Biosensor Lab 1: Clark Oxygen Electrode Simulation

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

void setup() {
  lcd.begin(16, 2);
  lcd.print("Dissolved O2:");
}

void loop() {
  int sensorValue = analogRead(A0);
  float voltage = sensorValue * (5.0 / 1023.0);
  float oxygenLevel = voltage * 20.0;

  lcd.setCursor(0, 1);
  lcd.print(oxygenLevel);
  lcd.print(" ppm ");
  delay(500);
}
```

Biosensor Lab 2: Blood Glucose Sensor Simulation

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

int potPin = A0;
int ledPin = 2;
int potValue = 0;

void setup() {
  lcd.begin(16, 2);
  pinMode(ledPin, OUTPUT);
}

void loop() {
```

```
  potValue = analogRead(potPin);
  int glucoseLevel = map(potValue, 0, 1023, 50, 200);
  int ledBrightness = map(potValue, 0, 1023, 0, 255);

  analogWrite(ledPin, ledBrightness);
  lcd.setCursor(0, 0);
  lcd.print("Glucose Level: ");
  lcd.setCursor(0, 1);
  lcd.print(glucoseLevel);
  lcd.print(" mg/dL");
  delay(500);
}
```

Biosensor Lab 3: Heart Rate Sensor Simulation

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

int sensorPin = A0;
int ledPin = 9;
int sensorValue = 0;
int bpm = 0;

void setup() {
  pinMode(ledPin, OUTPUT);
  lcd.begin(16, 2);
  lcd.print("Heart Rate:");
}

void loop() {
  sensorValue = analogRead(sensorPin);
  bpm = map(sensorValue, 0, 1023, 60, 150);

  digitalWrite(ledPin, HIGH);
  delay(60000 / bpm);
  digitalWrite(ledPin, LOW);
  delay(60000 / bpm);

  lcd.setCursor(0, 1);
  lcd.print("BPM: ");
```

```
  lcd.print(bpm);
  lcd.print(" ");
}
```

Biosensor Lab 4: Ion-Selective Electrode (ISE) Simulation

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

#define SensorPin A0
#define RedLED 9
#define GreenLED 10
#define BlueLED 11
#define Buzzer 8

void setup() {
  Serial.begin(115200);
  lcd.begin(16, 2);
  lcd.print("ISE Sensor Ready");
  pinMode(RedLED, OUTPUT);
  pinMode(GreenLED, OUTPUT);
  pinMode(BlueLED, OUTPUT);
  pinMode(Buzzer, OUTPUT);
}

void loop() {
  int sensorValue = analogRead(SensorPin);
  float voltage = sensorValue * (5.0 / 1023.0);
  float ionConcentration = (14.0 * voltage) / 5.0;

  Serial.print("Voltage: ");
  Serial.print(voltage, 2);
  Serial.print("V | Ion Concentration: ");
  Serial.println(ionConcentration, 2);

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Ion Conc: ");
  lcd.print(ionConcentration, 2);
```

```
  if (ionConcentration > 10.0) {
    lcd.setCursor(0, 1);
    lcd.print("High Level");
    analogWrite(RedLED, 255);
    analogWrite(GreenLED, 0);
    analogWrite(BlueLED, 0);
  } else if (ionConcentration > 5.0) {
    lcd.setCursor(0, 1);
    lcd.print("Medium Level");
    analogWrite(RedLED, 0);
    analogWrite(GreenLED, 255);
    analogWrite(BlueLED, 0);
  } else {
    lcd.setCursor(0, 1);
    lcd.print("Low Level");
    analogWrite(RedLED, 0);
    analogWrite(GreenLED, 0);
    analogWrite(BlueLED, 255);
  }

  if (ionConcentration > 12.0) {
    lcd.setCursor(0, 1);
    lcd.print("DANGER: High!");
    tone(Buzzer, 1000);
    delay(500);
    noTone(Buzzer);
  } else if (ionConcentration < 3.0) {
    lcd.setCursor(0, 1);
    lcd.print("DANGER: Low!");
    tone(Buzzer, 500);
    delay(500);
    noTone(Buzzer);
  }
  delay(500);
}
```

