ELEMENTS OF ELECTRICAL ENGINEERING
Course Code : UE25EE141A/B

PES UNIVERSITY

FACULTY CONTRIBUTED:

Department of EEE, RR Campus

Prof . Jyothi T N
Prof. Vadhiraj K P P
Prof. Kruthika N
Prof. Suma S
Prof. Pushpa K R
Prof. Sangeeta Modi

Department of ECE, EC Campus

Prof. Lokesh L
Prof. Dhanashree G Bhate
Dr. Renuka R Kajur
Prof. Rajesh Chandrashekar
Prof. Sangam Kumar G H

ELEMENTS OF ELECTRICAL ENGINEERING

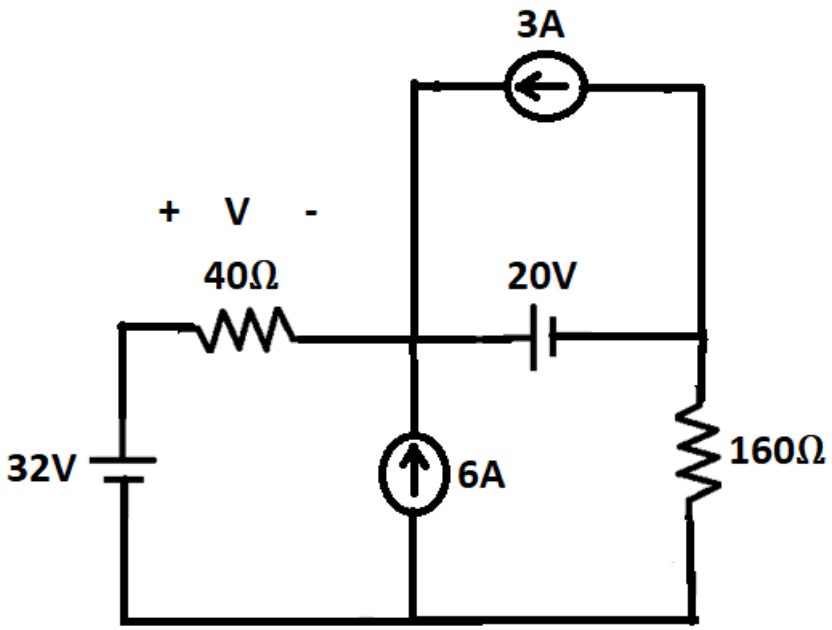
Numerical Examples on Superposition Theorem

Jyothi T N
Department of Electrical & Electronics Engineering

Numerical Example 1

Question:

Obtain voltage ‘V’ using Superposition Theorem.



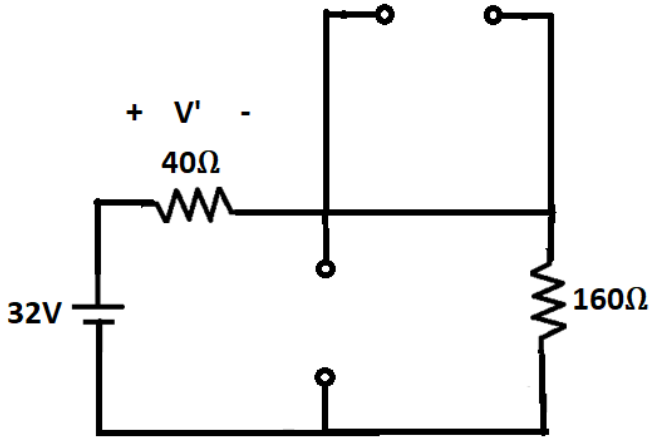
ELEMENTS OF ELECTRICAL ENGINEERING

Numerical Example 1

$$V' = 32V * \frac{40\Omega}{200\Omega} = 6.4V$$

Solution :

