition Thevinins theorem •

How we find the current at each• resistance in the net work by the .above theorem

الأهداف السلوكية

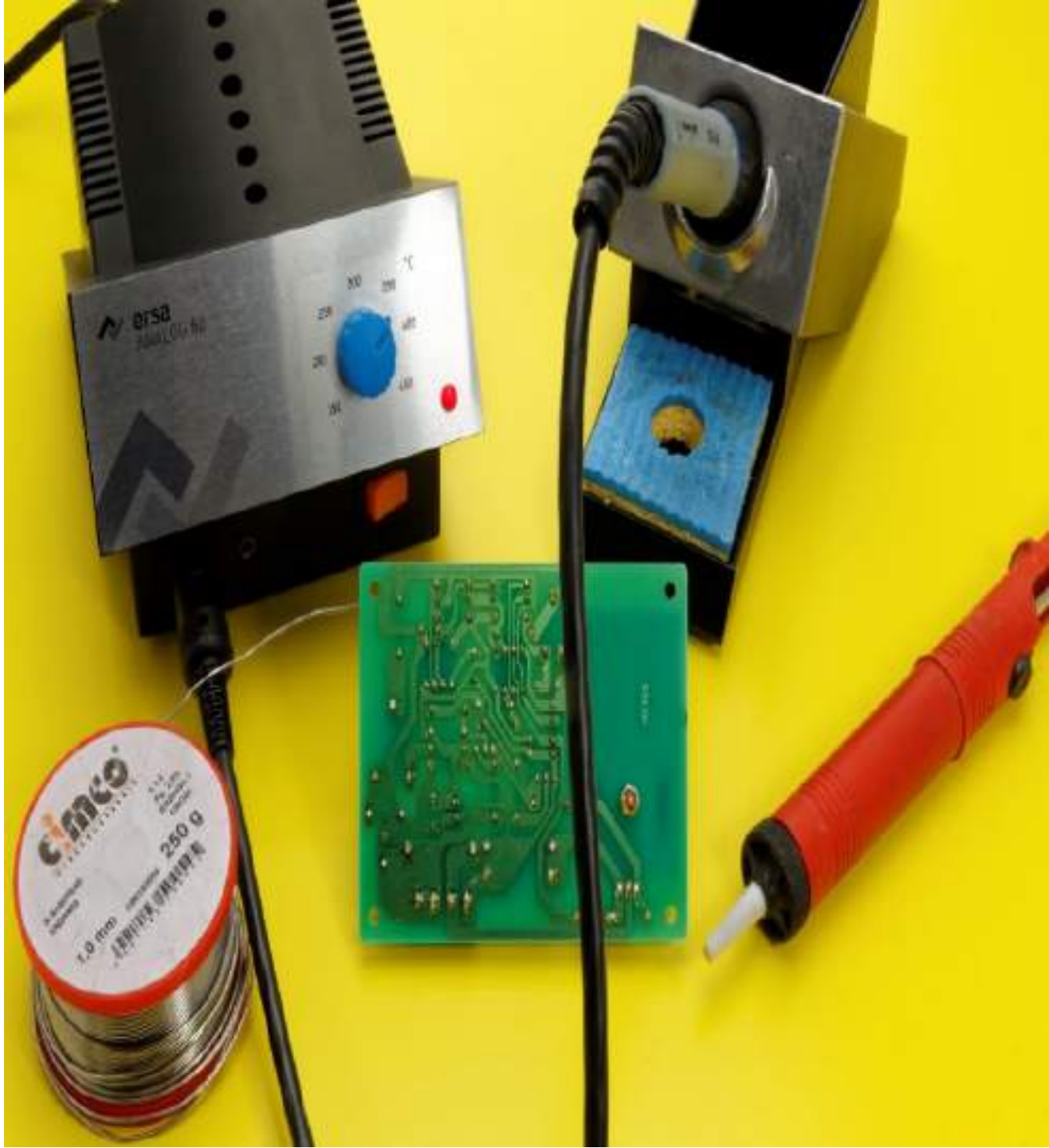
في نهاية هذه المحاضرة سيكون الطالب قادرا على

- معرفة المبادئ الأساسية لنظرية ثفنن
- تحليل الدوائر الخطية باستخدام نظرية ثفنن

الاختبار القبلي:

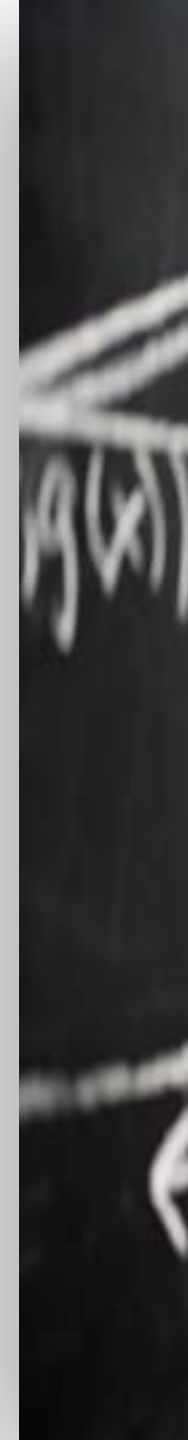
هل يمكن ان نختزل دائرة كهربائية تحتوي على العديد من المصادر والمقاومات الى دائرة تحتوي على مصدر فولتية واحد على التوالي مع مقاومة ؟
كيف؟

(الإجابة مباشرة داخل القاعه)



Thevenin’s theorem

Statement: A linear network consisting of a number of voltage sources and resistances can be replaced by an equivalent network having a single voltage source called Thevenin’s voltage (VTh) and a single .resistance called Thevenin’s resistance (RTh)



EXPLANATION :

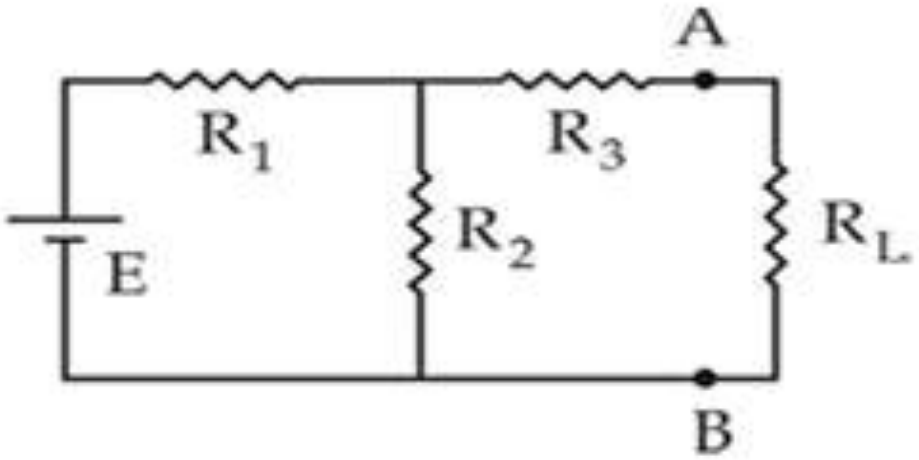
Consider a network or a circuit as shown figure (a)

Let E be the emf of the cell having its internal resistance r = 0 . . RLload resistance The load resistance (RL) is removed figure (b).the current (I) in the circuit is

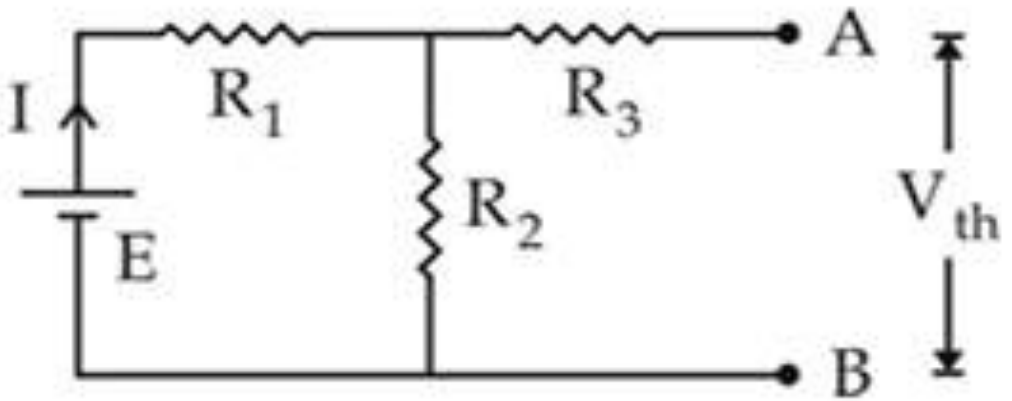
I= $E/(R1+R2)$ The voltage across AB = Thevenin's voltage

(VTh) $V_{Th}=V_{AB}=I\times R2=E\times \frac{R2}{R1+R2}$

$V_{Th}=V_{AB}=I\times R2=E\times \frac{R2}{R1+R2}$

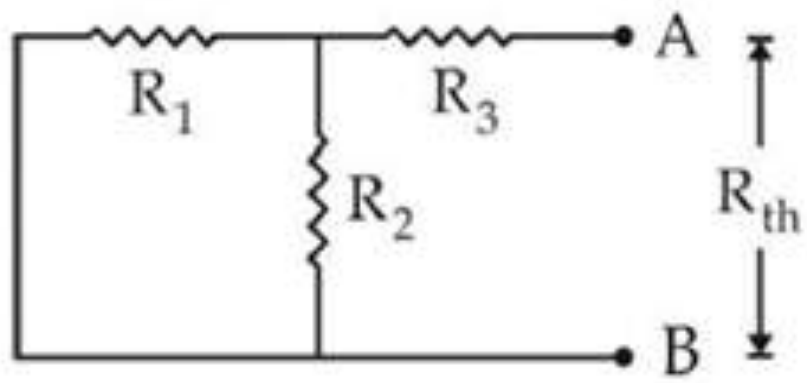


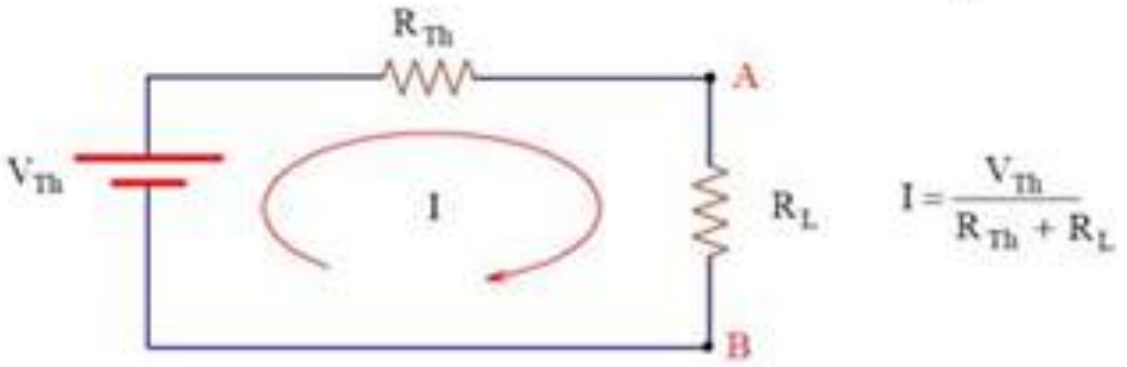
a



b

:To find RTh





$$R_{Th} = R_3 + \frac{R_1 \times R_2}{R_1 + R_2}$$

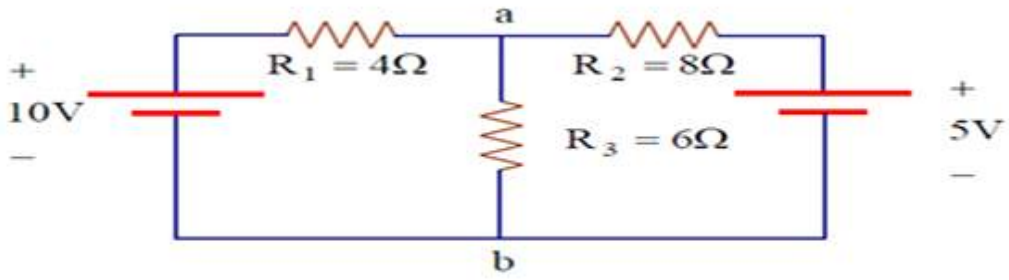
Example: For the circuit in figure find the .current in (R=6Ω)by using Thevenin's theorem

:SOLUTION

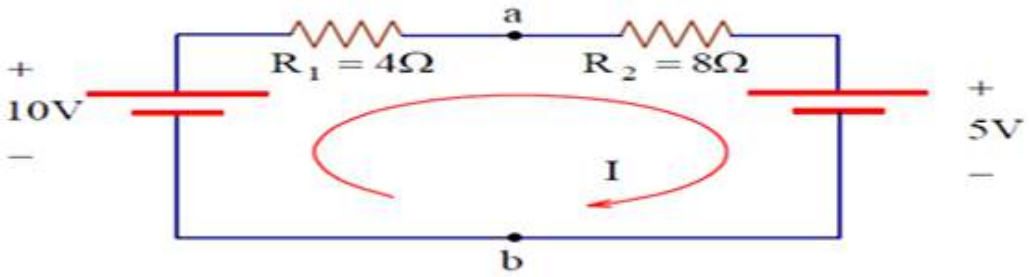
10-5=I(**4+8**)⇒ I=) **5/ 12**(A

VTh=**10−4×(5/ 12) =8.33**V

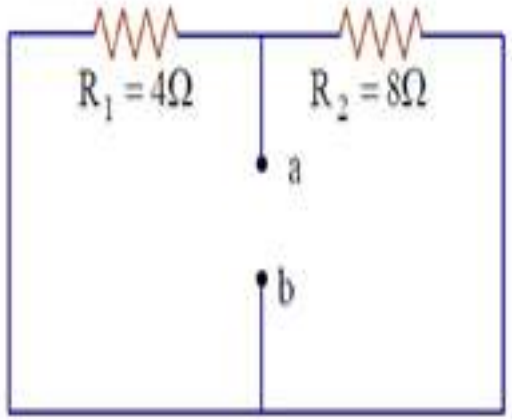
or : VTh=**5+8×(5 /12)**

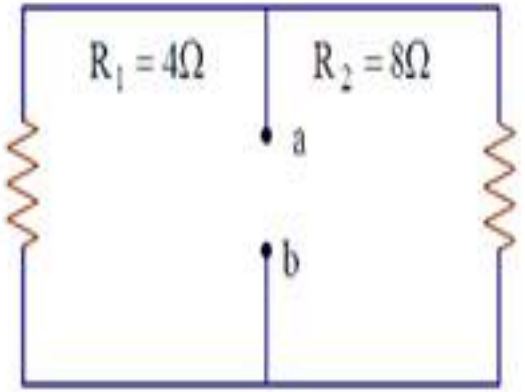


To find the (V_{Th})



Now to find **Rth**



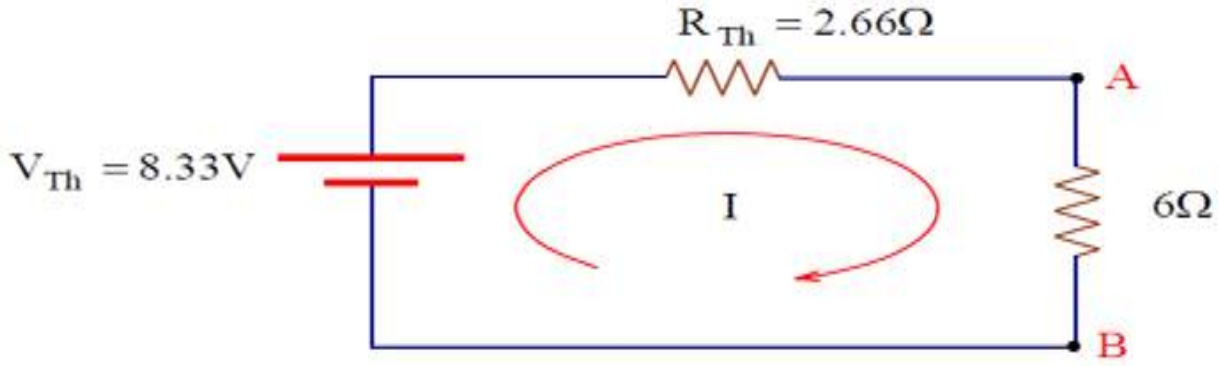


Rth= (4x8)/ (4+8)

Rth = 2.66**Ω**

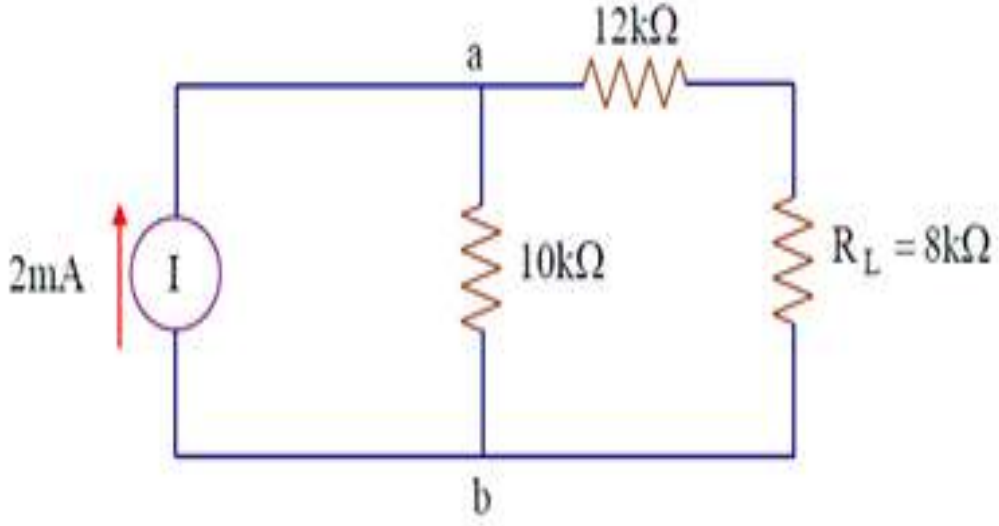
I (6Ω) =8.33/(2.66+6)

I =0.96 A

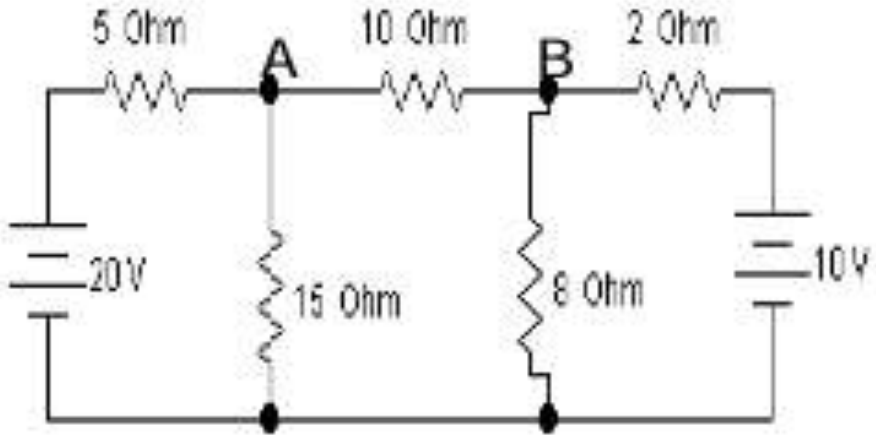


نشاط تفاعلي
(just 2S)

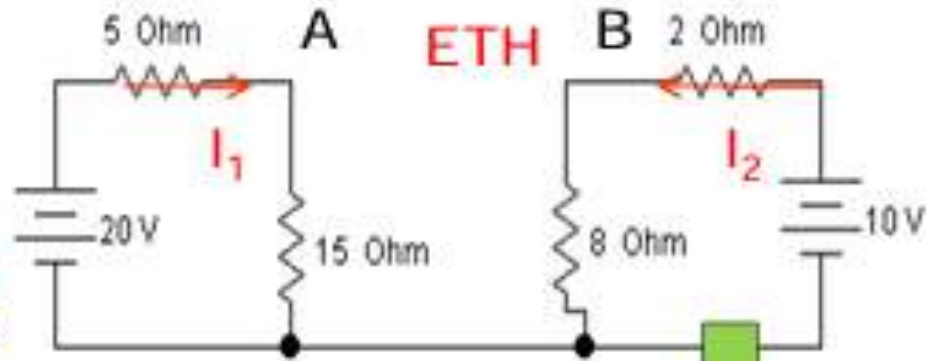
For the circuit in figure find the current in (R=8Ω)by using Thevenin's theorem



Home work : Using Thevenins theorem To Find (I_L) .



