Course Name:	**Elements of Electrical and Electronics Engineering**	**Semester:**	**II**
Date of Performance:	**21/04/2022**	**Batch No:**	**E1**
Faculty Name:		**Roll No:**	**16010321005**
Faculty Sign & Date:		**Grade/Marks:**	**/ 25**

Experiment No: 2

Title: Battery level Indicator.

Aim and Objective of the Experiment:

- To understand voltage division concept, current division concept and principle of operation of LED.
- To develop a micro project (Battery level indicator) based on the concepts learned in the form of various task performed in the experiment.

COs to be achieved:

CO1: Analyze resistive networks excited by DC sources using various network theorems.
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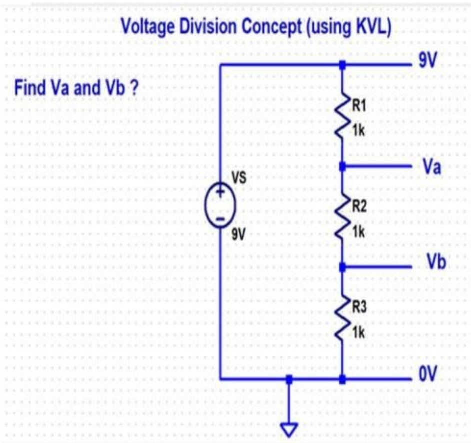
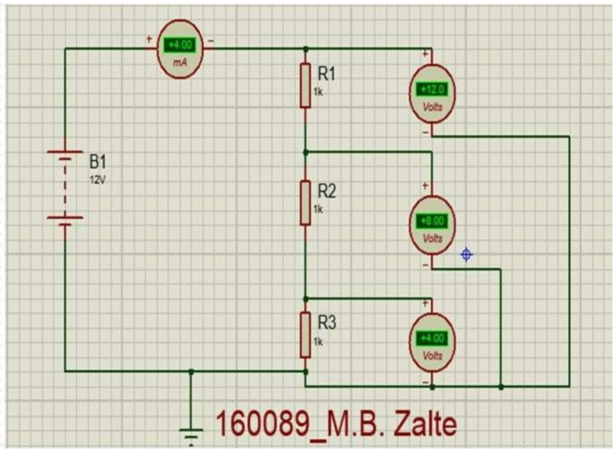
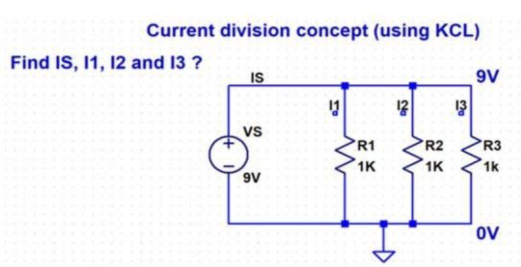
Circuit Diagram/ Block Diagram:

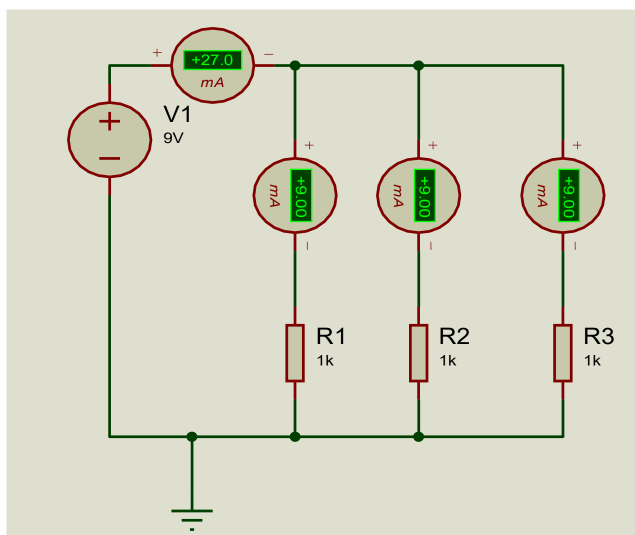
Task 1: Voltage division Concept and its verification on breadboard