Biosensor Lab 5: pH Sensor Simulation

```
#include <LiquidCrystal.h>
#define SensorPin A0
```

```
#define RedLED 9
#define GreenLED 10
#define BlueLED 11

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

void setup() {
  Serial.begin(115200);
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print("pH Sensor Ready");
  pinMode(RedLED, OUTPUT);
  pinMode(GreenLED, OUTPUT);
  pinMode(BlueLED, OUTPUT);
}

void loop() {
  int sensorValue = analogRead(SensorPin);
  float voltage = sensorValue * (5.0 / 1023.0);
  float pH = 14.0 * (voltage / 5.0);

  Serial.print("Voltage: ");
  Serial.print(voltage, 2);
  Serial.print("V | Simulated pH Value: ");
  Serial.println(pH, 2);

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("pH Value: ");
  lcd.print(pH, 2);

  if (pH < 6.5) {
    lcd.setCursor(0, 1);
    lcd.print("Acidic");
    analogWrite(RedLED, 255);
    analogWrite(GreenLED, 0);
    analogWrite(BlueLED, 0);
  } else if (pH >= 6.5 && pH <= 7.5) {
    lcd.setCursor(0, 1);
    lcd.print("Neutral");
    analogWrite(RedLED, 0);
    analogWrite(GreenLED, 255);
    analogWrite(BlueLED, 0);
  } else {
    lcd.setCursor(0, 1);
    lcd.print("Basic");
```

```
    analogWrite(RedLED, 0);
    analogWrite(GreenLED, 0);
    analogWrite(BlueLED, 255);
  }
  delay(500);
}
```

Biosensor Lab 6: Alcohol Detector Simulation

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

#define SENSOR_PIN A0
#define GREEN_LED 8
#define RED_LED 9
#define BUZZER 10

void setup() {
  pinMode(GREEN_LED, OUTPUT);
  pinMode(RED_LED, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  lcd.begin(16, 2);
  lcd.print("Alcohol Level:");
  Serial.begin(9600);
}

void loop() {
  int sensorValue = analogRead(SENSOR_PIN);
  Serial.print("Sensor Value: ");
  Serial.println(sensorValue);

  lcd.setCursor(0, 1);
  lcd.print("V: ");
  lcd.print(sensorValue);
  lcd.print(" ");

  if (sensorValue > 600) {
    digitalWrite(RED_LED, HIGH);
    digitalWrite(GREEN_LED, LOW);
    digitalWrite(BUZZER, HIGH);
```

```
    lcd.setCursor(9, 1);
    lcd.print("HIGH");
  } else {
    digitalWrite(RED_LED, LOW);
    digitalWrite(GREEN_LED, HIGH);
    digitalWrite(BUZZER, LOW);
    lcd.setCursor(9, 1);
    lcd.print("SAFE");
  }
  delay(500);
}
```

Biosensor Lab 7: Optical Biosensor Simulation

```
#include <LiquidCrystal.h>
#define RED_LED 3
#define GREEN_LED 5
#define BLUE_LED 6
#define SENSOR A0

LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.print("Light Sensor");
  pinMode(GREEN_LED, OUTPUT);
  pinMode(RED_LED, OUTPUT);
  pinMode(BLUE_LED, OUTPUT);
}

void loop() {
  int lightIntensity;

  digitalWrite(RED_LED, HIGH);
  digitalWrite(GREEN_LED, LOW);
  digitalWrite(BLUE_LED, LOW);
  delay(1000);
  lightIntensity = analogRead(SENSOR);
  Serial.print("Red Absorption: ");
```

```
  Serial.println(lightIntensity);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Red: ");
  lcd.print(lightIntensity);

  digitalWrite(RED_LED, LOW);
  digitalWrite(GREEN_LED, HIGH);
  digitalWrite(BLUE_LED, LOW);
  delay(1000);
  lightIntensity = analogRead(SENSOR);
  Serial.print("Green Absorption: ");
  Serial.println(lightIntensity);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Green: ");
  lcd.print(lightIntensity);

  digitalWrite(RED_LED, LOW);
  digitalWrite(GREEN_LED, LOW);
  digitalWrite(BLUE_LED, HIGH);
  delay(1000);
  lightIntensity = analogRead(SENSOR);
  Serial.print("Blue Absorption: ");
  Serial.println(lightIntensity);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Blue: ");
  lcd.print(lightIntensity);
  delay(1000);
}
```