RGB LED Lesson Note (SSS Level)

1. Introduction

An **RGB LED (Red–Green–Blue Light Emitting Diode)** is an electronic component that contains **three LEDs in one package**. These three LEDs are **red, green, and blue**. By controlling the brightness of each color, an RGB LED can produce **many different colors**. RGB LEDs are widely used in **electronics, displays, traffic lights, decorative lighting, and Arduino projects**.

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2. Learning Objectives

At the end of this lesson, students should be able to: - Define an RGB LED - Identify the pins of an RGB LED - Differentiate between common anode and common cathode RGB LEDs - Explain how color mixing works in RGB LEDs - State the applications of RGB LEDs - Connect an RGB LED in a simple circuit

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3. Structure of an RGB LED

An RGB LED has **four (4) pins**: 1. **Red pin (R)** – controls red light 2. **Green pin (G)** – controls green light 3. **Blue pin (B)** – controls blue light 4. **Common pin (COM)** – shared connection for all colors

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4. Types of RGB LED

(a) Common Cathode RGB LED

- The **common pin** is connected to **ground (GND)**
- The LED lights when a positive voltage is applied to the R, G, or B pin

(b) Common Anode RGB LED

- The **common pin** is connected to **positive voltage (+5V)**
- The LED lights when the R, G, or B pin is connected to ground

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5. Working Principle of RGB LED

Each color inside the RGB LED works like a **normal LED**. When current flows through any color pin, that color lights up. When two or more colors are turned ON together, **color mixing** occurs.

Color Mixing Table

Red	Green	Blue	Resulting Color
ON	OFF	OFF	Red
OFF	ON	OFF	Green
OFF	OFF	ON	Blue
ON	ON	OFF	Yellow
ON	OFF	ON	Magenta
OFF	ON	ON	Cyan
ON	ON	ON	White

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6. Current Limiting Resistors

- Each color pin must be connected through a **resistor**
- Common resistor values: **220Ω – 330Ω**
- Resistors prevent excessive current that can damage the LED

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7. Very Simple Hand-Drawn Circuit Diagram Description

(For chalkboard and notebook use)

1. Draw a **rectangle** and label it **Power Supply / Arduino**.
2. Draw a **round LED shape** beside it and label **RGB LED**.
3. Draw **four pins** under the LED and label them **R, COM, G, B**.
4. Draw a **zig-zag line (resistor)** from R, G, and B pins.
5. Connect the resistors to output pins or power supply.
6. Connect **COM** to **GND** (for common cathode) or **+5V** (for common anode).

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8. Interfacing RGB LED with Arduino (Basic)

- The R, G, and B pins are connected to **Arduino digital pins** through resistors
- The common pin is connected to **GND** (for common cathode RGB LED)
- Arduino controls the RGB LED by turning pins **ON and OFF**

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9. Simple Arduino Code for RGB LED

```
int redPin = 10;
int greenPin = 9;
int bluePin = 8;

void setup() {
  pinMode(redPin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}

void loop() {
  // RED color
  digitalWrite(redPin, HIGH);
  digitalWrite(greenPin, LOW);
  digitalWrite(bluePin, LOW);
  delay(2000);

  // GREEN color
  digitalWrite(redPin, LOW);
  digitalWrite(greenPin, HIGH);
  digitalWrite(bluePin, LOW);
  delay(2000);

  // BLUE color
  digitalWrite(redPin, LOW);
  digitalWrite(greenPin, LOW);
  digitalWrite(bluePin, HIGH);
  delay(2000);

  // YELLOW color (Red + Green)
  digitalWrite(redPin, HIGH);
  digitalWrite(greenPin, HIGH);
  digitalWrite(bluePin, LOW);
  delay(2000);
}
```

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10. Explanation of the Arduino Code (SSS Level)

- `int redPin = 10;` → assigns pin 10 to red LED
- `int greenPin = 9;` → assigns pin 9 to green LED
- `int bluePin = 8;` → assigns pin 8 to blue LED

- `void setup()` → runs once when Arduino starts
- `pinMode(pin, OUTPUT);` → sets the pin to control light output
- `void loop()` → repeats continuously
- `digitalWrite(pin, HIGH);` → turns the LED ON
- `digitalWrite(pin, LOW);` → turns the LED OFF
- `delay(2000);` → waits for 2 seconds

The Arduino switches ON different colors one after another, producing **red, green, blue, and yellow** light.

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9. Applications of RGB LED

- Traffic light systems
- Electronic displays
- Decorative and stage lighting
- Arduino and robotics projects
- Computer indicators
- Advertising boards

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10. Advantages of RGB LED

- Can produce many colors
- Uses one LED instead of three separate LEDs
- Low power consumption
- Easy to control with microcontrollers

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11. Safety Precautions

- Always use current-limiting resistors
- Do not connect directly to power supply
- Check the LED type before connection
- Switch off power after use

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12. Summary

An RGB LED is a combination of **red, green, and blue LEDs** in one package. By controlling each color, many different colors can be produced. RGB LEDs are important components in **modern electronics and Arduino-based projects**.

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13. Evaluation / Revision Questions

1. Define an RGB LED.
2. How many pins does an RGB LED have?
3. Differentiate between common anode and common cathode RGB LEDs.
4. Explain how yellow color is produced using an RGB LED.
5. State three applications of RGB LEDs.

End of SSS Lesson Notes