Solution



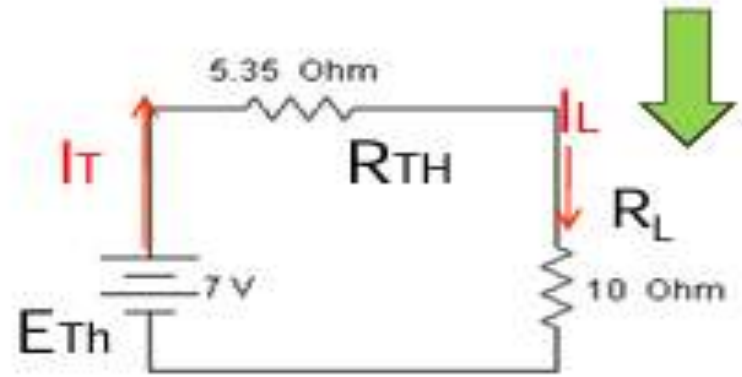
I_1=20/(5+15)=1A , $V_{at15\Omega}$ =1x15=15v

I_2=10/(2+10)=1A :. $V_{at8\Omega}$ =1x8=8v

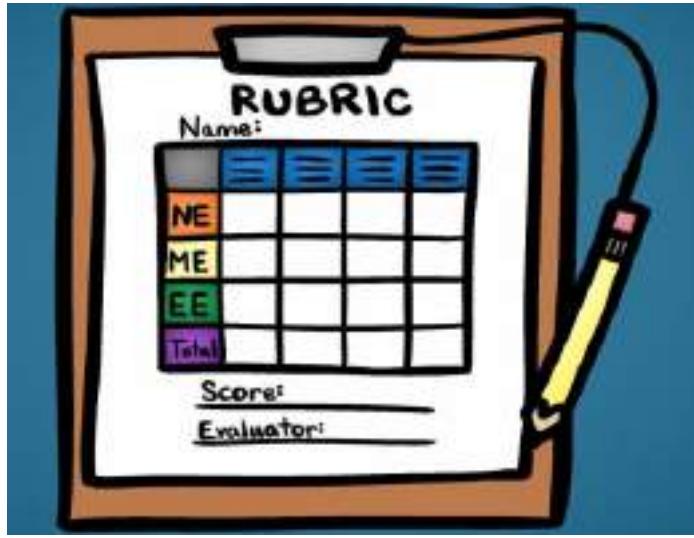
:. E_{th}=15-8=7v

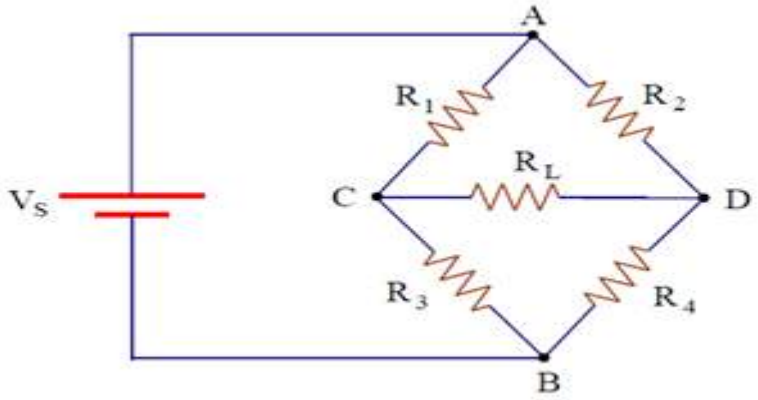
RTh=(5x15)/(5+15) +(8x2)/(8+2)=5.35Ω

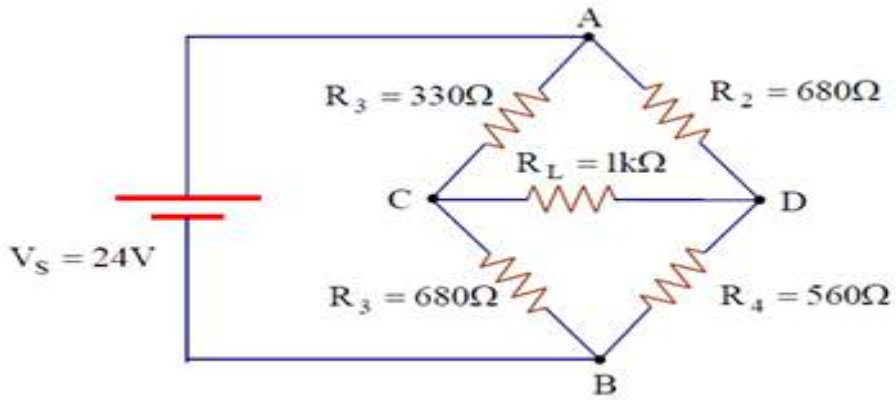
:. I_L=I_T=7/(5.35+10)=0.456 A



الاختبار البعدي





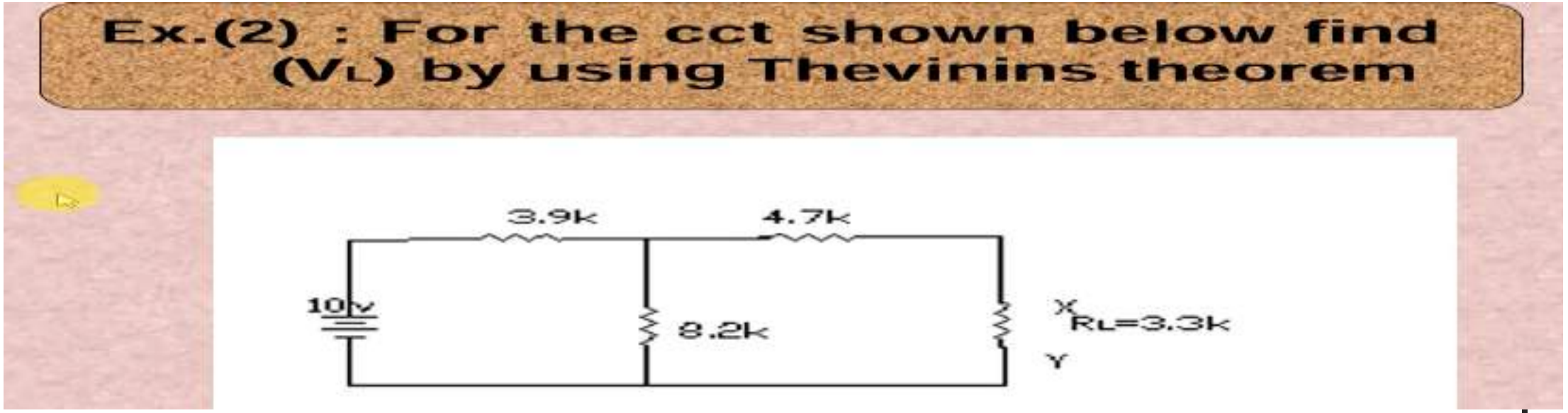


https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/a/NzY1NzU4NzU1NDEx/details

ملاحظة : يرفع الحل على الرابط اعلاه ويكون التصحيح ذاتيا باستخدام معاييرRUBRICS

يرجى الاطلاع على الفيديو ادناه (شرح مختصر لنظرية ثفنن)

https://youtu.be/StMuQgBtA2M




المحاضرة السادسة
نظرية نورتن
NORTON THEOREM

:Rational

It is very important to study -

.Norton's theorem

Also to study how apply the -

three step to the save

. theorem

:Central idea

. Definition Norton's theorem •

How we find the current at each•

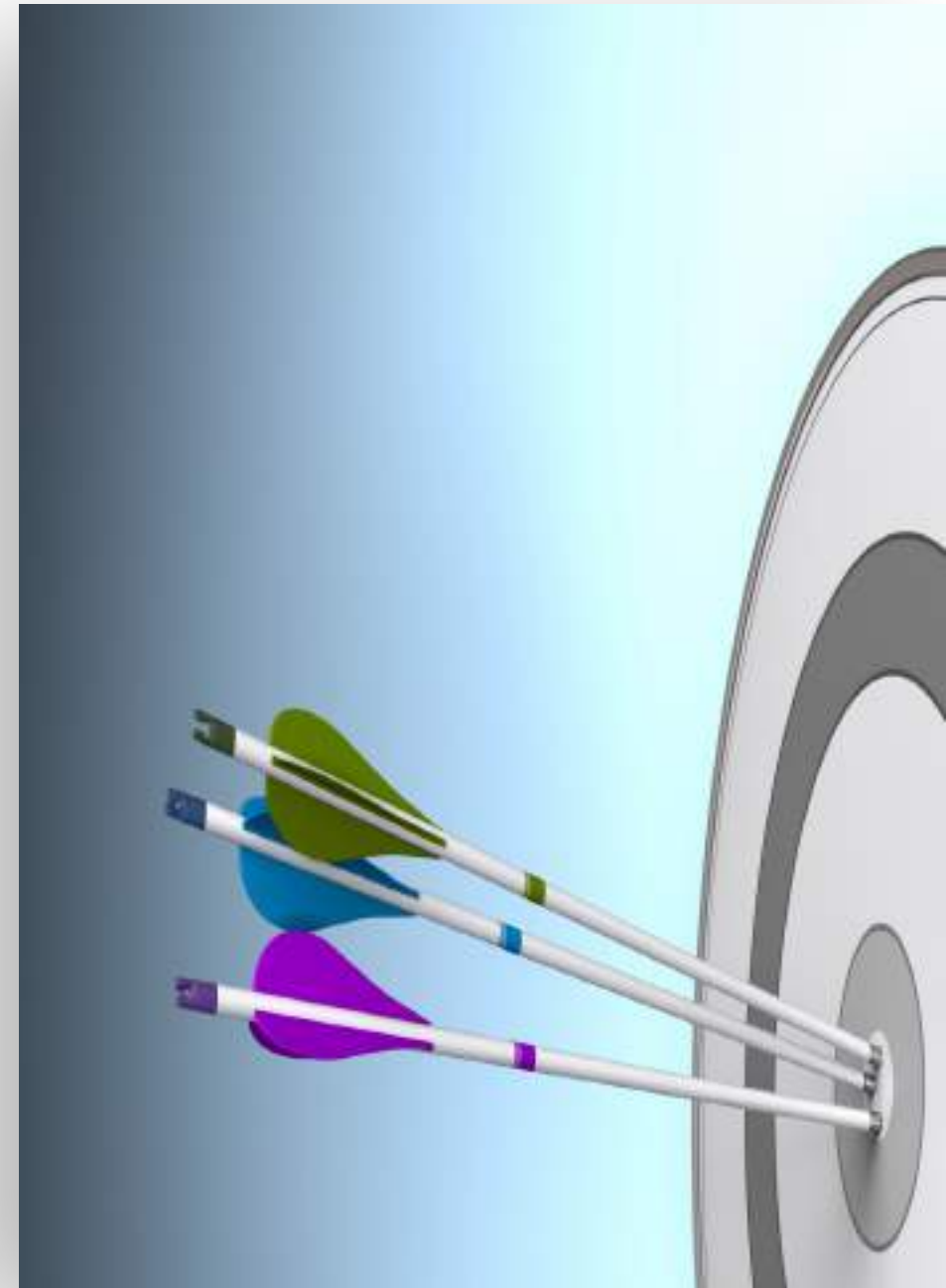
resistance in the net work by the

. above theorem

objectives

after ending of this lecture the student will be able to:

- understanding principles of Norton theorem
- analysing leaner circuit by using Norton theorm



Pretest ألاختبار القبلي

Define : short circuit , Open circuit

solution

Short circuit : هي دائرة القصر التي يمر فيها جميع التيارات لنفس الدائرة الكهربائية لعدم وجود مقاومة فيها أي أن قيمة مقاومتها تكون صفرا .

Open circuit هي الدائرة المفتوحة التي تكون مقاومتها مالا نهاية وقيمة التيار المار فيها يكون صفرا .

:Norton's Theorem

This theorem is an alternative to the .Thevenin's theorem

.In fact it is the dual of Thevenin's theorem

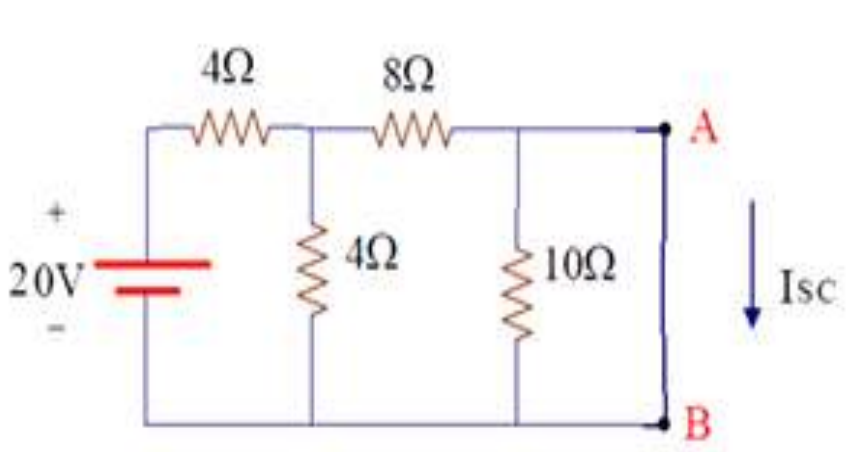
Whereas Thevenin's theorem reduces a two-terminal active network of linear resistances and generators to an equivalent constant-voltage source and series resistance. Norton's theorem replaces the network by an equivalent constant-current and a parallel .resistance

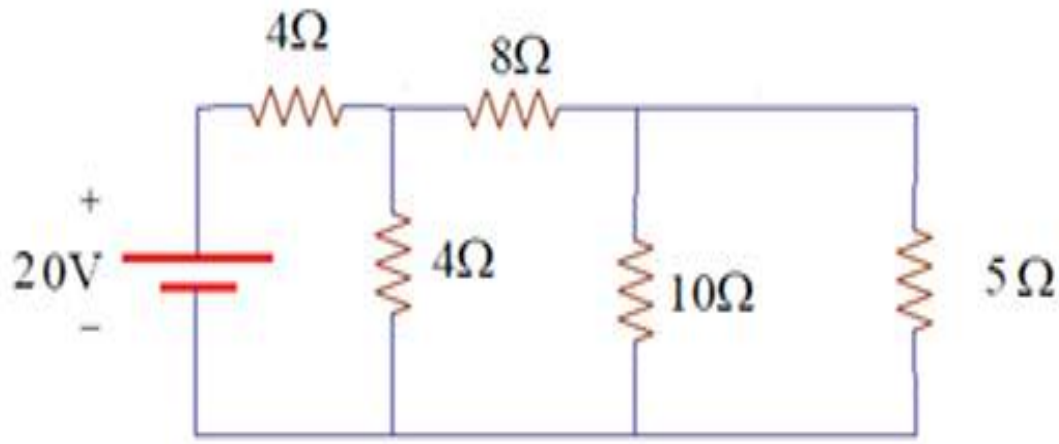
EXAMPLE:

Apply Norton's theorem to calculate current flowing through .5Ω resistor of figure (a) below

:SOLUTION

Remove 5Ω resistor and put a short circuit across terminals A and B as shown in .figure (b)





تكملة الحل :

.Let us find **ISC**

.I combination of(4Ω and 8Ω) in series with a 4Ω resistanc

$R_T = 4 + (4 \times 8) / 4 + 8 = (20 / 3)\ \Omega$

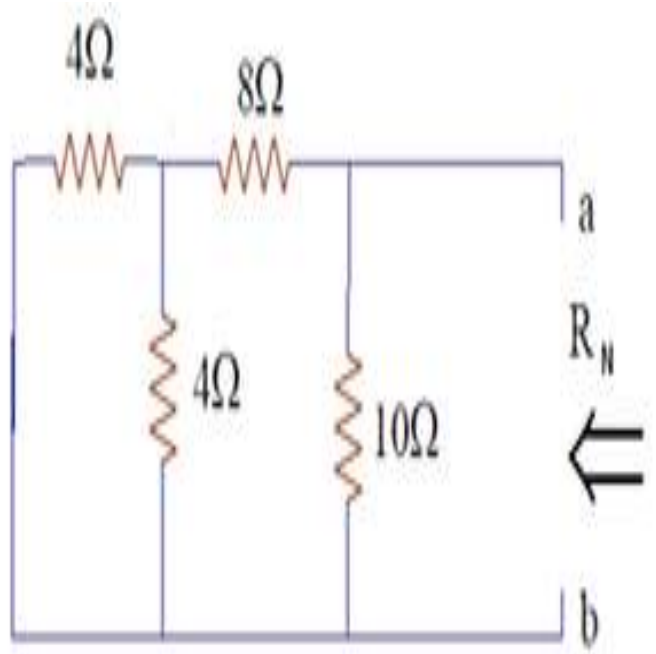
Hence $I = 20 / R_T = 20 / (20/3) = 3A$

$I_{SC} = 3 \times 4 / (4+8) = 1A$

In figure BESIDE battery has been removed by

:short circuit and Norton's resistance is

$5\Omega = 10 // [8 + (4//4)]$



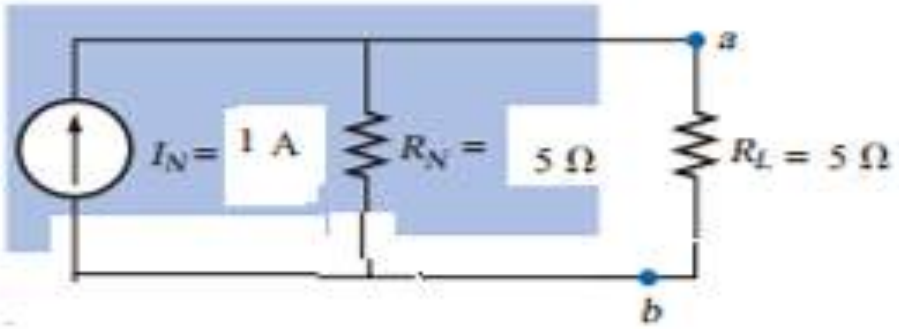
Hence; figure (e) gives Norton's equivalent circuit Now join 5Ω resistance back across terminals A and B.

