

(1)

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SUBJECT: BASIC ELECTRO MECHANICAL

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QUESTION: Q1

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

ANSWER:

FOR TWO NUMBERS

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

FOR ANY NUMBERS

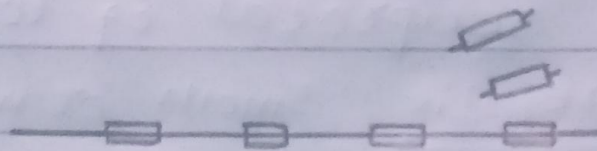
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots \dots \frac{1}{R_n}$$

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

$$G = 1/R$$

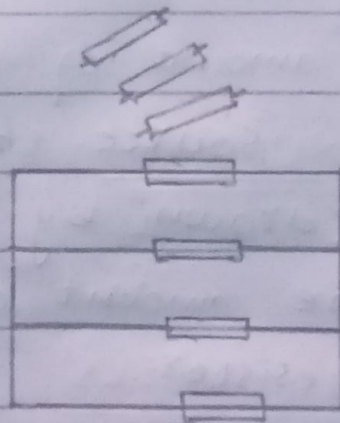
(2)

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



It increase with more resistors  
& decrease with more resistors

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



Adding successive resistor  
in parallel.

ANSWER:

With parallel resistors the number of total resistance decreases since the total resistance is in reciprocal form so it divides into intervals as given below:

(3)

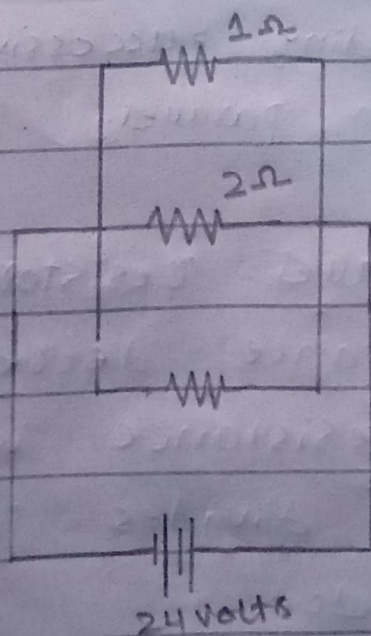
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

While the total conductance will increase because total conductance is the reciprocal of total resistance so there is smooth or more flow of electrons.

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

### QUESTION: 2

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



(4)

ANSWER:

$\therefore R_1$  is in parallel  
So,  $I_1 = 1/R_1$

$$I_1 = V_1 / R_1$$

$$I_1 = 24/1 \quad \therefore V_1 = 24V$$

$$R_1 = 1\Omega$$

$$I_1 = 24A$$

$R_2$  is in series so (R)

$$\therefore I_2 = V_2 / R_2$$

$$I_2 = \frac{24}{2} \quad \therefore V_2 = 24V$$

$$R_2 = 2\Omega$$

$$I_2 = 12A$$

$R_3$  is in parallel

$$I_3 = V_3 / R_3$$

$$I_3 = 24/3 \quad \therefore V_3 = 24V$$

$$R_3 = 3\Omega$$

$$I_3 = 8A$$

(5)

## Power Dissipated by Each Resistor

$$P = VI$$

$$P_1 = V I_1$$

$$P_1 = 24 \times 24$$

$$P_1 = 576 \text{ W}$$

$$P_2 = V I_2$$

$$P_2 = 24 \times 12$$

$$P_2 = 288 \text{ W}$$

$$P_3 = V I_3$$

$$P_3 = 24 \times 8$$

$$P_3 = 192 \text{ W}$$

## QUESTION: 3

Differentiate between the following.

- current & voltage
- Resistance & conductance
- Power & Energy
- inductance & capacitance
- synchronous motor & asynchronous motor.

6

ANSWER:

### CURRENT

- Current is just the rate of flow of electric charge
- In series circuit current is constant
- Unit of current is Ampere (A)

### RESISTANCE

- Resistance is a property of a material (conductor) which tells us how much the resistor resists the current to which it is pass through it.
- Resistance is the opposition of current which is passing through a circuit.

### VOLTAGE

- Voltage is the difference in electric potential between two points.
- In parallel circuit voltage is constant.
- Unit of voltage is Volt (V)

### CONDUCTANCE

- Conductance is a property of a conductor which tells us how much the resistor allows the current to pass through it.
- Conduction is the reciprocal of resistance

7

## POWER

→ power is how fast you can do it  
(energy is the total amount of work done)

→ power is energy per unit of time  
power is watts

→ power = energy / time

$$E = V/I$$

power unit is watts

## INDUCTANCE

→ Inductance is a property of a current carrying conductor which generates a magnetic field

→ Inductor is used to store the energy in the form of a magnetic field

## ENERGY

Energy is the total amount of work done.

Energy is watt-hours

Energy unit is joule

## CAPACITANCE

(Capacitor stores the energy) capacitance is a property of a device to hold and store electric charges

Capacitor stores the energy in the form of an electric field

8

### SYNCHRONOUS MOTOR

### A SYNCHRONOUS MOTOR

→ Synchronous motor is a machine whose rotor speed and the speed of the stator magnetic field is equal.

A synchronous motor is a machine whose rotor rotates at the speed less than the synchronous speed.

→ Synchronous motor does not have slip

A c induction motor is known as the asynchronous motor.



The stator carries windings connected to an AC supply to produce a rotating magnetic field. At synchronous speed the rotor poles lock to the rotating magnetic field, because of the constant magnetic field in the rotor these can't use induction windings for starting. Synchronous motors are inherently not self starting while asynchronous motor is self start and it is also called induction motor. Induction motor and synchronous motor, the stator winding of induction motor is energized from an AC source. Synchronous motor always runs at synchronous speed and the speed of the motor is independent of load but an induction motor always runs less than the synchronous speed.