Considering 32V source alone,

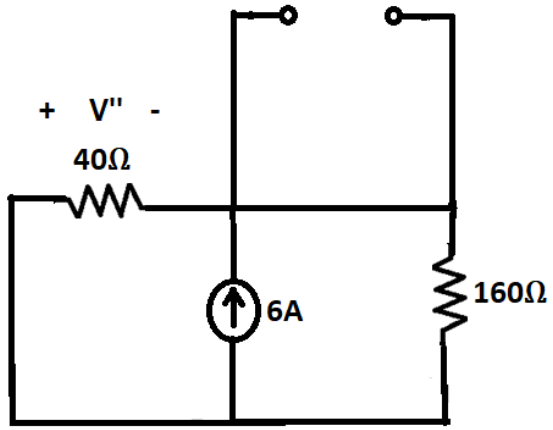


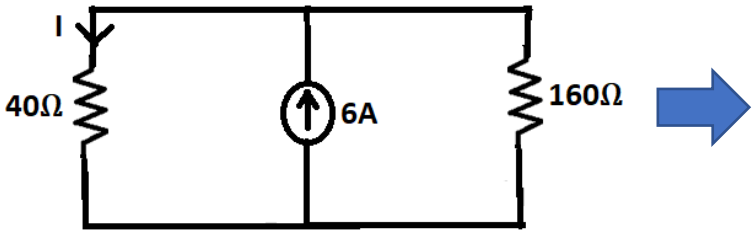
$$V' = 32V * \frac{40\Omega}{200\Omega} = 6.4V$$

Numerical Example 1

Solution (Continued..) :

Considering 6A source alone,





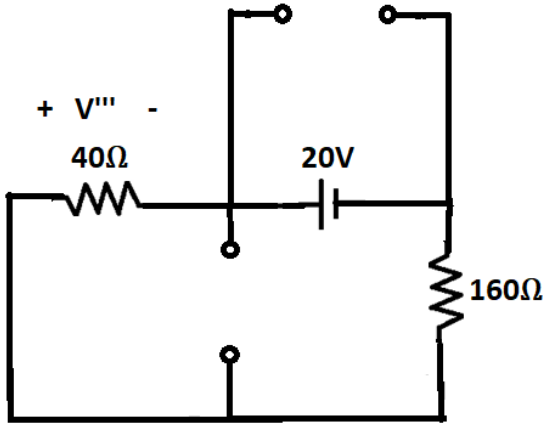
$$I = 6A * \frac{160\Omega}{200\Omega} = 4.8A$$

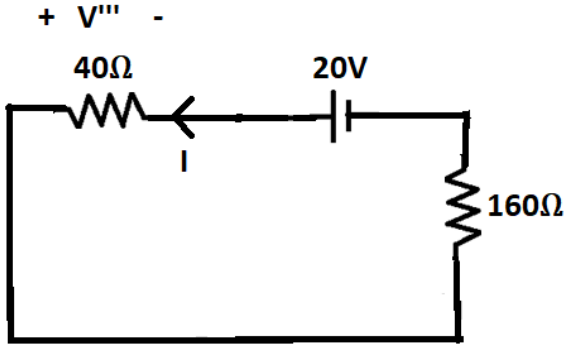
$$V'' = -4.8A * 40\Omega = -192V$$

Numerical Example 1

Solution (Continued..) :

Considering 20V source alone,





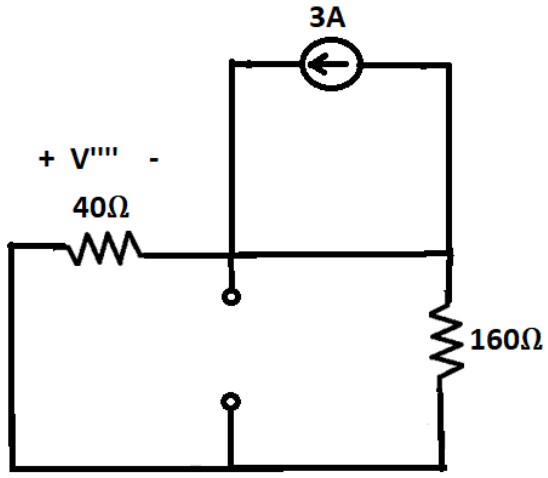
$$I = \frac{20V}{200\Omega} = 0.1A$$

$$V''' = -0.1A * 40\Omega = -4V$$

Numerical Example 1

Solution (Continued..) :