: the current flowing through it is

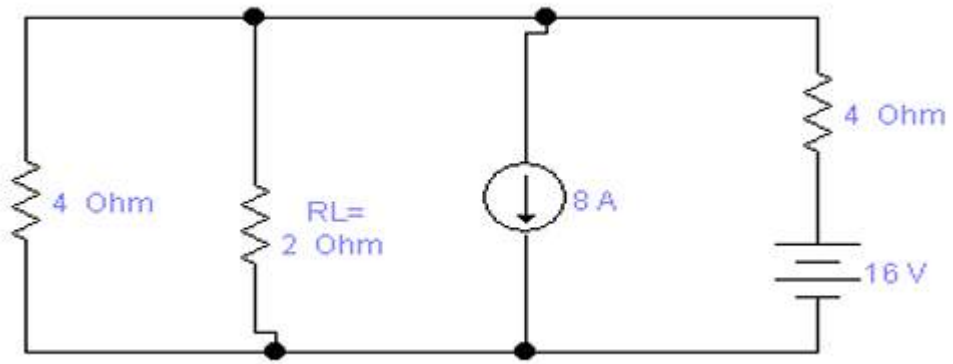
Hence; figure (e) gives Norton's equivalent circuit

Now join 5Ω resistance back across terminals A and B. the current flowing through it is:

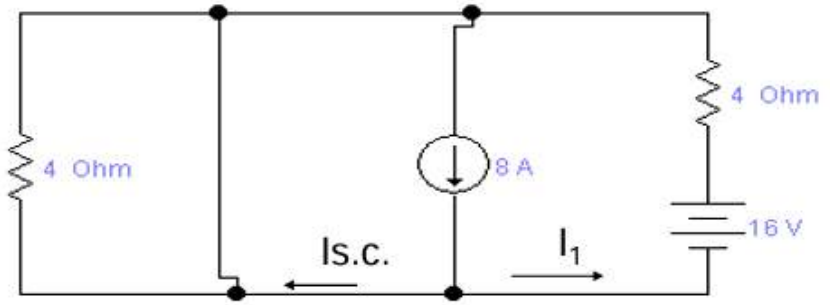
$$I = \frac{R_N I}{R_L + R_N} = \frac{(5\ \Omega)(1\ \text{A})}{5\ \Omega + 5\ \Omega} = 0.5\ \text{A}$$



Ex: find IL FOR THE CIRCUIT SHOWEN BY .USING NORTON THEOREM



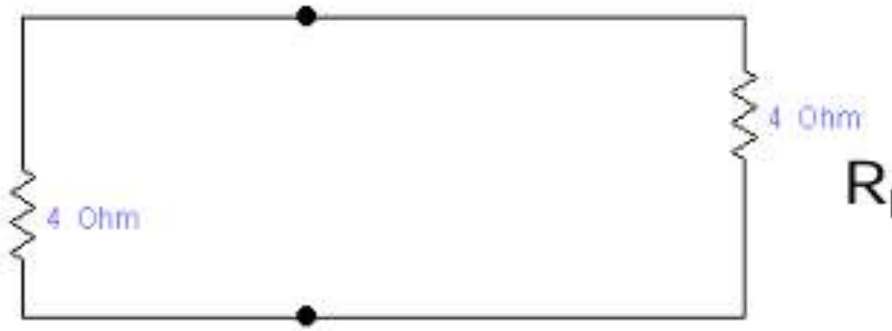
Solution; 1- To find $I_{s.c}$



$I_1 = 16/4 = 4A$ $\quad 8 - I_1 - I_{s.c} = o$ (K.c.L)

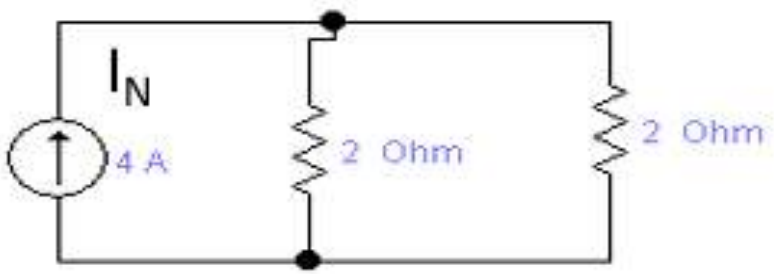
then; $I_{s.c.} = 4A = I_N$

2- TO find R_N :



$R_N=(4x4)/\ 8=\ 2Ω$

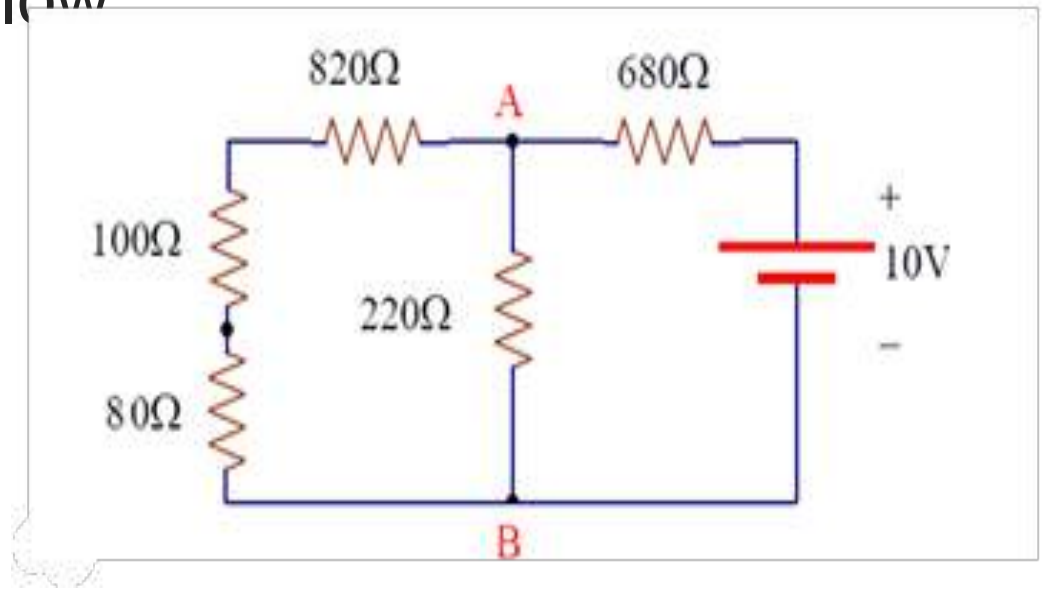
3- Drawing Norton's equivalent and calculate $I_{at\ RL=2\ ohm}$



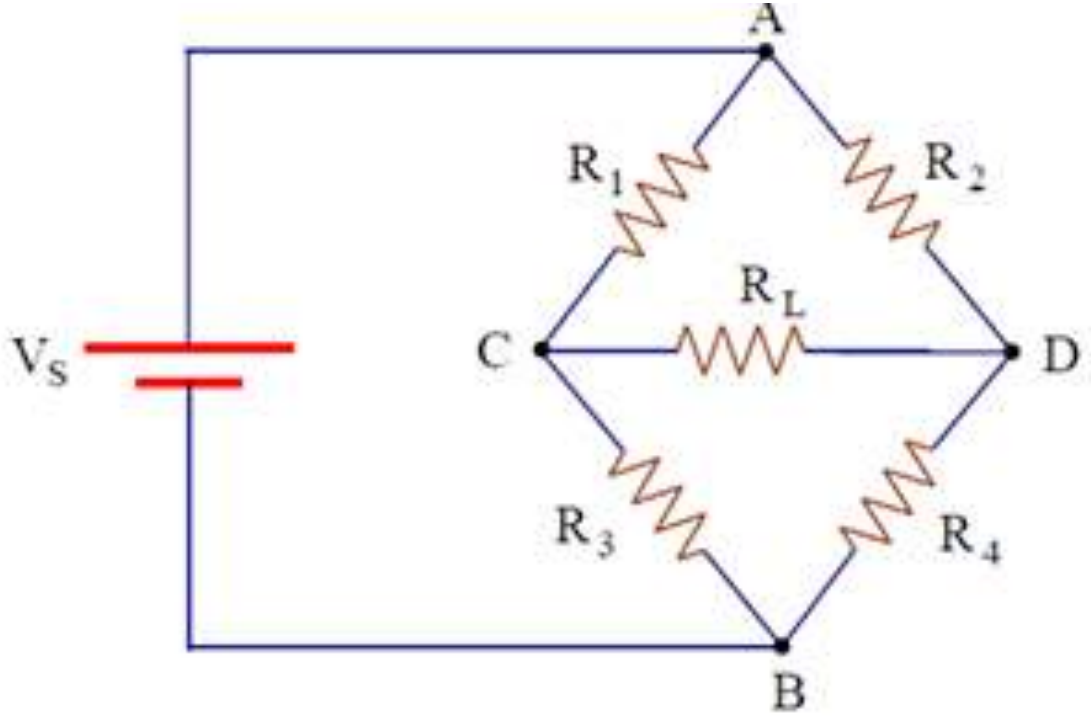
$I_L=(4x2)/(2+2)=2A$

نشاط جماعي

Apply Norton's theorem to calculate current flowing through 80Ω resistor of fig. below



H.W. by using NORTON's theorem find the current through RL=1KΩ



https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/a/NzgzOTI4MzgxMTA0/details

ملاحظة :الحل يكون عبر منصتنا على الكلاسروم باستخدام الرابط اعلاه

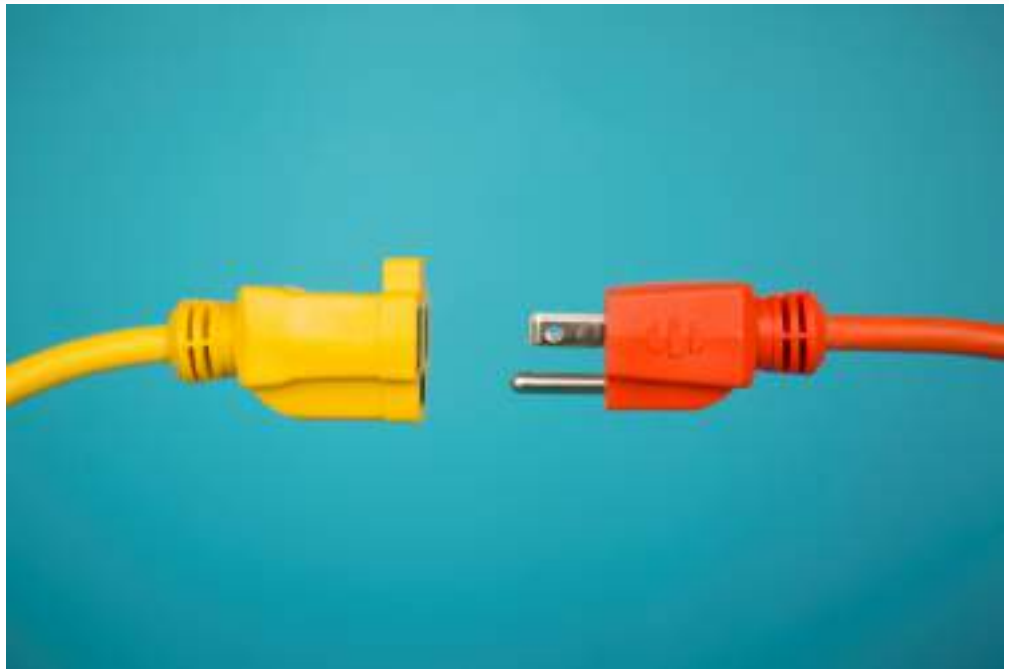
رأيك يهمنا :

اعزائي الطلبة يرجى ملء الاستبيان ادناه :


المحاضرة السابعة
SOURCE
TRANSFORMATION

:RATIONALS

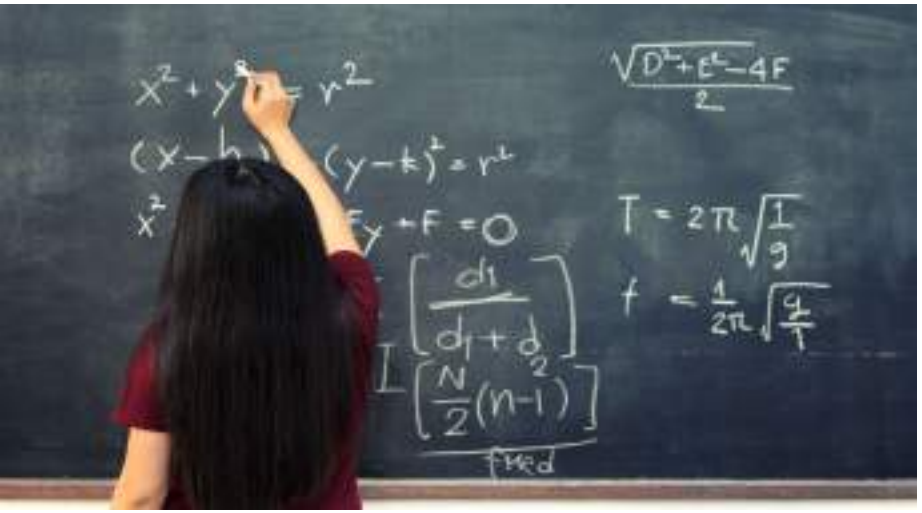
ITS IMPORTANT TO STUDY SOURCE TRANSFORMATION THEOREM TO ANALYSING ELECTRICAL CIRCUITS



الأهداف السلوكية

في نهاية المحاضرة سيكون الطالب قادرا على :

- فهم المبادئ الأساسية لنظرية تحويل المصادر
- - تحليل الدوائر الكهربائية التي تحوي على اكثر من مصدر فولتية او تيار او كلاهما



الاختبار القبلي

برأيك هل من الممكن تحويل مصدر التيار الى مصدر فولتية ؟

:Source Transformation

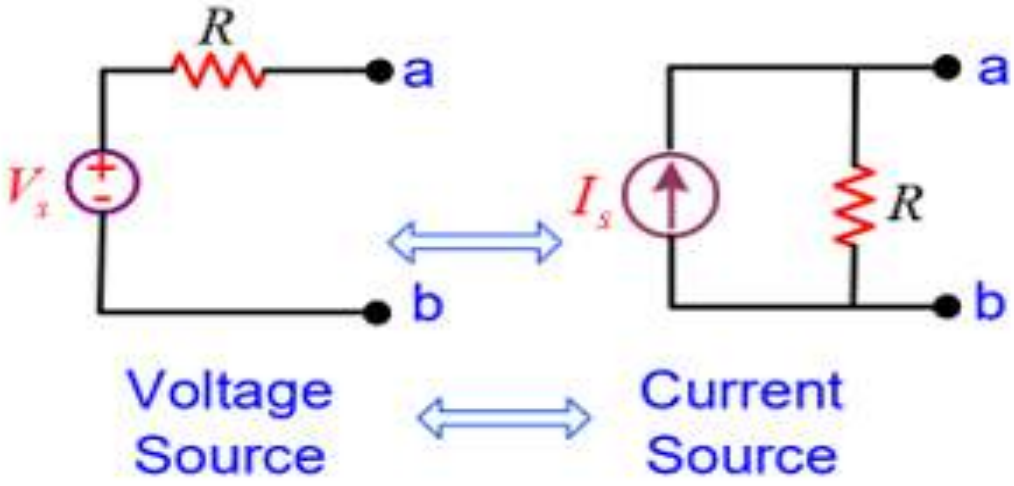
Equivalent sources can be used to simplify the analysis of some circuits.-

A voltage source in series with a resistor is transformed into a current-source in parallel with a resistor.