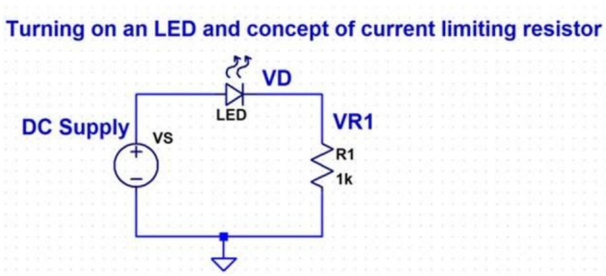


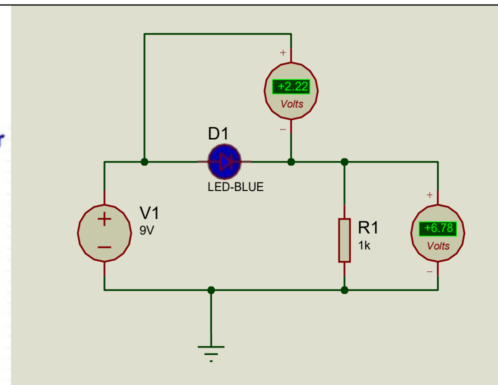
Task 2: **Current division Concept**



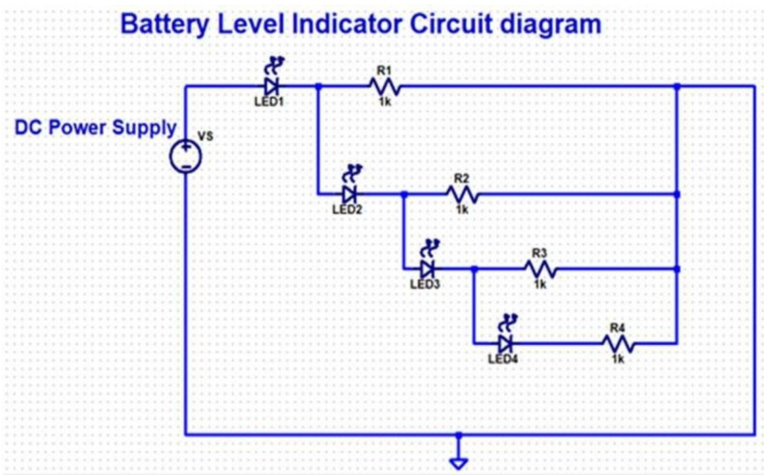


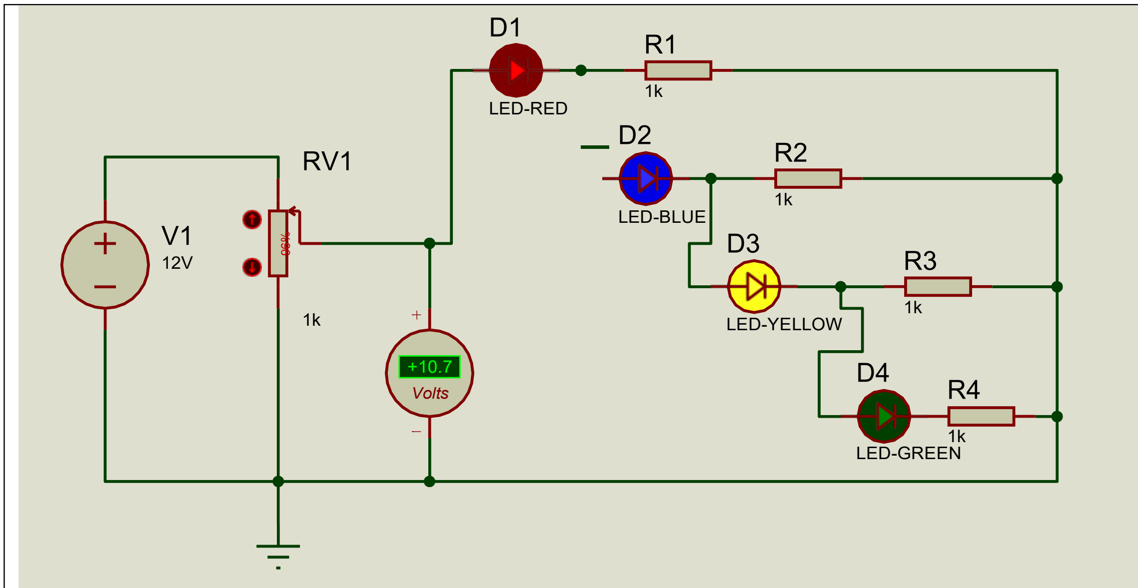
3: Turn on an LED and measure its turn-on voltage





Task 4: Battery Level Indicator Circuit





Stepwise-Procedure:

1. Make the connections as shown in the circuit diagram for Task1. Measure the voltages Va, Vb and current Is for Task 1 and compare with calculated results.
2. Make the connections as shown in the circuit diagram for Task2. Measure the currents I1,I2, I3 and IS and compare with calculated results.
3. Make the connections as shown in the circuit diagram for Task3. Measure the voltages VS, VD, VR1 for Case1 and Case 2.
4. Make the connections as shown in the circuit diagram for Task4. Measure the voltages across LED and resistors.

