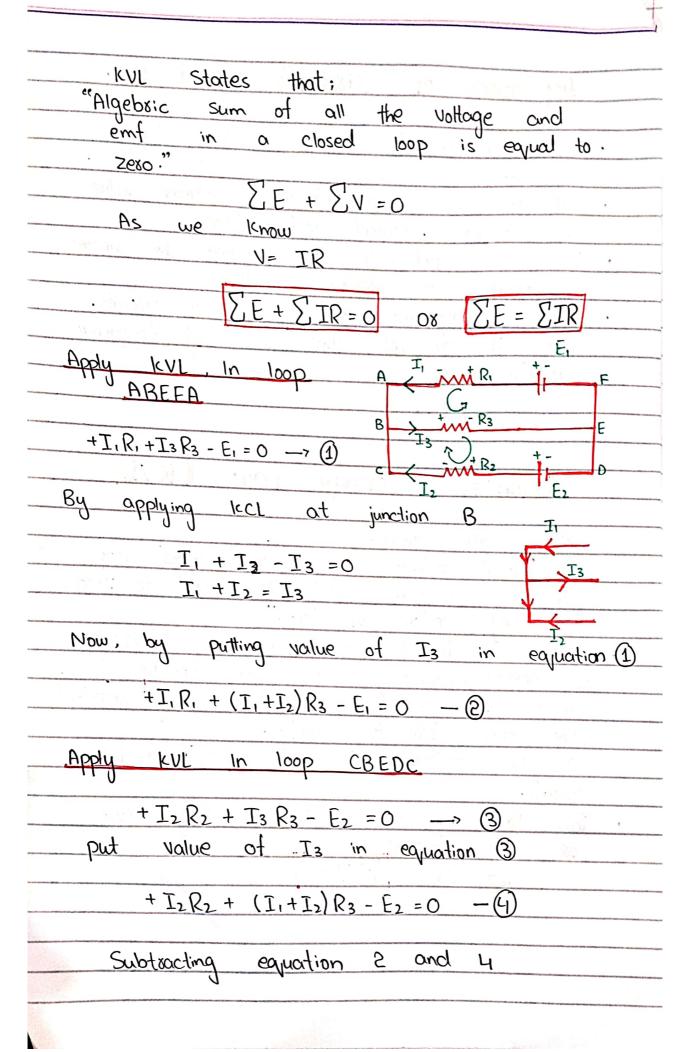
Lectures : Ayesha
Applied Physics
Applied Physics Topic: Kirchhoff's Law .
· Krichhoff's laws are very helpful tool for Circuit analysis.
• These laws are used to find current cucl voltage in complex electrical circuits.
vollage in complex electrical ciscuits.
Types of kixhhoff's Law:
V. Congression
These are two types of kirchhoff's law:
1. Kirchhoff's Current Law (KCI)
2. Krichhoff's voltage law (KVL)
Kirchhoff's Current Law (KCL)
Kirchhoff's Current Law (KCL)
ICCL States that
"Algebraic sum of current at nocle or
junction is zero"
$\Sigma I = 0$ or .
"Current flowing into a node must be
equal to current flowing out of it."
I (enter) + I (exit) = 0
· This law is based on conservation
of charges.
• kcl is also known as Kirchhoff's 1st law, junction or current law.
iaw, juriction of cassent law.
· From given · Current entering the
dicaxam mode equals to current st.
leaving the nocle I I_3 I
$I_1 + I_2 = I_3 + I_4$
<u> </u>

· we consider, current directed towards
a point as Positive and disected
away from point as Negative.
So, according to diagram
Cuspent disected towards is
I_1 and I_2 and
Current directed away from point is
Thus,
which is same as;
$\overline{I_1 + \overline{I_2}} = \overline{I_3 + \overline{I_4}}$
$\Sigma I_{in} = \Sigma I_{out}$
· From Kirchoff's law,
The state of the s
$I_1 \qquad I_3 \qquad I_1 + I_2 = I_3$
T ₂
The state of the s
$I_1 = I_3$
$I_1 = I_2 + I_3$
12 20 went com 21 100 .
But Parthing Co Chaire Parthing - Udi
e prissing them to gate with
to the same to the same to the same to
A. F. Sign W. Store
11. + 81