Considering 3A source alone,



$V'''' = 0$

By Superposition Theorem,

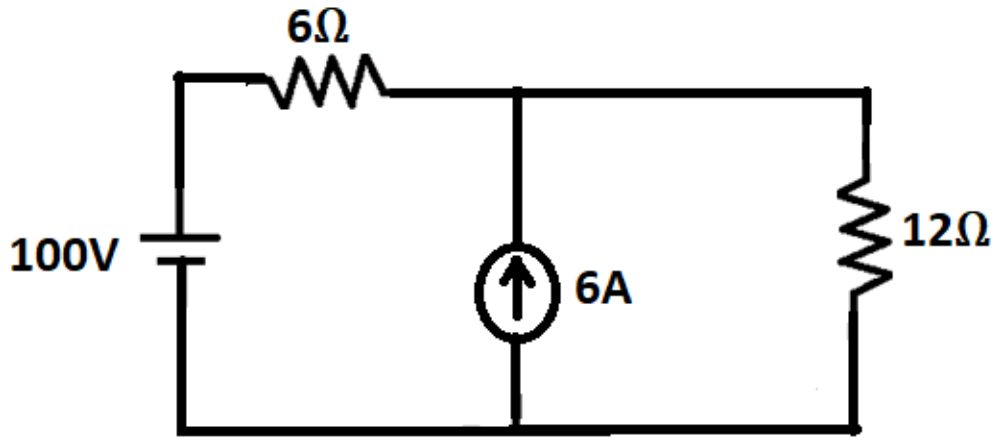
$V = V' + V'' + V''' + V'''' = -189.6V$

ELEMENTS OF ELECTRICAL ENGINEERING

Numerical Example 2

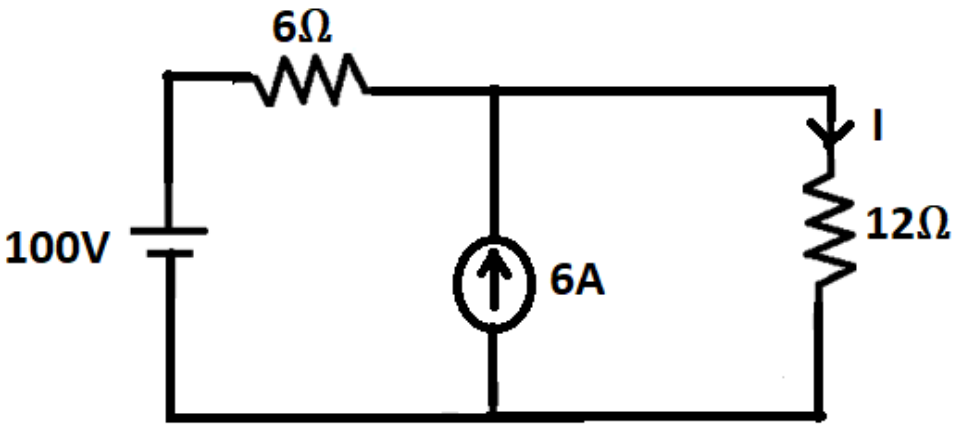
Question:

Find the power absorbed by 12Ω resistor using Superposition Theorem.



Numerical Example 2

Solution :



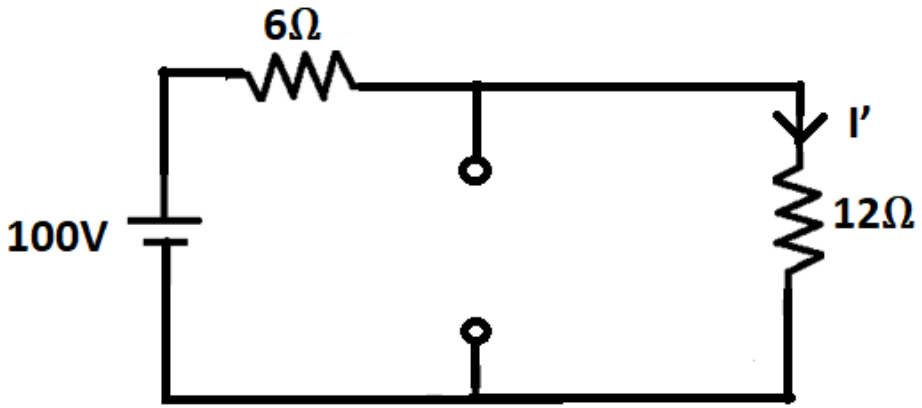
Let us consider individual current & Power responses due to 100V source acting alone as I′ & P’