Observation Table:

Observation Table 1 (Task 1)

Voltages / Currents	Theoretical reading	Practical reading
Va(V)	7.615	7.74
Vb(V)	4.56	4.61
IS(mA)	1.38	1.39

Calulations (Task1):

Calclaute Va and Vb using the formula given below:

$$Va = \frac{(R2 + R3) * VS}{R1 + R2 + R3}$$

$$Vb = \frac{(R3) * VS}{R1 + R2 + R3}$$

Observation Table 2

Currents	Theoretical reading	Practical Reading
I1 (mA)	9	9
I2 (mA)	4.09	4.09
I3 (mA)	2.72	2.72
IS (mA)	15.81	15.81

Calculations (Task2):

Calculate I1, I2, I3 and IS using the formula given below:

$$I1 = \frac{VS}{R1}$$

$$I2 = \frac{VS}{R2}$$

$$I3 = \frac{VS}{R3}$$

$$IS = I1 + I2 + I3$$

Observation (Task 3):
Case 1 : LED just turn's ON

Parameters	Practical reading
VS (V)	1.8
VD (V)	0.08
VR1 (V)	1.68

Case 2 : LED turn's ON (glows brightly)

Parameters	Practical reading
VS	2
VD	0.33
VR1	1.74

Observations (Task4):
Case 1 : Supply Voltage Levels recording

Scenario	Range of Battery voltage (V)
ALL LEDS OFF	0V
LED 1 ON	1.9V
LED 1 ON & LED 2 ON	3.8V
LED 1 ON & LED 2 ON & LED 3 ON	5.7 V
ALL LEDs ON	7.8 V

Case 2: Status of voltages in the circuit when all LEDs On

Voltages	Practical reading (in Volts)
$V_{LED\,1}$	2.01V
$V_{LED\,2}$	1.98V
$V_{LED\,3}$	1.9V
$V_{LED\,4}$	1.8V
VR1	6.9V
VR2	4.9V
VR3	3.01V
VR4	1.2V

Post Lab Subjective/Objective type Questions:

1. Mention some applications of battery level indicator.

   Battery level display on all sorts of electronic devices which run on stored electrical energy

2. Explain practical usage of Voltage- division concept?

   Groove Slide Potentiometer-The potentiometer is useful to help achieve a variable voltage from a fixed-voltage source. It can connect the outer terminals of a potentiometer across the voltage source and control the voltage you need between your potentiometer and one of the outer terminals for your circuit.
   Groove Rotatory Angle Sensor-The Grove-Rotary Angle Sensor (P) is capable of producing analog output between 0 and Vcc (5V DC with Seeeduino) on its D1 connector.
   Groove Voltage Divider-The Grove – Voltage Divider provides an interface for measuring external voltage which eliminates the need to connect a resistance to input interface.
   Resistive Sensors Reading-Most sensors are simple resistive devices like our Grove – Infrared Reflective Sensor. However, most of them are only able to read voltage but not resistance. By adding another resistor to the circuit, we are able to create a voltage divider together with the sensor. As we are able to check the output of the voltage divider, we can now calculate the amount of resistance of the sensor.
   Level Shifters- A voltage divider comes in and saves the day acting as a level shifter which interfaces two circuits that use different operating voltages.

3. Explain working of Battery Level Indicator implemented in this experiment in your own words?

   Battery level indicator works on the principle of voltage division. When a LED receives sufficient amount of voltage it starts to glow. As the voltage supplied increases, the LED's start to glow one by one, and when voltage supplied is maximum, all the LED,s would be glowing. If this circuit is connected with an electrical device which works on stored electricity, when the device is fully charged, all the LED's would be glowing. As the electrical device is used and it's stored electrical energy is reducing, one by one the LED's would start to go off. When the electrical device is completely drained of electricity, all the LED's would go off. This is the way in which a Battery Level Indicator works.

Conclusion:
Hence, we learnt the concepts of voltage division and current division and also the development of a battery level indicator.

Signature of faculty in-charge with Date: