Basic Electro-Mechanical Engineering

Summer mid Paper

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Section: A

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HAYATABAD, PESHAWAR

Q1 a) There are two well-known formulae for calculating the total resistance of parallel-connected resistances. One of these works only for two resistances while the other works for any number of parallel resistances. Write these two formulae.

Solution:

Formula for calculating two resistance in a parallel connected circuit.

$$\mathbf{R_T = \frac{R1R2}{R1+R2}}$$

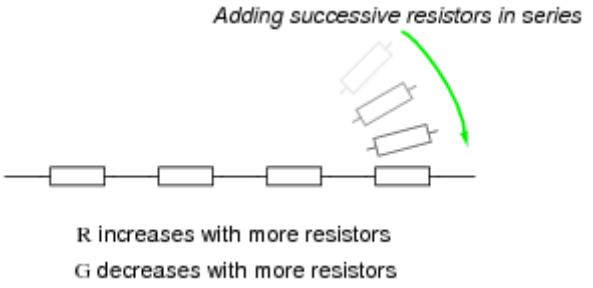
Formula for calculating more than two resistance in a parallel connected circuit.

$$\frac{\mathbf{1}}{\boldsymbol{RT}} = \frac{\mathbf{1}}{\boldsymbol{R1}} + \frac{\mathbf{1}}{\boldsymbol{R2}} + \frac{\mathbf{1}}{\boldsymbol{R3}} + \cdots + \frac{\mathbf{1}}{\boldsymbol{RN}}$$

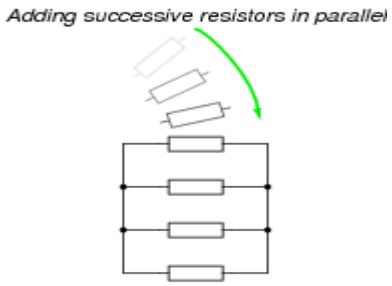
b) A quantity often useful in electric circuit analysis is conductance, defined as the reciprocal of resistance;

$$G = \frac{1}{R}$$

In a series circuit, resistance increases and conductance decreases with the addition of more resistors;



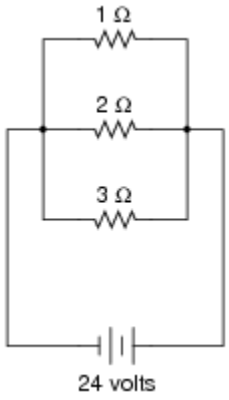
Describe what happens to total resistance and total conductance with the addition of parallel resistors;



ANS: When successive resistors are connected in parallel, total resistance decreases while total conductance increases.

END

Q.2: In the given circuit, three resistors receive the same amount of voltage (24 volts) from single source. Calculate the amount of current "drawn" by each resistor, as well as the amount of power dissipated by each resistor;



Given:

V=24v

$R_1=1\Omega$

$R_2=2\Omega$

$R_3=3\Omega$

Required:

I=?

P=?

Solution:

Current “drawn” by each resistor

We know that

V=I R

First we have to find “I”

So,

$I_1=\frac{V}{R1}$

Put values of ‘V’ and ‘R_1’ we get

$I_1=\frac{24}{1}$

I_1=24 A ……

Now for ‘I_2’

$I_2=\frac{V}{R2}$

$I_2=\frac{24}{2}$

I_2=12 A ……

Now for ‘I_3’

$I_3=\frac{V}{R3}$

$I_3=\frac{24}{3}$

I_3= 8 A ……

Now Power dissipated by each resistor

We know that

P=V I

Put the values of ‘V’ and ‘I_1’

P_1= 24 * 24

P_1= 576 W ……

Now for 'P_2'

$P_2 = V * I_2$

$P_2 = 24 * 12$

$P_2 = 288$ W ……

Now for 'P_3'

$P_3 = V * I_3$

$P_3 = 24 * 8$

$P_3 = 192$ W ……

Current "drawn" by each resistor	**Power dissipated by each resistor**
$I_1 = 24$ A	$P_1 = 576$ W
$I_2 = 12$ A	$P_2 = 288$ W
$I_3 = 8$ A	$P_3 = 192$ W

END

Q.3: Differentiate between the following**;**

(a) Current & Voltage.
(b) Resistance & Conductance.
(c) Power & Energy
(d) Inductance & Capacitance
(e) Synchronous motor & Asynchronous motor

(a) Current & Voltage.

Current	Voltage
➢ The rate of flow of charges through a cross section of a conductor.	➢ Electric potential difference between two points on a conductor.
➢ Needs a complete closed conducting path to flow.	➢ Sometimes described as 'electric pressure' that makes current flow.
➢ Ends of the conducting path must have a potential difference (voltage).	➢ Supplies the energy of the circuit.
➢ Measured with an 'ammeter' in amps (A) named for Ampere-French scientist.	➢ Measured in Volts (V) using a voltmeter.
➢ One ampere (A) is charge flowing at the rate of one coulomb per second past a point in the circuit.	➢ The amount of energy per coulomb of charge is called the voltage.
$I=\frac{Q}{t}$	

(b) Resistance & Conductance.

Resistance	Conductance
➢ It is defined as the hindrance to the flow of current.	➢ It is the ease with which current flows per unit area of conductor.
➢ It is the ratio of potential difference to current i.e. R=V/I	➢ And per unit potential applied & is reciprocal to resistance (R)
➢ Its S.I unit is volts per ampere or ohm (denoted by Ω)	➢ G = conductance G =1/R

(c) Power & Energy

Power	Energy
➢ The work done in a unit time is jnown as power.	➢ The ability of a body to do work is called energy.
➢ It is denoted by P	➢ It is denoted by J
➢ The S.I unit of power is watt (W).	➢ The unit of energy is the same as that of the work i.e joule (J).

(d) Inductance & Capacitance

Inductance	Capacitance
➢ Block aternating current.	➢ Block direct current.
➢ Passes direct current.	➢ Passes alternating current.
➢ Current in an inductor cannot change instantly.	➢ Voltage in capacitor cannot change instantly.
➢ Quick current change produceses large voltage.	➢ Quick voltage change produceses large current.
➢ Stores energy in magnetic field.	➢ Stores energy in electric field.

(e) Synchronous motor & Asynchronous motor

Synchronous motor	Asynchronous motor
➢ Magnetic field current is supplied by separate DC source.	➢ Magnetic field current is supplied by induction.
➢ Speed is always synchronous.	➢ Speed is always less than synchronous speed.
➢ Could have leading or logging P.F.	➢ Always operate at logging P.F.
➢ Can be used for P.F improvement.	➢ Cannot be used for P.F improvement.
➢ Expensive.	➢ Cheep.
➢ Not self-starting.	➢ Self-starting.
➢ Complicated design.	➢ Simple design.
➢ Sudden load change causes hunting.	➢ Has no hunting.