Let us consider individual current & Power responses due to 6A source acting alone as I″ & P’’

Numerical Example 2

Solution (Continued..) :

Considering 100V source alone,

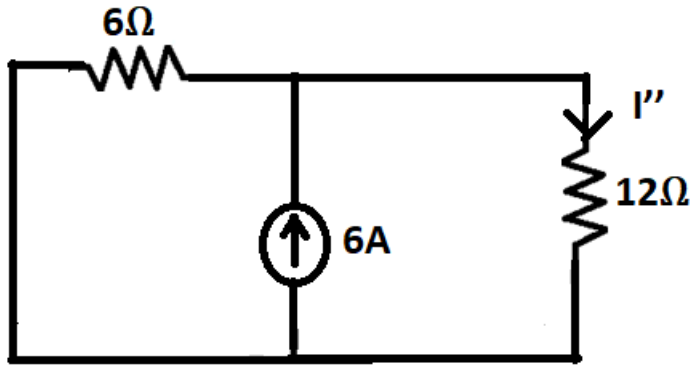


$I' = \frac{100V}{18\Omega} = 5.56A$ & $P' = (I')^2 * 12 = 370.96W$

Numerical Example 2

Solution (Continued..) :

Considering 6A source alone,



$I'' = 6A * \frac{6\Omega}{18\Omega} = 2A$ & $P'' = (I'')^2 * 12 = 48W$

Numerical Example 2

Solution (Continued..) :

By Superposition, current in 12Ω resistor = I = I’ + I’’ = 7.56A

Hence, Power absorbed by 12Ω resistor = I^2*12 = 685.84W

Adding the individual Power responses, P’ + P’’ = 418.96W, which is not equal to the actual power absorbed.

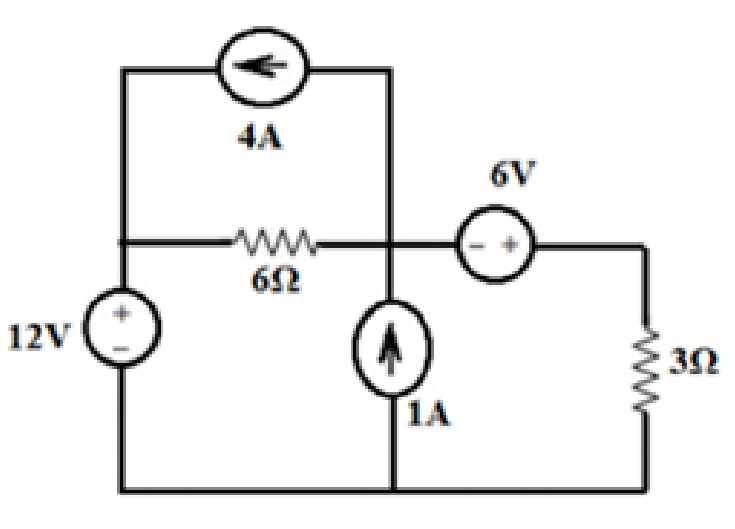
Hence, individual power responses cannot be superposed to get total power because power is a quadratic term.

Thus, to get total power response, apply superposition principle to get total current or total voltage & using that find the power.

ELEMENTS OF ELECTRICAL ENGINEERING

Class Work

Find the current through 3Ω resistor in the circuit shown below using Superposition Theorem



ELEMENTS OF ELECTRICAL ENGINEERING

Text Book & References

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023

2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.

THANK YOU

Jyothi T N

Department of Electrical & Electronics Engineering

jyothitn@pes.edu