A current source in parallel with a resistor is transformed into a voltage -source in serie

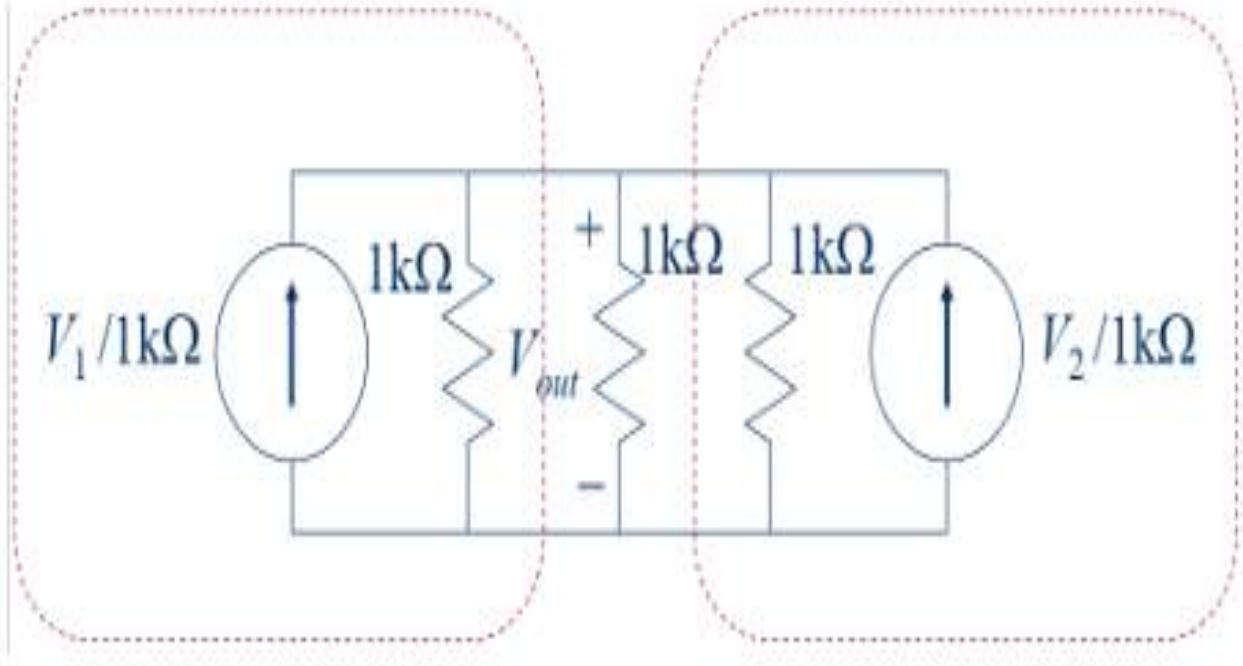
$$V_S = I_S R$$

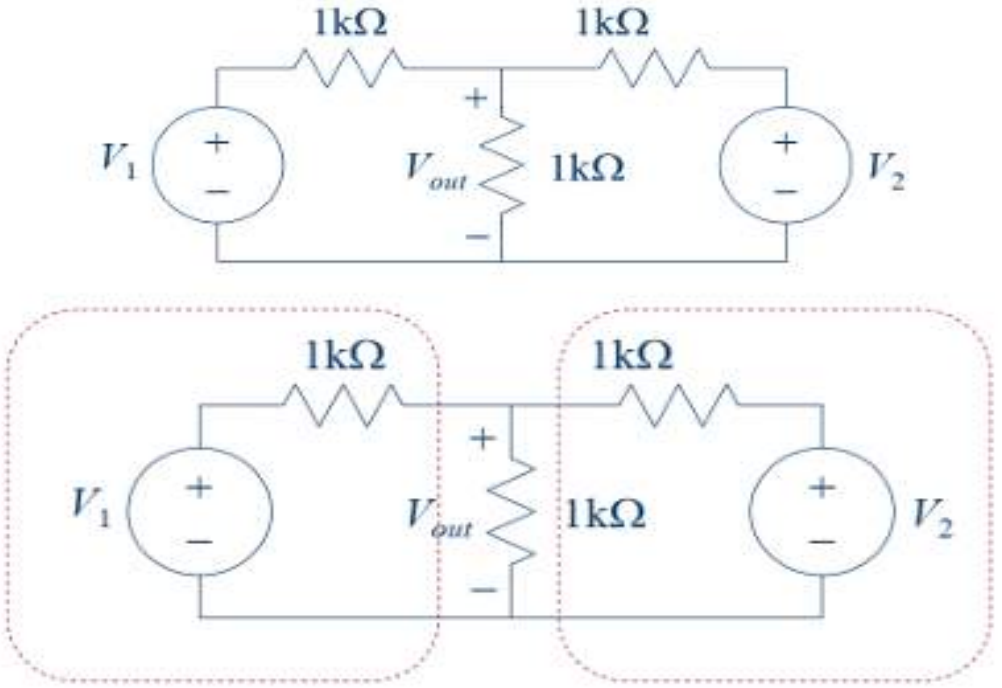
$$I_S = \frac{V_S}{R}$$



For the circuit shown in the Figure below, how can source ?transformation make analysis of this circuit easier

Which is a single node-pair circuit
.that we can use current division on





EXAMPLE: In the circuit shown below, use a source transformation to determine Vo.

:SOLUTION

Replace the current source 3A in parallel with 4Ω resistor

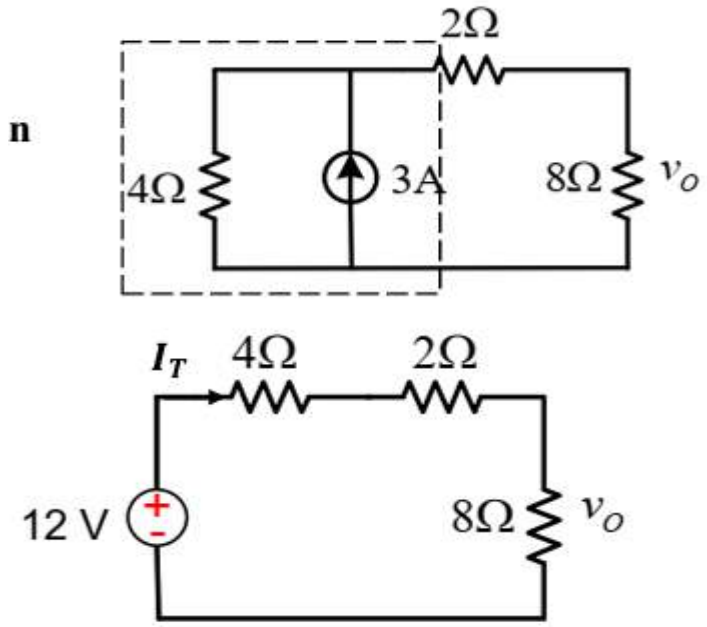
to a 12V voltage source in series with 4Ω resistor:

$VS = 3A \times 4\Omega = 12V$

$RT = 4\Omega + 2\Omega + 8\Omega = 14\Omega$

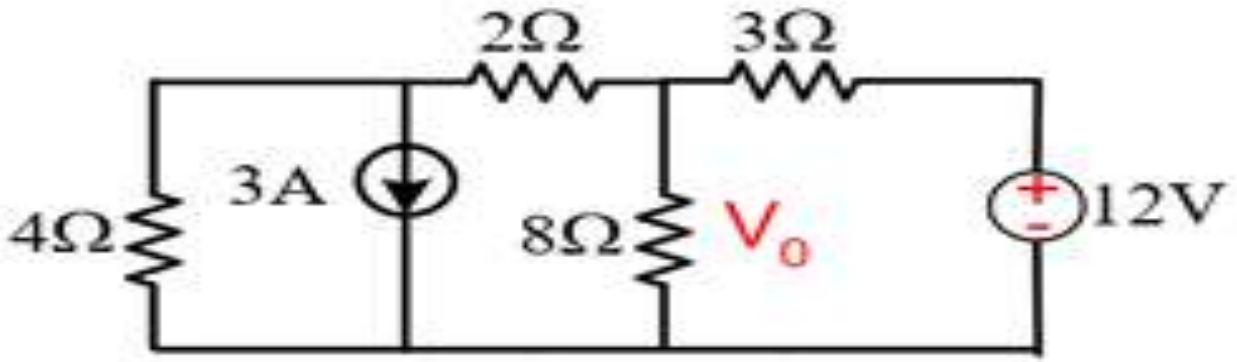
$IT = VS / RT = 12V / 14\Omega = 0.857A$

$Vo = 0.857 \times 8\Omega = 6.856V$ ∴



نشاط تفاعلي(3 دقائق)

For the circuit shown in Figure determine .the Vo using source transformation



Google Classroom

HOMEWORK

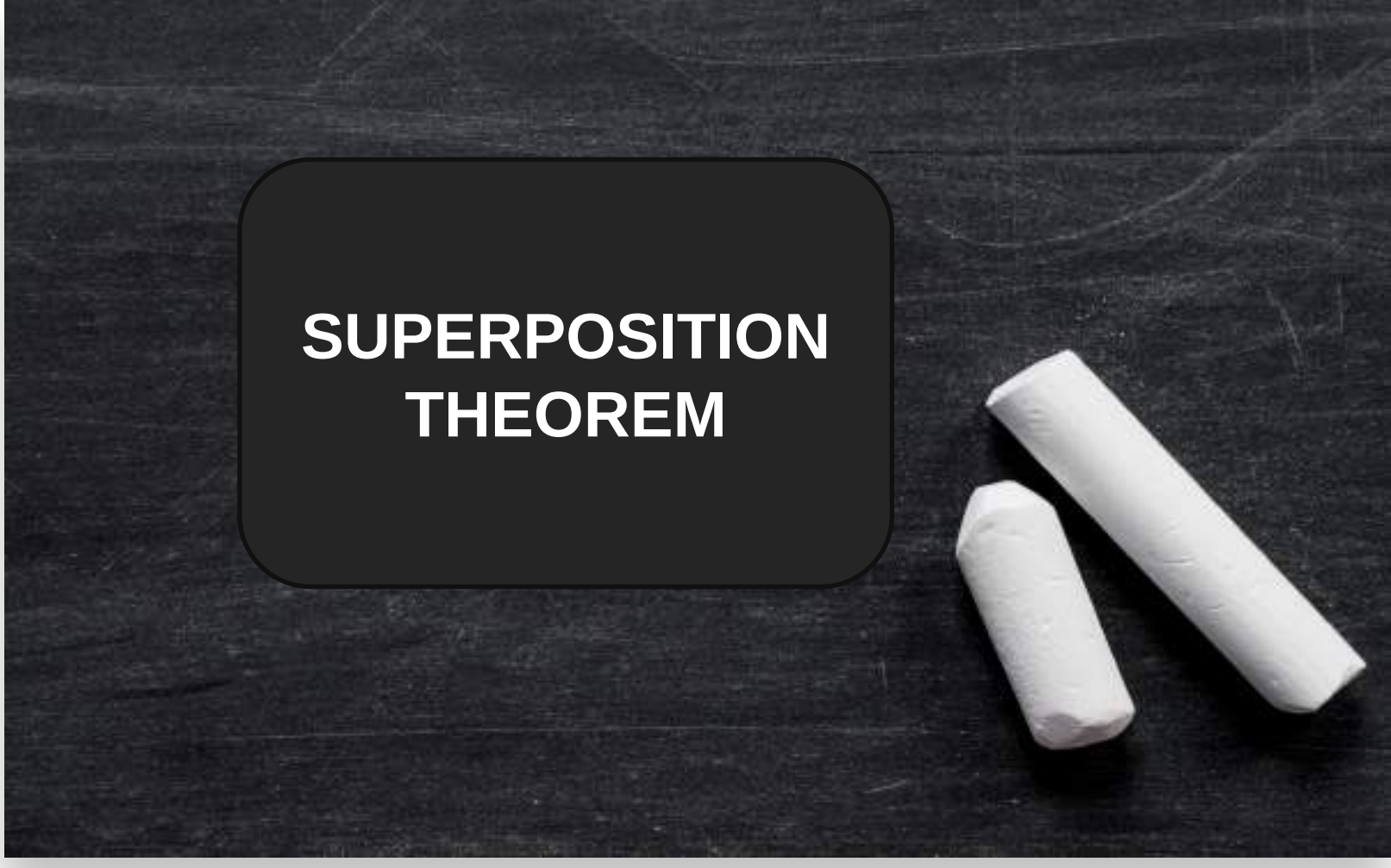
الاختبار البعدي

اكتب تقريرا معززا بالامثلة عن كيفية تطبيق نظرية تحويل المصادر مع نظرية ثيفنن

ملاحظة : ارفع الجواب على الرابط ادناه في منصة الكلاسروم

https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/a/NzgzOTcwNjAxMDY5/details

المحاضرة الثامنة



SUPERPOSITION THEOREM

:RATIONAL

Definition Suppers position theorem •

To calculate the load current flows from each source and to find the result •
.from the total currents

الأهداف السلوكية

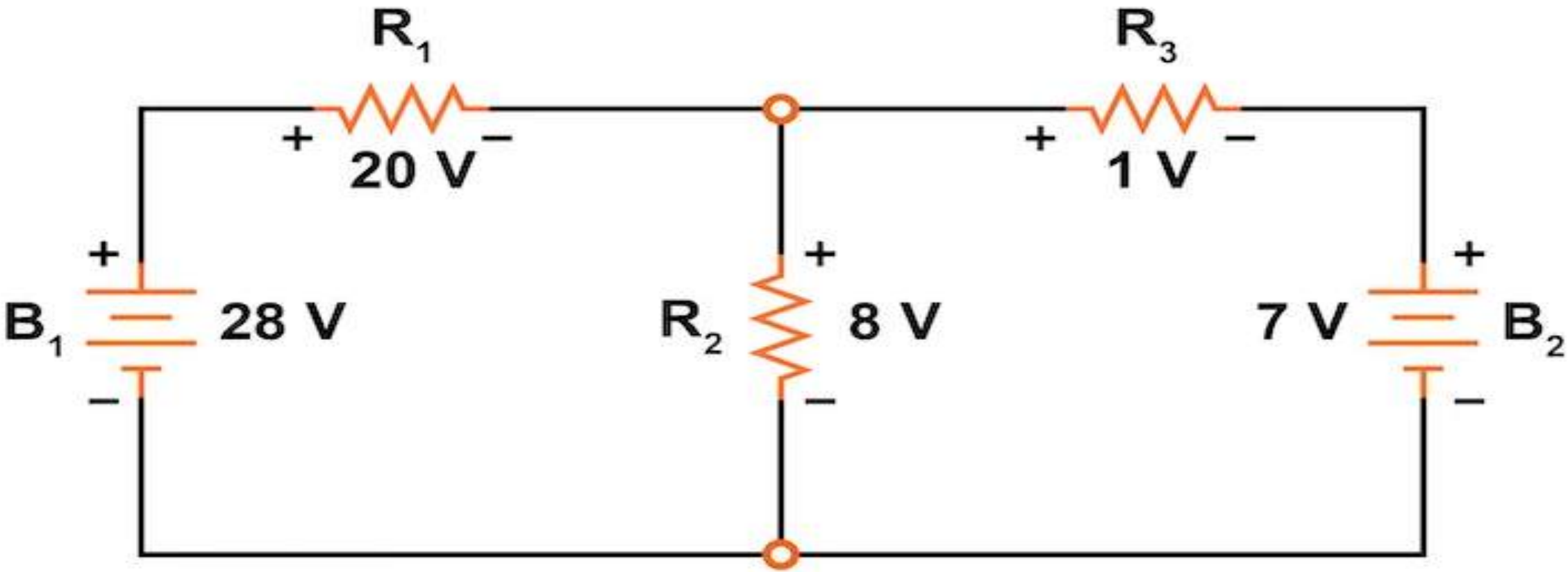
- فهم المبادئ الأساسية لنظرية التراكب
- تحليل الدوائر الكهربائية الخطية التي تحتوي على اكثر من مصدر

Did you have any information about super position ?theorem

الاختبار القبلي

Raise your hand before answer

CAN you find the total current for the .circuit below



The superposition theorem states the :following

The current through , or voltage across , at any element in a linear network is equal to the algebraic sum of the currents or voltages .produced independently by each source
This is done by making voltage source as short circuit , and current .source as open circuit

:Example 1

Using superposition theorem ,to determine the current through 4-ohm resistor

:Solution

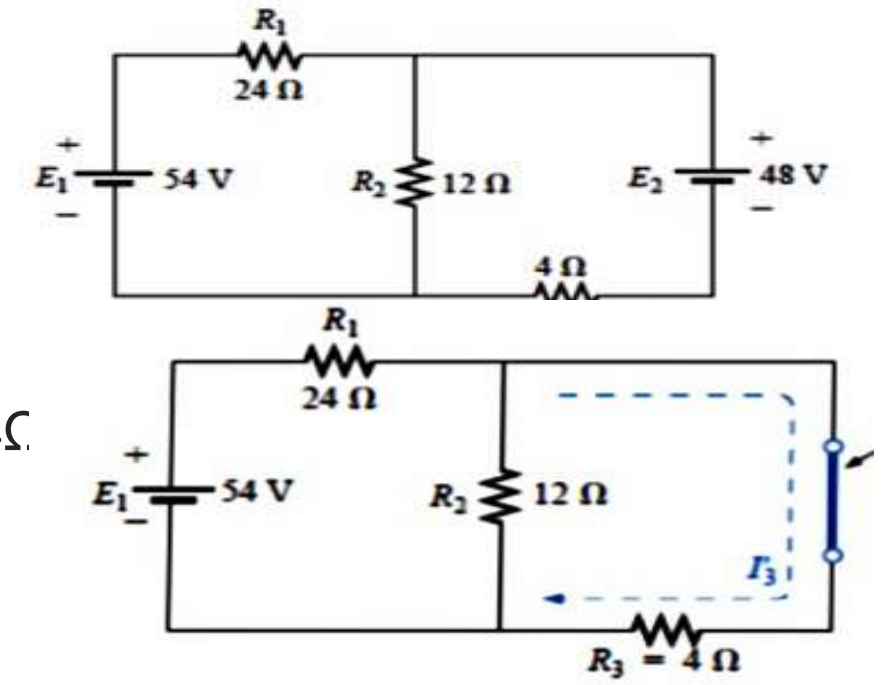
:Considering the effect of 54V Source

RT= R1+ (R2// R3)=24 + (12//4) =27Ω

I=E1/RT= (54/27)=2A

(NOW by using current divider we can calculate the current through (4Ω

I'=2*(12/4+12)=1.5 A



RT=4+(12//24)