Application	ns of	Kixchoff's	Cussent	Low
· kcL is	ucoful	tool lov	Calwaa	Carallon
Circuits.	uscim	(DOI 108	Solving	Complex
	possible	to clotexmin	e unkm	wn Value
	stance, cur	THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TRANSPORT OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO		
· KCL is	useful	in unde	estanding	the transfer
of energy	y in	electoic c	iscuit.	
· KCL is	opplicable,	to alm	ost every	ciocuits,
but i	y in opplicable t can ro	t used	for high	n-foequency
circuits.	and the second s	1	U	
1				
		•		
Kirchh	off's \	10ltage	Low	(KVL)
	٠	J J		11.00.11
kVL .	states the	at; e axound	any Cl	osed loop
kVL S	states the tal voltage electrica	at; e axound 1 cixcuit	l any cl is equ	osed 100p ual to ze80
kVL S To in ar	states the tal voltage ny electrica ny instant	e axounce Ciscuit t of time	is equinciple of	osed loop ual to zexo f Conservation
kvl. S in ar at a	states the tal voltage nelectrical ny instant is based	e around circuit of time on pro	l any cl is equ ne." inciple of that	osed loop lad to zero f Conservation energy
kVL S in ar or or o	states the tal voltage ny electrica ny instant is based	e around L circuit t of time on process ted or	is equine." inciple of that destayed	osed 100p ual to ze80
kVL STO	states the tal voltage ny electrica ny instant is based sgy, which	e axound I cixcuit t of tim on px n states ted ox to ar	is equine." inciple of that clest by education	osed loop and to zero f Conservation energy only converted
kvl. in ar at a level of ener cannot from	states the tal voltage ny electrica ny instant is based sgy, which be creat	e axounce I cixcuit t of time on px n states ted ox to ar	is equine." inciple of that destayed	osed loop and to zero f Conservation energy only converted
kVL S in ar ort a lcvL of ener cannot from lcvL is	states the tal voltage ny electrica ny instant is based sgy, which be creat	e asound I ciscuit t of tim on ps n states ted os to ar	any cl is equ ne." inciple of that destroyed other. both Ac	osed loop and to zero f Conservation energy only converted and DC
kVL S in ar ort a lcvL of ener cannot fxom lcvL is circuits.	states the tal Voltage ny instant is based sgy, which be creat one form application	e axounce I cixcuit t of time on px n states tect ox to or ble to	is equine." inciple of that clest both Ac	osed loop and to zero f Conservation energy only converted
kvl. is circuits.	states the tal voltage ny instant is based sgy, which be creat one form applicab	e axounce I cixcuit t of time on px n states tect ox to or ble to	any cl is equ ne." inciple of that destroyed other. both Ac	osed loop and to zero f Conservation energy only converted and DC
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kvl. is circuits.	states the tal voltage ne electrical ny instant is based sgy, which be creat one form applicate aw is loop theore	e axounce I cixcuit t of time on px n states tect ox to or ble to	any cl is equ ne." inciple of that destroyed other. both Ac	osed loop and to zero f Conservation energy only converted and DC



I,R, + (I, +I) R3 - E1 =0	
I2R2 + (F1+I2)R3 - E2=0	rictorium
-0 = 01 = 2 (+1 + ,E) + - 126	
$I_1R_1 - I_2R_2 - E_1 + E_2 = 0$	
	-
$(I_1R_1 - I_2R_2) + (E_2 - E_1) = 0$	
William Control of the control of th	
EIR + EE=O	
Creatily Falls Falls Fall	
Sv + EE =0	_
	_
· KVL is based on principle of Conservation	
of energy, which states that energy cannot be executed or destroyed, only	_
cannot be exected as destroyed, only	_
converted trom one trom to another.	_
· ICVL is applicable to both AC and DC	_
Ciscuits.	_
· This law is also called voltage rule	
08 loop theosem.	
2 - 1 Le + 1 Le	
Numericals:	
A G - 1 lov - E Given:	
Problem: 01 $I_1 = ?$ $R_3 = 35$	2
12	
$\beta \rightarrow \gamma $	
	_
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-
Cl + D	
Calculate Cussent in each branch.	-
O (18 + 11)	-
11 11 ADETA	- 5
TO + TaPa + TO - To - O	Nikituwa
11K1 T +3K3 7 LIKE # E1 = U	-
Apply KVL in Closed Loop ABETA IIRI + I3R3 + IIR = E1 = 0	

 $1I_1 + 3I_3 + 2I_1 - 10 = 0$ $4I_1 + 3(I_1 + I_2) + 2I_1 = 10$ $I_1 + 3I_1 + 3I_2 + 2I_1 = 10$ 6I, +3I2=10 1 Apply KVL closed loop CBEDC in I2 R2 + I3 R3 + I2R2 - E2 =0 $I_2 + 3I_3 + 5I_2 - 5 = 0$ $I_2 + 3(I_1 + I_2) + 5I_2 = 5$ I2 + 3I, + 3I2 + 5I2=5 $3I_1 + 9I_2 = 5 - 0$ Multiply "2" from $bI_1 + 18I_2 = 10$ Subtract eq and $6I_1 + 3I_2 = 10$:100 61, +1812 = 10 - 1512 = 0 $I_2 = 0/-15 = 0$ $\overline{I}_2 = 0$