12Ω=(24/12+24*12)+4=

It=48/12=4A

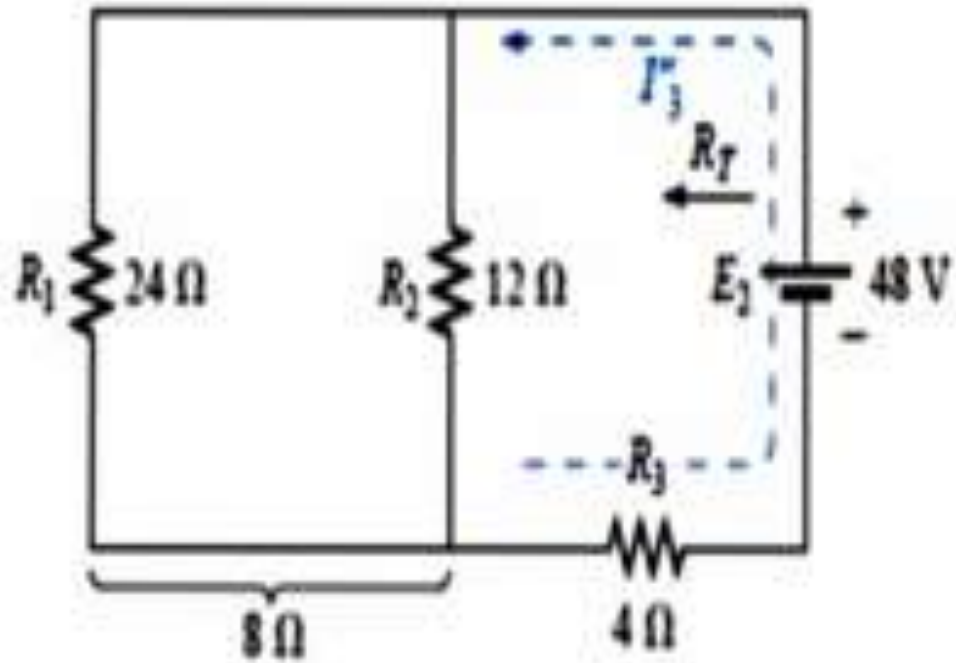
to find the current through 4Ω resistor

It’s the same of total current

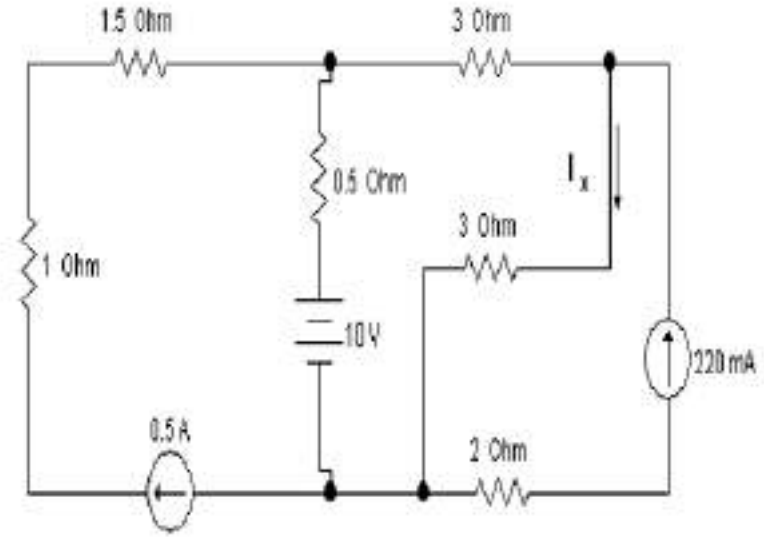
I‘’ =4 A

Now the current through 4 Ω is the ’‘algebraic sum of I’ and I

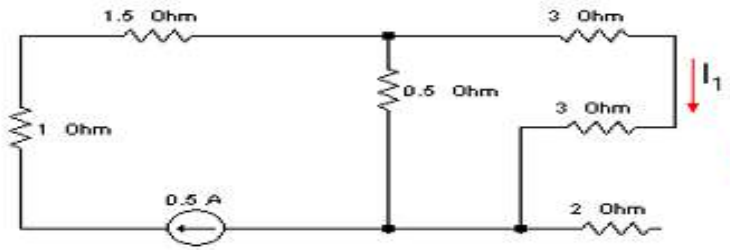
I"‘’= 4 - 1 .5 =2.5 A



For the cct. Shown using supper position theorem to find (Ix)

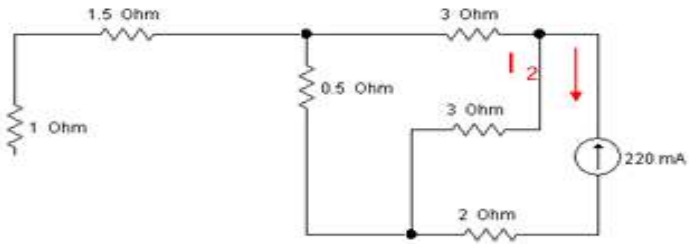


Solution:- 1- Effect of 0.5A only



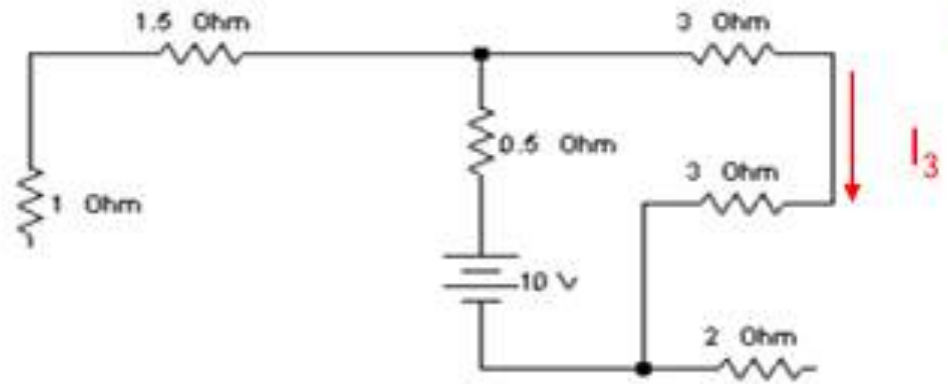
I_1= 0.5x(0.5)/ 0.5+(3+3)=0.038 A ↓

2- Effect of 220mA only



I_2=0.22x(3+0.5)/3.5+3=0.118A ↓

3- Effect of 10v only



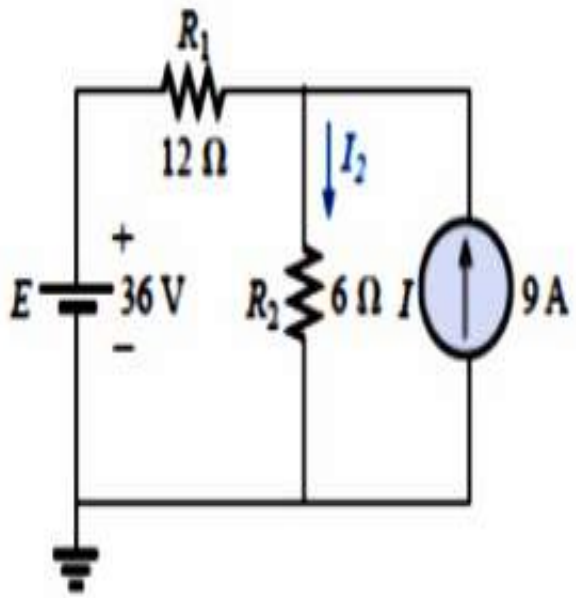
I_3=10/(0.5+3+3)=1.538A ↓

Then $I_x = I_1 + I_2 + I_3 = 1.694A$ ↓

:Example 2

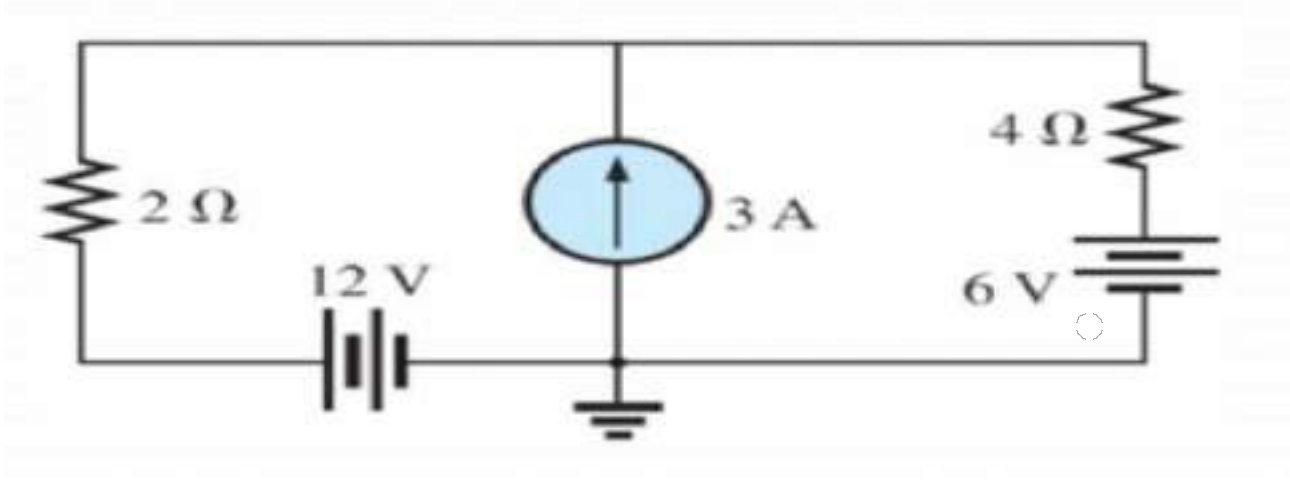
نشاط جماعي

Using superposition, determine the current through the 6-Ω resistor ??



الاختبار البعدي H.W

BY USING SUPERPOSITION THEORM ,FIND THE CURRENT THROUGH (2Ω) .resistor



الواجب البيتي يرفع على منصة الكلاس روم على ال QR CODE اعلاه

رابط المحاضرة على
منصة النير بود

https://app.nearpod.com/?pin=X2VUP

رابط المحاضرة على منصة
ال كوكل كلاس روم

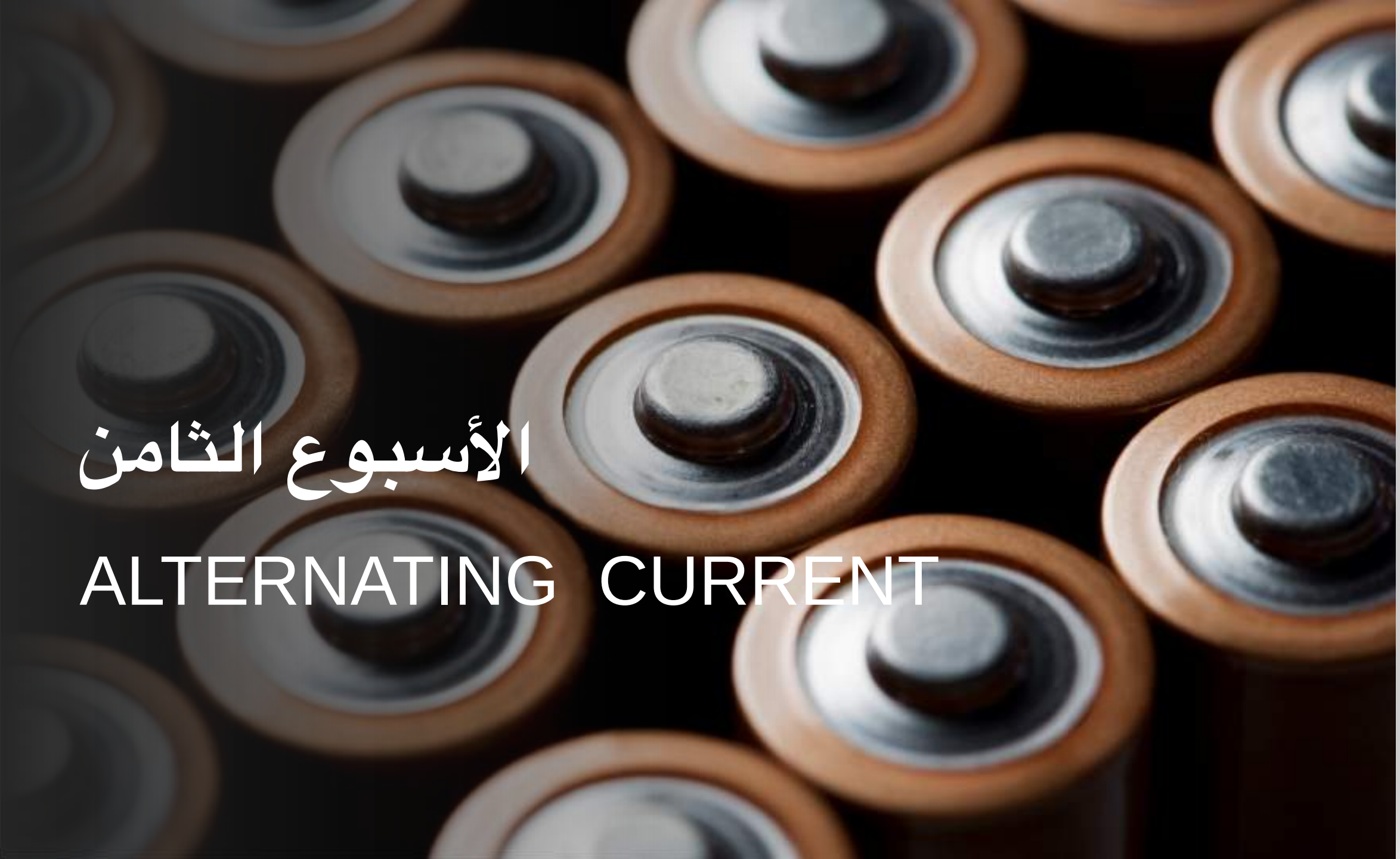
https://classroom.google.com/c/NzcxOTQ3MjE5MTc5/m/Njk5ODIxMzc2MTM1/details

Before homework you can see this channel on youtube

https://youtube.com/playlist?list=PLpyY3RPgxKCKuMsdS-X6LXQMxpRlaGwFa&si=SkuVH63t0bzbUbfX

رأيك يهمنا

يرجى فتح الQR code
لملء الاستبيان:



الأسبوع الثامن

ALTERNATING CURRENT

:RATIONAL

It is very important to study
Alternating current (A . C)
Also to analysis the sine
wave

:CENTERAL IDEA

Definition the sine wave

To learn how the sine wave generated •
• To learn haw we find R.m.s current
and average value

Pretest ألاختبار القبلي

Define :1- frequency

2- Angular frequency 3- ∏

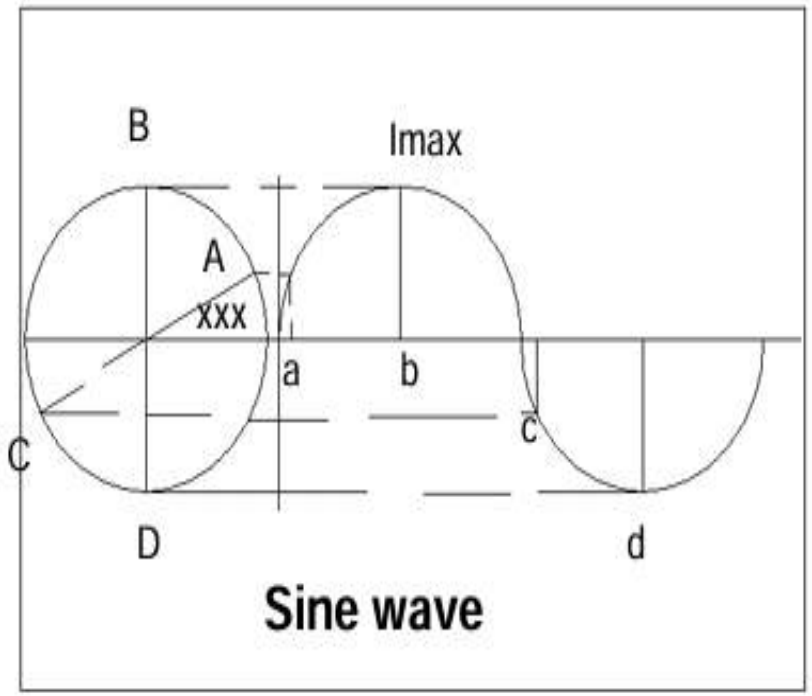
Solution

1- f : عدد الذبذبات الحاصلة خلال الثانية الواحدة ويقاس (ذ/ثا) أو هرتز

2- ω التردد الزاوي/ أي أن الموجة تتذبذب بشكل زاوي وليس بشكل خطي ويقاس (زاوية نصف قطرية/ثانية)

3- ∏ : وهي النسبة الثابتة (3,14) أما بالزوايا فمقدارها (180درجة)

$$W=2\,\pi f$$



Sin θ= A/ Imax :. A=Imax sin θ

T: time period (s)

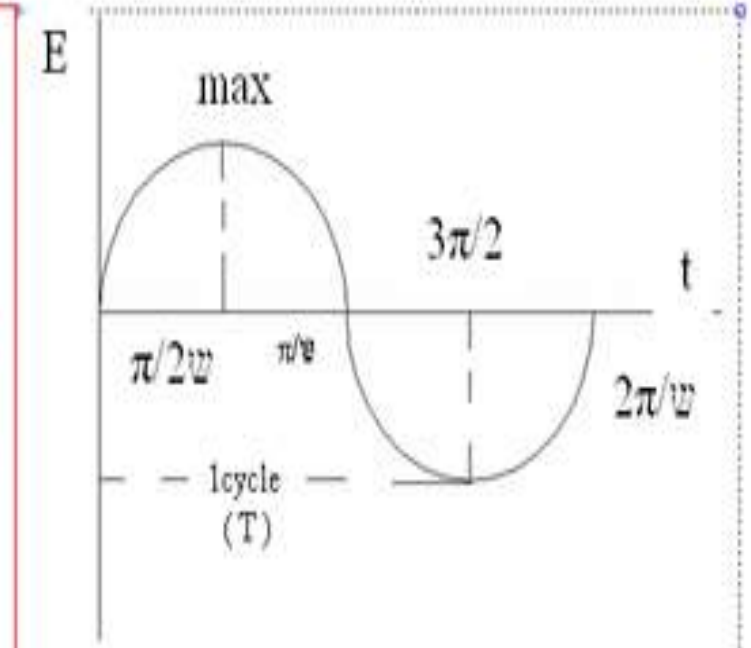
Max: maximum value of current or voltage

f : frequency (Hz)

T= 1/f

ω =2π/T=2πf

ω : angular frequency (radian / second)



Average value (Means value)

$$I_{av.} = \frac{i_1 + i_2 + \text{-----} + i_n}{n}$$

$$I_{av.} = 1/T \int_0^T i_{(t)} .dt \quad ; V_{av.} = 1/T \int_0^T e_{(t)} .dt$$

Instantaneous value

$i(t) = I_{max.} \sin(\omega t)$; $v(t) = V_{max.} \sin(\omega t)$

i:- Instantaneous value of current

V :- Instantaneous value of voltage .

Maximum value :- It is the maximum Value of the instantaneous values . ($I_{max.}$, $V_{max.}$) .

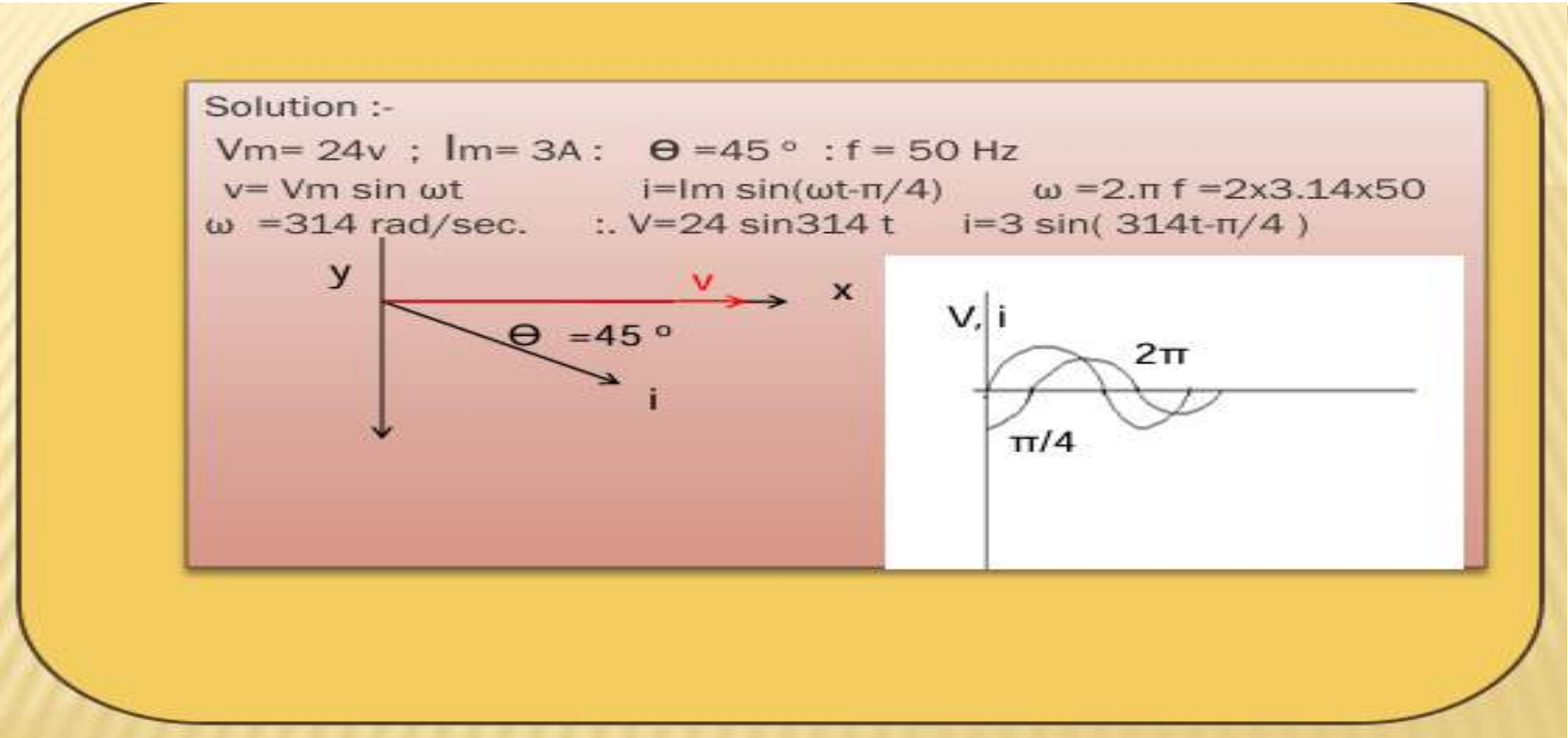
Root mean square (r.m.s.) ($I_{r.m.s.} = I_{effect}$) .

$$I_{r.m.s.} = \sqrt{\frac{i_1^2 + i_2^2 + i_3^2 + \text{-------} + in^2}{n}}$$

For full wave we fawned the effect value as follow :-

$$I_{r.m.s.} = \sqrt{\frac{1}{T}\int_0^T i^2 . dt} \quad ; \quad V_{r.m.s.} = \sqrt{\frac{1}{T}\int_0^T v^2 \, dt}$$

Example (1): In A.c. sinusoidal voltage with peak (24v) applaud to a circuit then the current (3A) if the voltage lead the peak current by (45 o) and frequency (50 . HZ) write the equation for V(t), I (t) and draw form and phase diagram



Ex 2: Find(r.m.s.) : Av. :Kf : Kp : f for the voltage

$v = 100 \sin 314t$

Solution:-

$V = V_m \sin \omega t \qquad V_m = 100 \qquad \omega = 314$

$V_{r.m.s} = V_m / \sqrt{2} = 0.707 \times V_m = 0.707 \times 100 = 70.7\ v$

$V_{av.} = 2V_{max} / \pi = 0.636 \times V_{max.} = 0.636 \times 100 = 63.6\ v$

$K_f = V_{r.m.s.} / V_{av.} = 70.7 / 63.6 = 1.11$

$K_p = V_{max} / V_{r.m.s.} = 100/70.7 = 1.414$, $\omega = 2\pi f$ $\therefore f = \omega / 2\pi = 314/2 \times 3.14 = 50$ Hz

لحساب القيمة الفعالة لموجة تيار جيبية نتبع الآتي :

$$I^2_{r.m.s.}=1/2\pi\int_{\circ}^{2\pi} I^2 d\theta = 1/2\pi\int_{\circ}^{2\pi} (I_m \sin\theta)^2 \, d\theta =$$

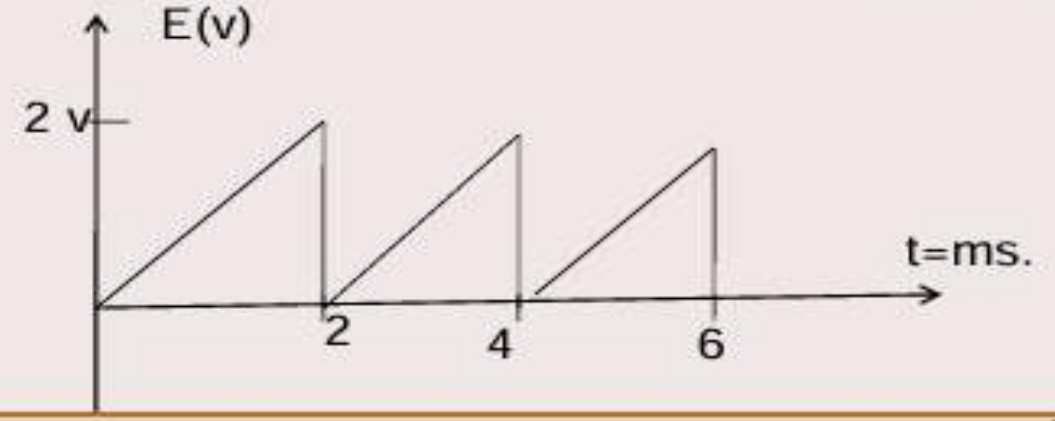
$$I^2_m /2\pi\int_{\circ}^{2\pi} \sin\theta^2 \, d\theta \quad \text{But: } \sin\theta^2 = 1/2(1-\cos 2\theta) \quad \text{then:}$$

$$I^2_{r.m.s.}=I^2_m /4\pi \int_{\circ}^{2\pi} (1-\cos 2\theta)d\theta = I^2_m /4\pi \left[(\theta - \sin 2\theta)/2\right]_{\circ}^{2\pi}$$

$$= I^2_m /4\pi [2\pi-0] \therefore I_{r.m.s.}=I_m/\sqrt{2}=0.707 I_m$$

وبنفس الطريقة يمكن إيجاد $V_{r.m.s.}$ ⬅ $V_{r.m.s}=0.707 V_m$

Ex : For the wave form shown find the Peak factor (kp) . Then find form factor (kf) .



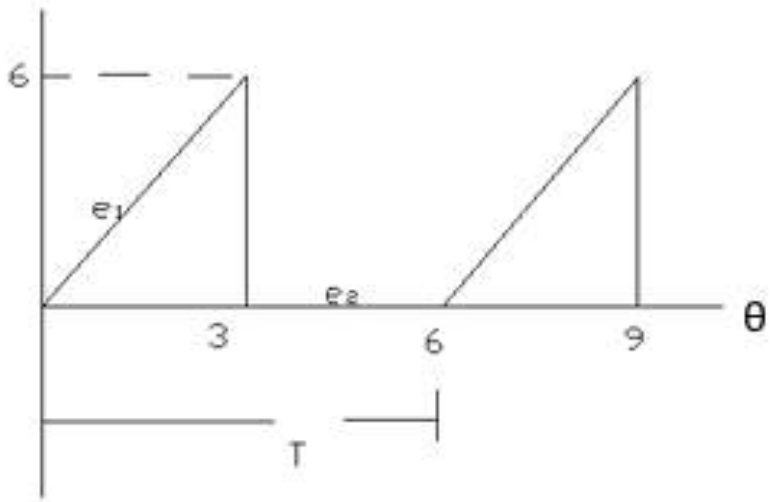
Solution :- $k_p = E_m/E_{av.}$: $E_m = 2v$ $T = 2$ $E_{av.} = \frac{1}{T}\int_0^T e(t)\,.dt$, $e = mx+y$

$= (2/2)t + y = t+0 = t$ $\therefore E_{av.} = \frac{1}{2}\int_0^2 t.dt = \frac{1}{4}\,(t^2)_0^2 = (1/4)x4 = 1$volt $\therefore$ **$k_p = 2$**

$$E_{r.m.s} = \sqrt{\frac{1}{T}\int_0^T e^{2}(t).dt} \quad , \quad \therefore E^2_{r.m.s} = 1/4\left(\int_0^2 t^2\,dt\right) = (1/4)\,x\,(t^3/3)_0^2$$

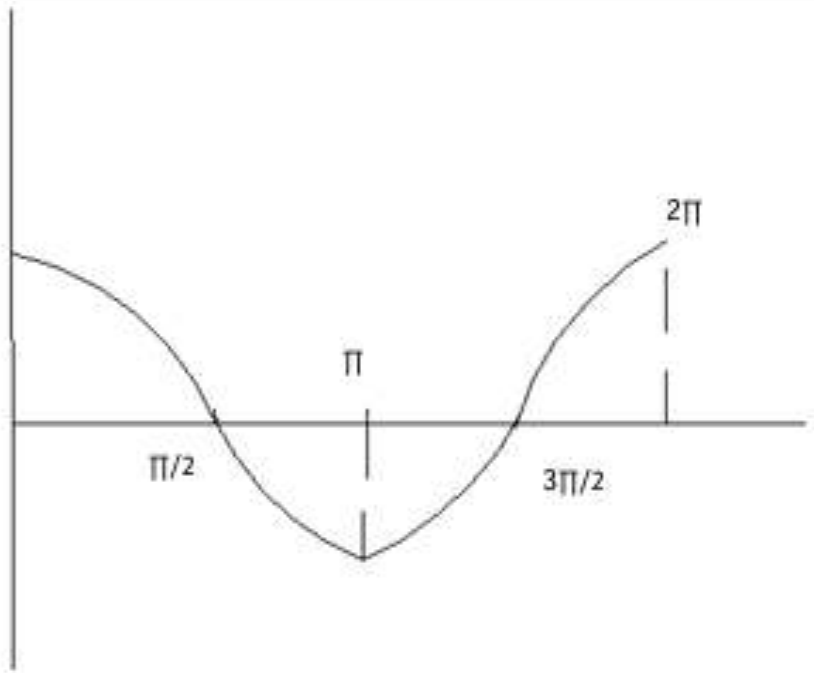
$$\therefore E^2_{r.m.s} = 8/12 \quad \therefore E_{r.m.s.} = 2/\sqrt{3}, \quad k_f = E_{r.m.s.}/E_{a.v.} = 2/\sqrt{3}$$

H.W.FIND Kf , Kp for current wave below



الاختبار البعدي

Find average value ,Kf ,Ka for half wave shown :



Effect of alternating current at circuit in seiries

الأسبوع التاسع

Objectives

Aim of lecture To make the student should be able to determine the impact of AC circuits linking respectively, and to learn to find the relationship between the current and voltages in connecting respectively, and finding phase angle and total defiance of the electrical .circuit

pretest

, Define : Phase shift , Phase diagram ,Phase angle(ϕ)

,inductance(L), Capacitance (c), Inductive reactance (XL)

Capacitive reactance (xc),Impedance(Z)

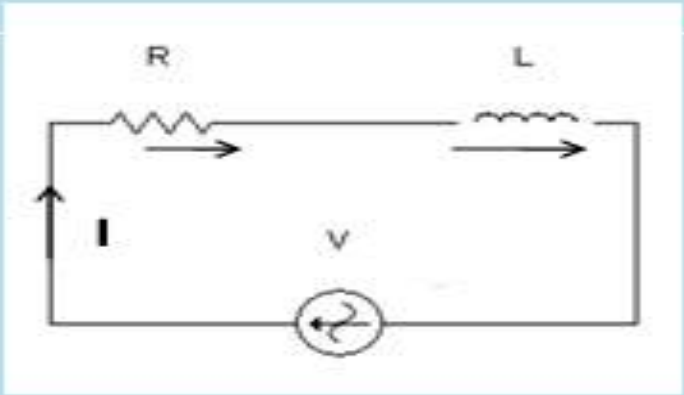
R- L in series

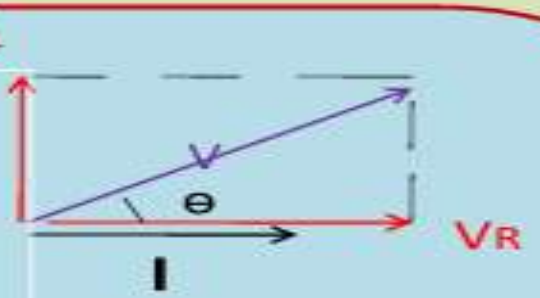
$V_R = I.R$, $V_L = I.X_L$

$V = \sqrt{V_R^2 + V_L^2}$

$= \sqrt{(I.R)^2 + (I.X_L)^2}$

$V = I\sqrt{(R^2 + X_L^2)}$



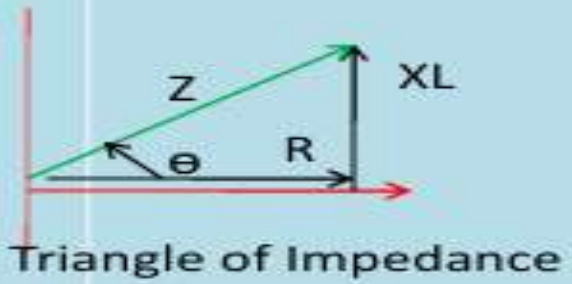


$\therefore Z = V/I = \sqrt{(R^2 + X_L^2)}$

(Ω) Impedance of the cct. ,

$\tan\theta = V_L/V_R = I.X_L/I.R = X_L/R$

$\therefore \tan\theta = V_L/V_R \therefore \theta = \tan^{-1} V_L/V_R$



Triangle of Impedance

$\tan\theta = X_L/R \therefore \theta = \tan^{-1} X_L/R$

θ =phase angle between V and I

قيمة الزاوية تتراوح اكبر من الصفر واصغر من 90 درجة (موجبة)مثل +30 او +45او +60 = θ

(قيمة الزاوية الفولتية – قيمةθ)مثل -30 او -45او -60 = زاوية التيار) في حال زاوية الفولتية =0

Ex(1) :- For the cct. Shown find the value and direction the current

$Z=\sqrt{R^2+XL^2}$, $XL=\omega.L=314\times 0.1=31.4\ \Omega$

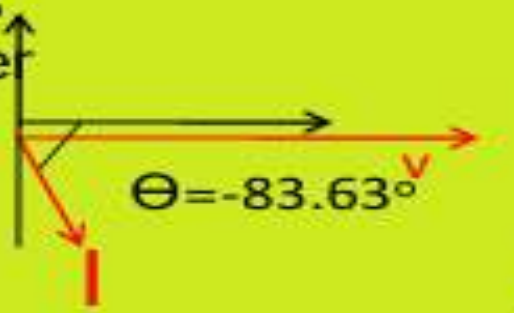
$Z=\sqrt{(3.5)^2+(31.4)^2}=31.6\Omega$

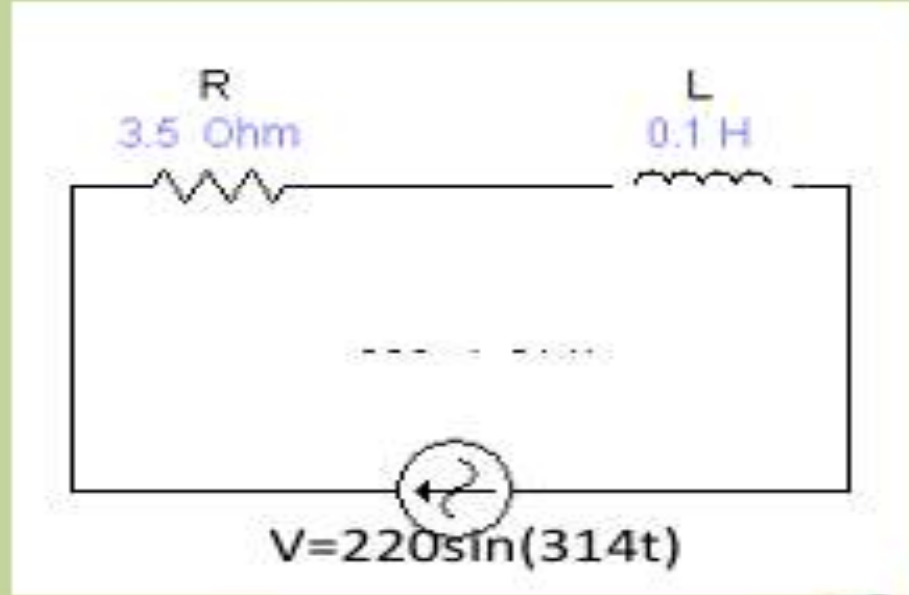
$I=V/Z=220/31.6=6.96\ A$

$\Theta=\tan^{-1} XL/R=\tan^{-1} 31.4/3.5=\tan^{-1} 8.97$

$\therefore \Theta=83.63^{o}$ $\therefore i=6.96\angle -83.63$

$\therefore i=6.96\sin(314t-83.63)$ Amer





R-c in series

$V_R=I.R$, $V_C=I.XC$

$V=\sqrt{V_R^2+V_C^2}=\sqrt{(I.R)^2+(I.Xc)^2}$

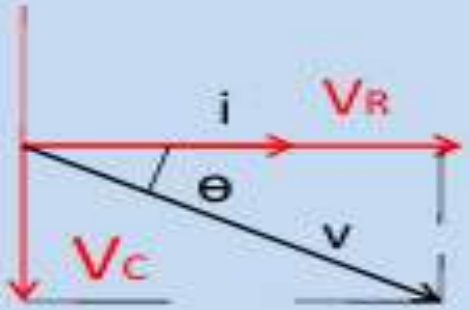
$V=I\sqrt{(R^2+Xc^2}$

$\therefore Z=V/I=\sqrt{(R^2+Xc^2}$, $Xc=1/\omega.c$

$\tan\theta=V_C/V_R=I.Xc/I.R=Xc/R$

$\therefore \theta=\tan^{-1} V_C/V_R$ Or

$\tan\theta=Xc/R$ $\therefore \theta=\tan^{-1} Xc/R$



Ex(2) : For the cct. Shown if(I=1A) find (f), then what are the value of (R) that connected with (C) to reduce قل the current to (0.5A) with the same frequency .