Put value of Iz in eq 1)
Put value of Iz in eq (1)
$6I_1 + 3I_2 = 10$
$6T_1 + 3x_0 = 10$
:512
$6\overline{L}_1 = 10$ =7 $\overline{L}_1 = 10$ 6 = 5/3
$T_1 = 1.66$
Alan In Charles To Man Andrews
Now we have to find 13
As we know
$I_1 + I_2 = I_3$
1.66 + 0 = I3
I3 = 1.66 0-64-94 (14-1.) +-4
St = { St++ LSt + - LT!
Problem: 02
" in I work of the child
Find Cussent flowing in Ciscuit using Kischoof's
F2.652 CU
T ₂
12.9 O maine boxine
I +1- Eldi i eloji = 81
12V 8/14 17/1 51
Given:
R1 = 42 11 A 11 00 12 12 12 12
$R_2 = b\mathcal{R}$ (and the substitution of the s
$R_3 = 12 \mathcal{R}$
$R_{3} = 12 \mathcal{R}$ $E = 12 \mathcal{V}$

$$I_1 = I_2 + I_3 = 7 \quad 1.0 + 0.5 = 7 \quad 1.5 = I_1$$

 $I_3 = 1/2 = 7 0.5 = I_3$

Problem 03 Using Kiachhoff's low calculate Current: R1= 452 12V + Тz 1 10v } R3 = 8.S Solution: Given dala: R1= 452 R2 = 22 B3 = 82 $E_1 = 12$ E2 = 10V To Find: I, = ? $T_{i}=?$ I3=? Consider loop ABCD A then KVL I,R, + I3R3 - E, = 0 4I, + I38 - 12 =0 where I3 = I1 + I2 4I, + (I,+I2) B-12=0 4I, + 8I, +8I2 = 12 $12I_1 + 8I_2 = 12$ $3I_1 + 2I_2 = 3$ - (1) Consider loop EBCFE I2R2 + I3R3 - E2 =0 I22 + (I,+I2)8-10=0 212 + 81,+812 - 10,=0 10I2 + 8I1 = 10 $SI_2 + UI_1 = 5$ 4I, +5 I2= 5 **(S)** Multiply and

$15I_1 + 10I_2 = 15 -3$
$8I_1 + 10I_2 = 10$
- Subtract eq, 3 and 4
$-15I_1 + 10I_2 = 15$
$8I_1 + 10I_2 = 10$
$7I_1 = 5$
T 51
$T_1 = 5/7 \Rightarrow T_1 = 0.714 A$
Now put value 1 Time 6
Now put value of II in eq 2
4I1+5I2=5 => 4(0.714)+5I2=5
$5I_2 = 2.144$
I2= 2.144/5 => I2=0.428A
$I_3 = I_2 + I_2 = 7$ $1.143 = I_3$
VI = IIR, => 0.714 x4 => VI = 2.856 V
1 2 2 3 5 V
V2= I2R2 =7 0.428 x2 =7 V2= 0.858 V
7
V3 = I3P2 => 1.143x8 => V3 = 9.144V
"c" not S now "home "?" not 2 now whitely

Problem 04.
Two batteries having emf 100 and 50
integral resistance use 252 and 152
respectively are connected in parallel
respectively are connected in Parallel in Such as way that they send Current in external resistance of 502
Current in external resistance of 50
in the same disection.
Calculate cussent in each branch
and potential difference across 52
xesistance.
2.0
A I, 22 T-10V F
T 5.2
C C C C C C C C C C
I, 12 SV
Apply KVL in closed loop ABEFA
IIR, + I3R3 - E, =0
$2I_1 + (I_1 + I_2)5 - 10 = 0$
21, + 51, + 512 = 10
$7T + 5T_2 = 10$ $-(1)$
Apply KVL in closed loop CBEDC
I2R2 + I3R3 - E2 = 0
12 K2 T 13 K3 L2 G
$1I_2 + (I_1 + I_2)S = 0$
$1I_2 + 5I_1 + 5I_2 - 5 = 0$
$6I_2 + 5I_1 = 5$ -2
Multiply ear 1 by "5" and ear 2 by "7"
us det:
351, + 2512 = 50 0
$35I_1 + 42I_2 = 35 - 9$
Now subtract ear 3 and 4

$$3ST_{1} + 2ST_{2} = S0$$

$$3ST_{1} + 412T_{2} = 35$$

$$-17T_{2} = 15$$

$$I_{1} = -15 | p A$$
Put T_{2} in eq. (1)
$$7T_{1} + 5 (-15|_{1}) = 10$$

$$7T_{1} - 75 = 10$$

$$17$$

$$7T_{1} = 10 + 15$$

$$17$$

$$T_{1} = 245 = 35|_{17} A$$

$$17 \times 7$$

$$T_{1} = 3S|_{17} A$$

$$T_{3} = T_{1} + T_{2} = 7 \cdot 3S + (-15) = 7 \cdot 35 - 15$$

$$17 \cdot 3S - 4S = 20 \cdot A = T_{3}$$

$$17 \cdot 3S - 4S = 20 \cdot A = T_{3}$$
Potential across SR resistance
$$V = TR$$

$$V_{3} = T_{3} R_{3}$$

$$= 20 \cdot xS = 7 \cdot 1000 \text{ V}$$

$$V_{5} = S \cdot 88 \text{ V}$$

$$V_{5} = S \cdot 88 \text{ V}$$

4 to find only potential we have acwss SDresistance. SVR 10/2 + 5/1 10 5+2+10 1/2+1/5+1/1 10×10 17 10 100 V 17/10 S.-88V Problem: E, and Ez, R, Rz and Rz are ciocuit Is, Iz and Is. given. Find 20 _ 10 \$ 10 Poblem: Find I_1, I_2, I_3 252 8^{3} I3 - T 12V