Solution

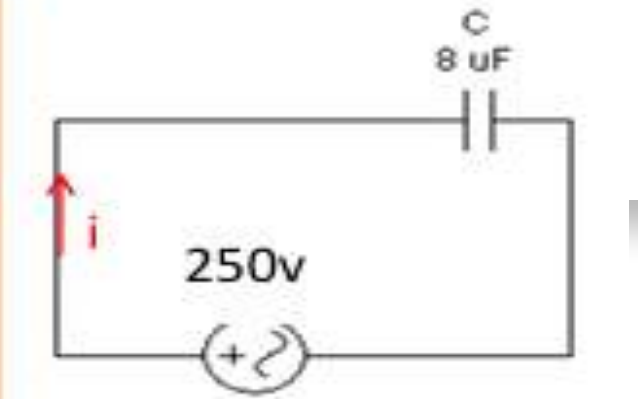
$X_c = V_c / I_c = 250/1 = 250\ \Omega$

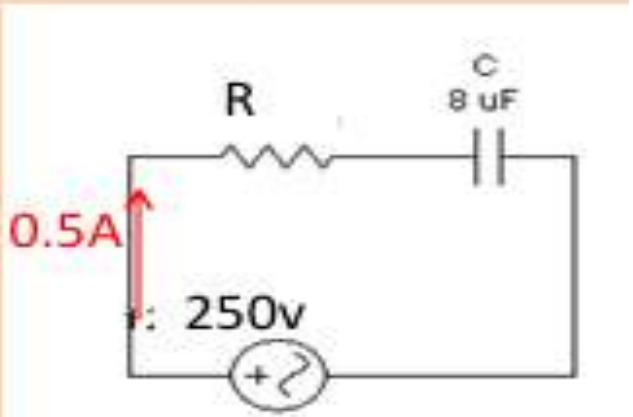
$X_c = 1/\omega.c = 1/2\pi fc \quad \therefore f = 1/(2\pi.c.X_c)$

$f = 1/(2 \times 3.14 \times 8 \times 10^{-6} \times 250) = 79.5\ HZ$

$Z = \sqrt{(R^2 + X_c^2)} = \sqrt{(R^2 + 250^2)}, \quad Z = 250/0.5 = 500\ \Omega$

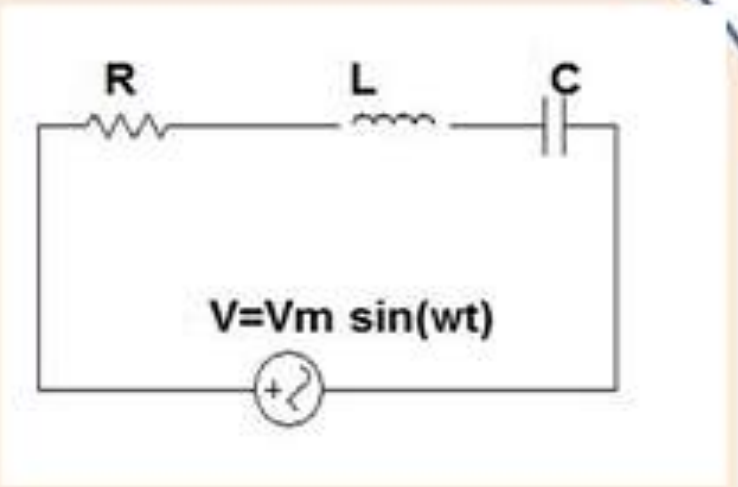
$\therefore 500^2 = R^2 + 250^2 \quad \therefore R^2 = 500^2 - 250^2 \therefore R = 433\ \Omega$





R-L-C in series

1- If $X_L > X_C$:. $V_L > V_C$



$V_R = I.R$, $V_L = I.X_L$, $Vc = I.Xc$, $V = \sqrt{V_R^2 + (V_L - V_c)^2}$

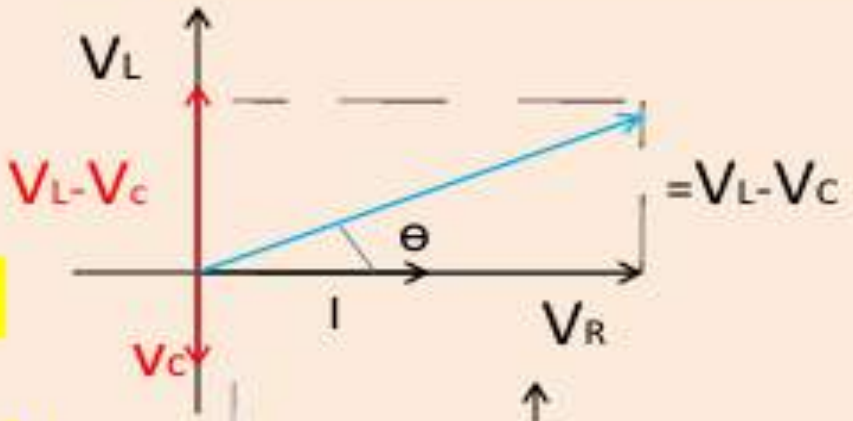
$$V = I \cdot \sqrt{R^2 + (XL - Xc)^2}$$

$$\therefore Z = V/I = \sqrt{R^2 + (XL - Xc)^2}$$

{The impedance of the cct.}

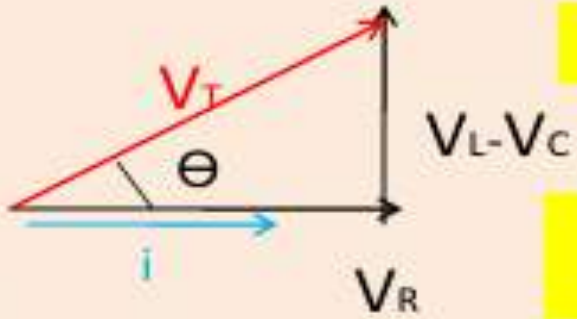
$$\Theta = \tan^{-1} (VL - Vc) / VR$$

$$\Theta = \tan^{-1} (XL - Xc) / R$$

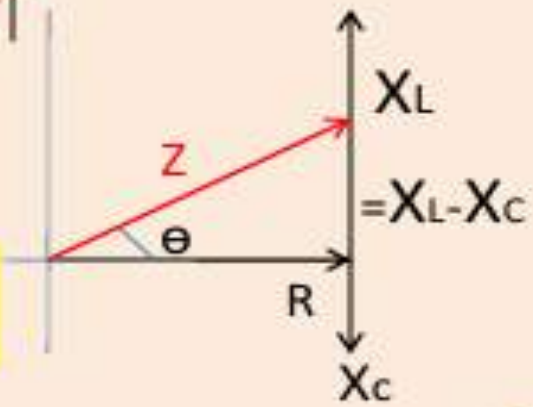


Also : $X_L > X_C$:

1/the cc.t is inductive



2/Θ is positive



3/ V_T lead إيتقدم I_T by Θ

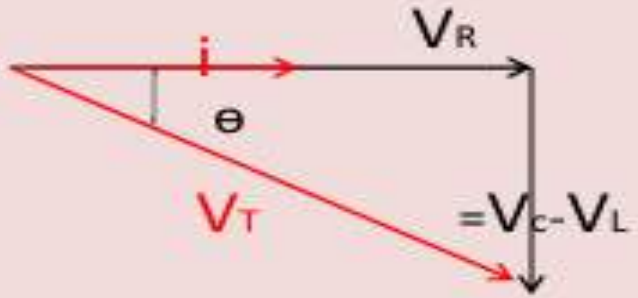
2/ If $X_C > X_L$:. $V_C > V_L$

When $X_L < X_C$

1/ The cct. Is capacitive

2/ϴ is negative

3/ i_T leads يتقدم V_T by ϴ



3/ If $X_L=X_C$;. $V_L=V_C$

When $X_L= X_C$

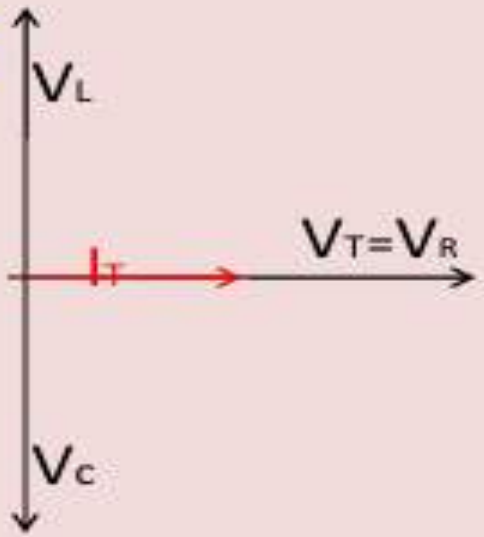
1/ We have **resonance case**

2/ Θ =0

3/Z =R

4/ $V_L=V_C$

5/ $V_T=V_R$



Resonance series frequancy

$X_L=X_C$:. $2\pi f_o.L=(1/2\pi f_o.C)$

:. $f_o^2=(1/4\pi^2 L.C)$

$f_r=f_o= 1/(2.\pi.\sqrt{L.C})$ HZ

The energy stord in the coil(w,e)

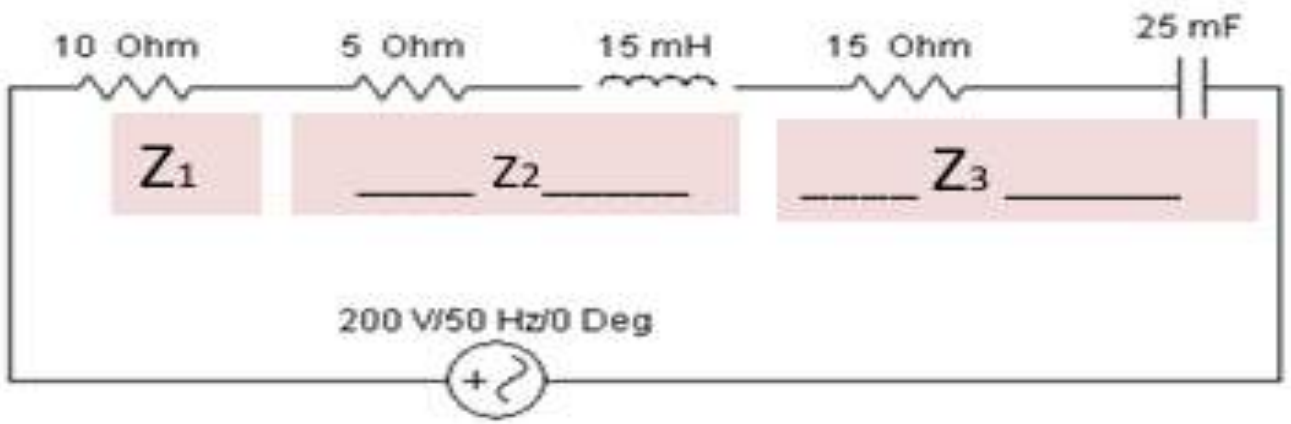
$W=(1/2)\ L.I_m^2$ joule

Post test

Ex(a) : For the cct. Shown Find (Z_T, I, ɵ , V_{Z1}, V_{Z2} , V_{Z3})then draw the phaser diagram

.

H .W



solution

Z_T=31.6 Ω ,
I=6.329A A

Θ =18.43°

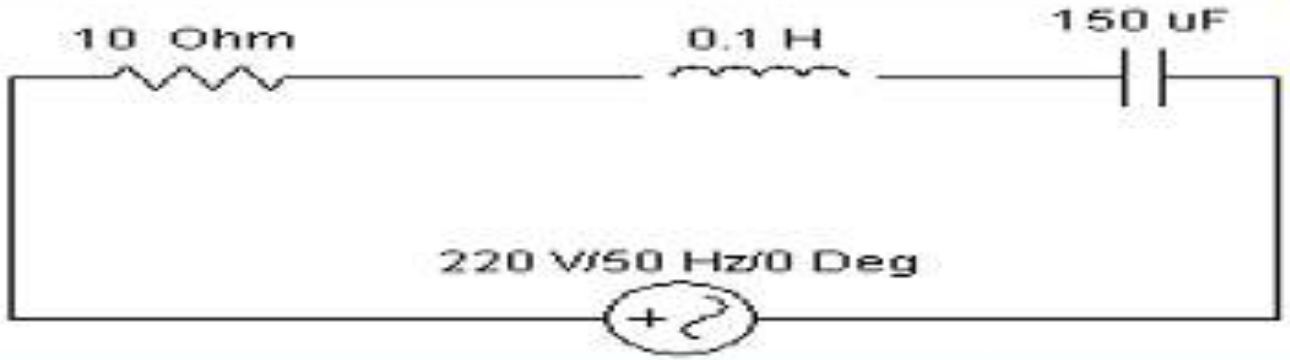
V_{Z1}= 63.29v

V_{Z2}= 99.998v

V_{Z3}=184.49v

EX(b): For the cct. Shown Find: I, ɵ ,VR,Vc , VL and draw the phaser diagram.

H.W



solution

I= 14 A

Θ =45.55°

V_R= 140v

V_C =297v

V_L= 439.81v

الأسبوع العاشر

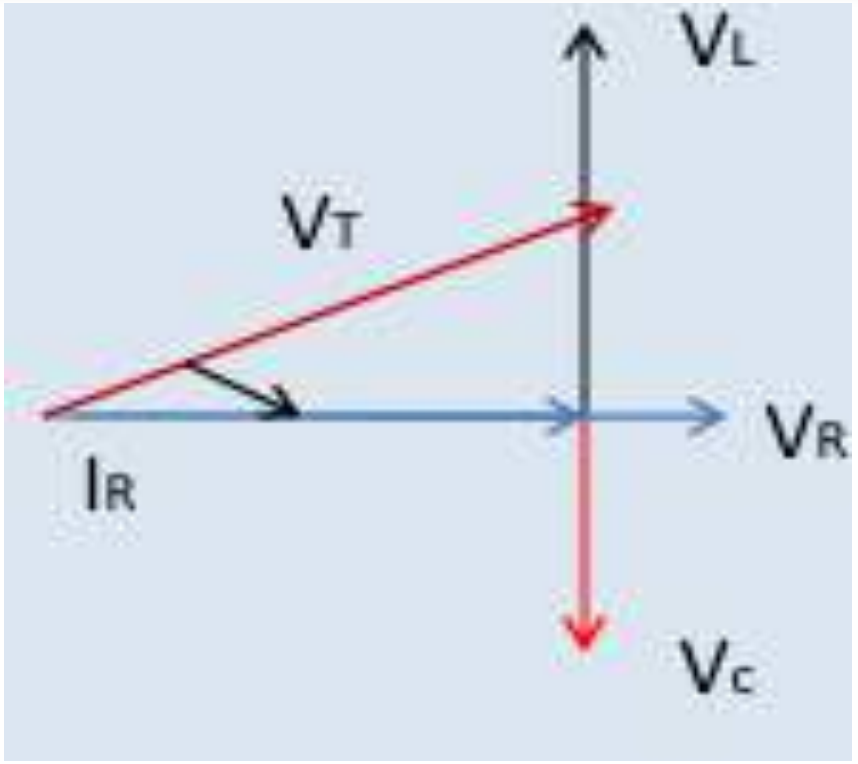
Effect of alternating current at parallel circuits

:Aim of lecture

Aim of lecture : To make the student should be able to decipher complex electrical networks linking parallel and current knowledge of the relationship Balvoltaip in this case, and how to find a phase angle and the reluctance of the circle and permittivity

pretest

Drawing the phase diagram for the cct contain (L,C)in series .If xL > xc



R-L in parallel

في حالات التوازي

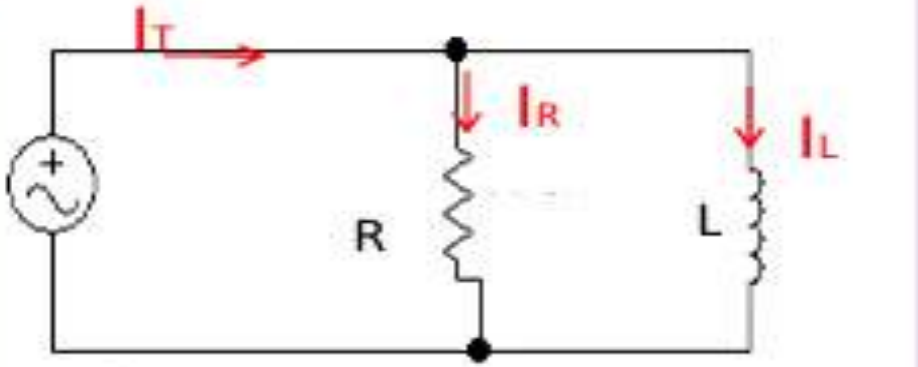
$I_R=V/R$, $I_L=V/X_L$, $I_T=\sqrt{I_R^2+I_L^2}$

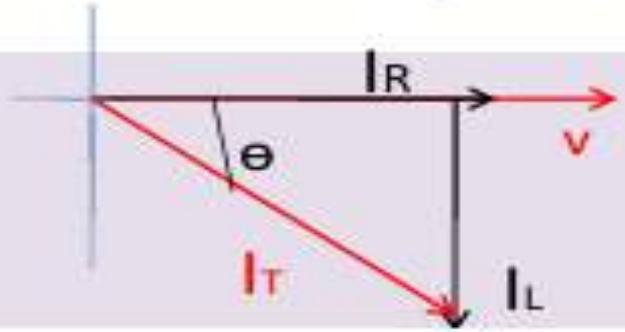
$I_T=\sqrt{(V/R)^2+(V/X_L)^2}=\sqrt{V^2/R^2+V^2/X_L^2}$

$I_T=V\sqrt{1/R^2+1/X_L^2}=I/V=Y=\sqrt{1/R^2+1/X_L^2}$ (Moh) ,

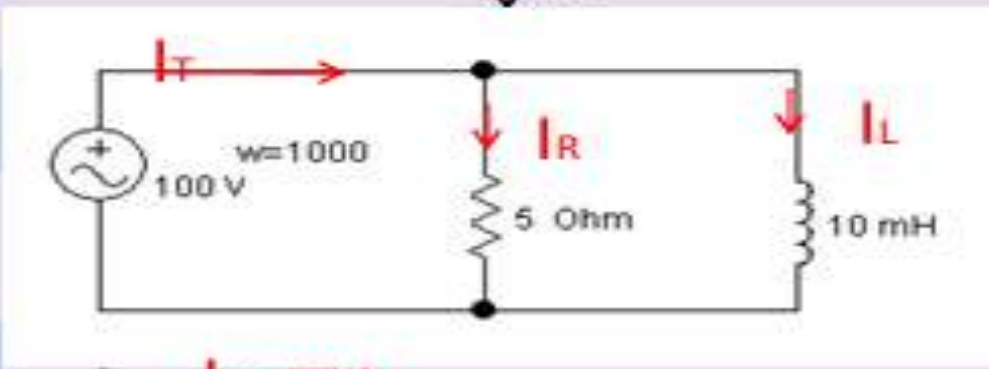
1/Ω ,(Siemens) ,(admittance of the cct.) , Y=1/Z, Z=1/Y

$\Theta=\tan^{-1}$ **(-IL / IR)**





EX(1): **for the cct. Shown find YT, ZT, IR ,IL , IT ,Θ**
Drawing the phaser diagram.



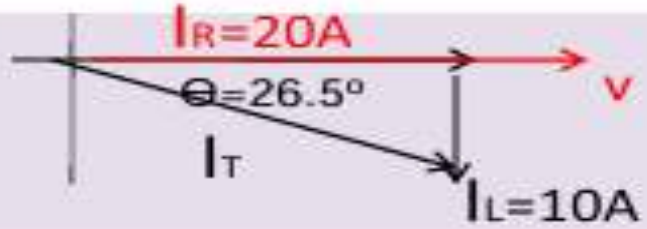
$I_R=v/R=100/5=20A$, $I_L=V/X_L=100/(1000*0.01))=10A$

$I_T=\sqrt{I_R^2+I_L^2}=\sqrt{20^2+102}=22A$

$\Theta=\tan^{-1}\ -I_L/I_R=\tan\text{-}1\ (-10/20)=-26.5$

$Z_T=V/I_T=100/22=4.545\Omega$

$Y_T=1/Z_T=0.22$ moh



R-C in Parallel

$I_R = V/R$, $I_C = V/X_C$

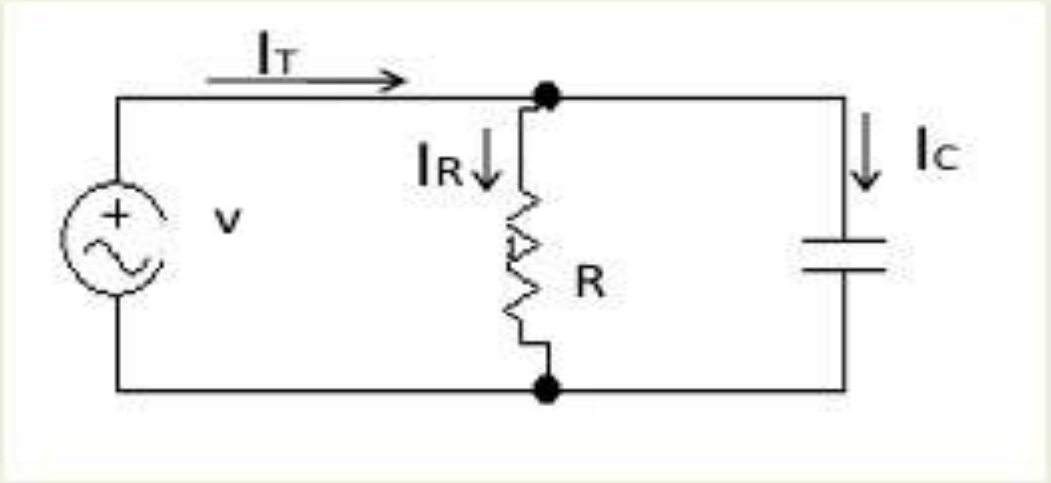
$I_T = \sqrt{I_R^2 + I_C^2}$

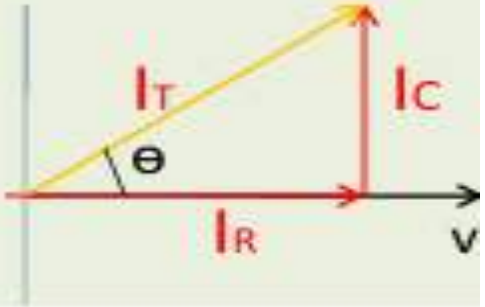
$= \sqrt{(V/R)^2 + (V/X_C)^2}$

$I = V\sqrt{(1/R^2) + (1/X_C^2)}$

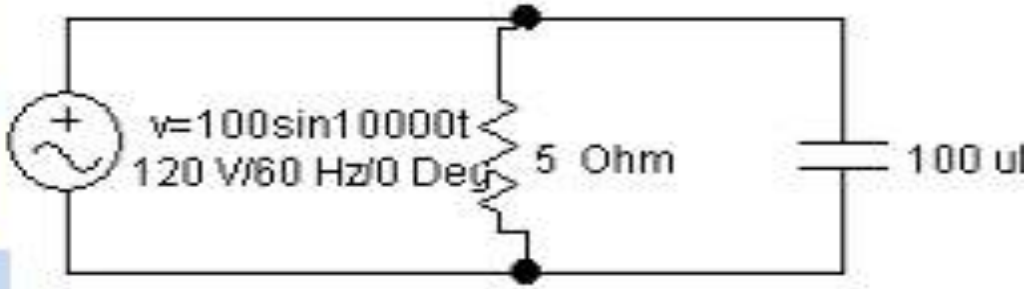
$I/V = Y = \sqrt{(1/R^2) + (1/X_C^2)}$

$\Theta = \tan^{-1}(I_C / I_R)$





EX(2) : for the cct. Shown find Y_T, Z_T, I_R , I_C , I_T , Θ Drawing the phaser diagram.



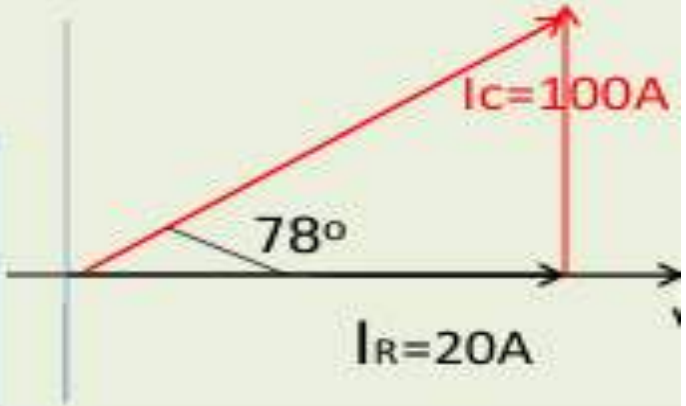
Solution :$X_C = 1/\omega.C = 1/(10000 \times 100 \times 10^{-6}) = 1\Omega$

$Y = \sqrt{1/R^2 + 1/X_C^2} = \sqrt{1/52 + 1/12} = 1.01$moh ,

$Z = 1/Y = 0.98\ \Omega$, or $Z = V/I = 100/101 = 0.98\ \Omega$, $I_R = V/R = 100/5 = 20$A

$I_C = V/X_C = 100/1 = 100$A, $I_T = \sqrt{I_R^2 + I_C^2} = \sqrt{20^2 + 100^2} = 101$A

$\Theta = \tan^{-1} I_C/I_R = \tan^{-1} 5 = 78^o$



The general Parallel case

1

If $X_L > X_C$:. $I_C > I_L$:. $I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$

$Z_T = 1/\sqrt{(1/R)^2 + (1/X_C - 1/X_L)^2}$ OR $Z = V/I_T$

$\Theta = \tan^{-1} (I_C - I_L) / I_R$

2

If $X_C > X_L$:. $I_L > I_C$:. $I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$

$Z_T = 1/\sqrt{(1/R)^2 + (1/X_L - 1/X_C)^2}$ OR $Z = V/I_T$

$\Theta = \tan^{-1} (I_C - I_L) / I_R$

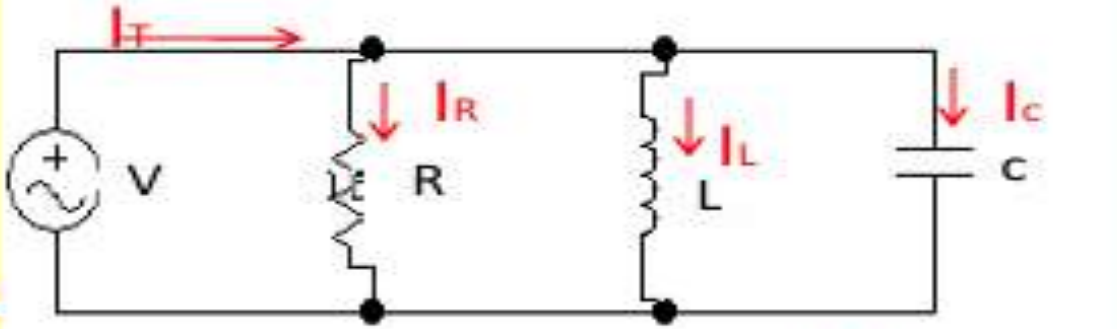
3

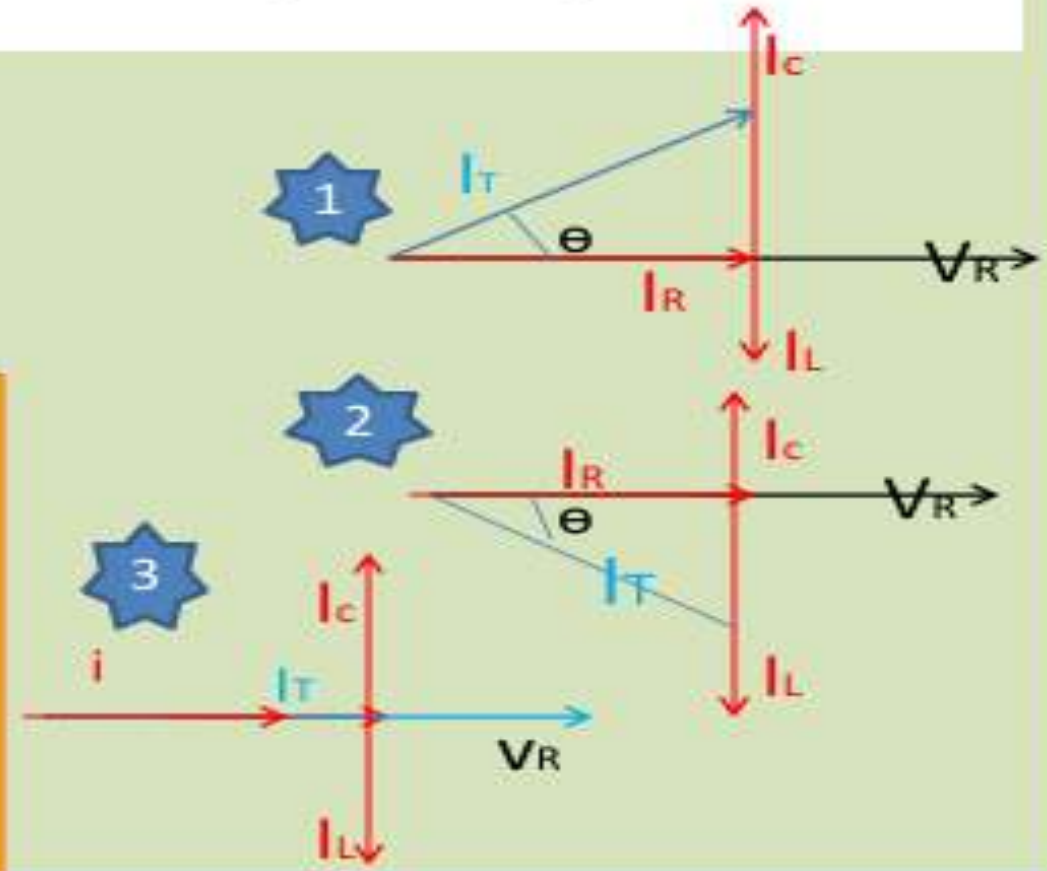
If $X_C = X_L$ (Resonance Parallel case) :. $I_C = I_L$:. $I_T = I_R$

$Z_T = 1/\sqrt{(1/R)^2}$:. $Z_T = R$, $V_T = I_T . Z_T$, $\Theta = 0$

$f_r = 1/ 2.\pi. \sqrt{L . C}$ HZ

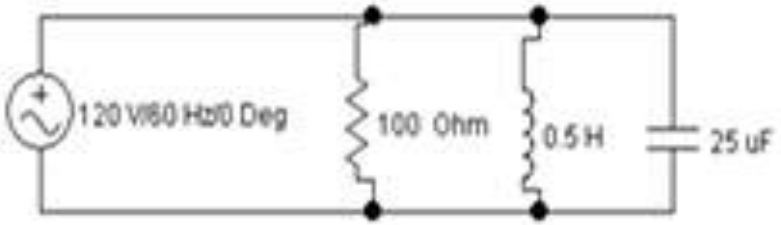
f_r: (Resonance Parallel frequancy)





Example(3):
For the parallel cct. Shown in figer find : 1/ The total current 2/ phase angle 3/ Impedance of the cct. 4/ phase diagram .

solution



$I_R = V/R = 120/100 = 1.2A$, $X_c = 1/2\pi f.c = 1/2\ \pi \times 60 \times 25 \times 10^{-6}$

$\therefore X_c = 100\Omega$, $I_c = V/X_c = 120/100 = 1.2A$, $X_L = 2\ \pi f.L = 2\ \pi \times 60 \times 0.5$

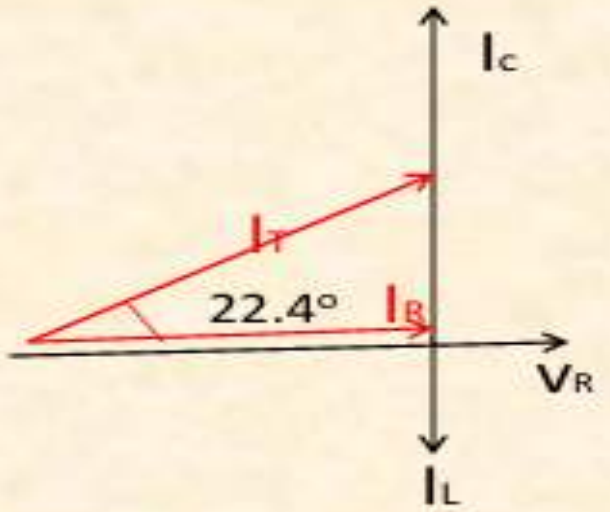
$\therefore X_L = 188.4\Omega$, $I_L = V/X_L = 120/188.4 = 0.63A$

$I_c - I_L = 1.2 - 0.63 = 0.57A$ $\therefore I_T = \sqrt{I_R^2 + (I_c - I_L)^2}$

$\therefore I_T = \sqrt{(1.2)^2 + (0.57)^2}$ $\therefore I_T = 1.3A$,

$\theta = \tan^{-1} I_c - I_L / I_R = \tan^{-1} 0.57/1.2 = 22.4^o$

$Z = V/I_T = 120/1.3 = 92\Omega$



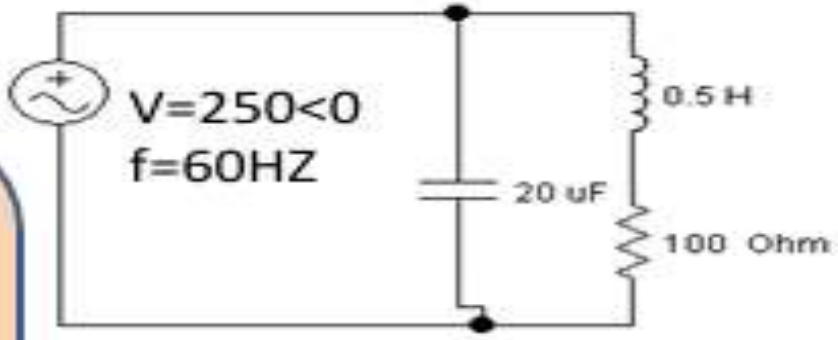
Posttest

Ex: For the cct. Shown in figer find 1) the source current I_T .
2) Active and reactive power and apparent power

Solution

$X_L=2\pi x60x0.5=188\Omega$

$X_c=1/2\ \pi x60x20x10^{-6}=132.6\Omega$



$Z_L=\sqrt{(1002+188^2)}=213\,\Omega$, $\theta=\tan^{-1}\ 188/100=62^o$

$Z_L=213<62^o\ \Omega$, $Z_c=132.6<-90^o$

$I_L=V/Z_L=250/213<62=1.17<-62$ A

$I_c=V/Z_c=250/132.6<-90^o=1.88<90$A , $I_T=I_L+I_C$

$\therefore I_T=1.88<90+1.17<-62$

$\therefore I\cos\theta=1.17x\cos -62+1.88x\cos 90=0.423A$

$I\sin\theta=1.17x\sin -62+1.88x\sin 90=0.79A$

$\therefore I_T=\sqrt{(0.423)^2+(0.79)^2}=0.896A$

$\theta=\tan^{-1}\ 0.79/0.423=61.8^o$ $\therefore I=0.896<61.8A$

P=I.Vcos θ =250x0.896xcos61.8=105.73 watt (Active power)

Q=I.Vsinθ =250x0.896 xsin61.8 =197.4 var (Reactive power)

S=V.I =250x0.896=224 V.A (Apparent power)

Refrences:

1- electrical technology (Edward Hughes)
2- Electrical technology (B.L THERAJA)
3-Fundemental Electrical Engineering (Fitzgerald Mc-Graw-Hill)
5- مبادئ علم الهندسة الكهربائية (د. محمد زكي, د. مظفر النعمة)

Thank you