Summary Notes for Electronics

Types of Switches

1. SPST (Single-Pole, Single-Throw)

- **Symbol**:
- **How it Works**: Two contacts, either open or closed.
- **Application**: Simple on-off switch. Can be used to switch the power supply to a circuit.
- **Real-World Example**: Light switches in homes.

2. SPDT (Single-Pole, Double-Throw)

- **Symbol**:
- **How it Works**: Three contacts. Also called a changeover switch.
- **Application**: Can operate two parts of a circuit. For example, used to switch on a red lamp in one position and a green lamp in the other position.
- **Real-World Example**: Railway signal controls.

3. DPDT (Double-Pole, Double-Throw)

- **Symbol**:
- **How it Works**: Six contacts. A pair of on-on switches that operate together.
- **Application**: Can operate two different circuits at the same time. Can be wired up as a reversing switch for a motor.
- **Real-World Example**: Forward and reverse control in electric motors.

Name of Switch	**Type of Switch**	**Physical Attributes to Differentiate**	**Real-World Applications & Examples**
Slide Switch	SPDT or SPST	**SPDT** has three positions, left, middle, right **SPST** slides between two positions only.	**SPDT**: Used in electronic toys like remote-controlled cars. **SPST**: Used in simple DIY electronics projects.
Rocker Switch	SPST	Generally only two positions: ON and OFF.	Used in computer power strips and some study lamps.
Toggle Switch	SPDT or DPDT	**SPDT** has three positions, left, middle, right **DPDT** has more and may have a locking mechanism.	**SPDT**: Used in model airplanes for control selection. **DPDT**: Used in robotics projects for motor direction control.

Name of Switch	Type of Switch	Physical Attributes to Differentiate	Real-World Applications & Examples
Push-button Switch	SPST or SPDT	**SPST** usually stays in one position until pushed again. **SPDT** returns to the original position when released.	**SPST**: Used in computer power buttons. **SPDT**: Used in arcade game machines.
Press Switch	SPST (Momentary)	Only one position; returns to OFF when released.	Used in school laboratory emergency stop buttons and computer keyboards.
Micro Switch	SPST or SPDT	**SPST** usually has two terminals **SPDT** has three.	**SPST**: Used in 3D printers for end-stop detection. **SPDT**: Used in DIY electronics projects for safety features.
Reed Switch	SPST	Generally only two positions: ON and OFF, activated by a magnet.	Used in simple magnetic door alarms.

Types of Capacitors

Type of Capacitor	Function	Similarities	Differences	Real-World Applications & Examples
Electrolytic	Stores electric charge; higher capacitance for more charge storage.	All types store electric charge. All types are measured in Farads (F), microFarads (uF), nanoFarads (nF), or picoFarads (pF).	- Has polarity; must be connected correctly. - Usually has a coloured strip to indicate polarity. - The negative terminal is usually shorter.	Used in DIY speaker projects to filter audio signals.
Non-Electrolytic	Stores electric charge; generally lower capacitance than electrolytic.		- Does not have polarity; can be connected either way. - No coloured strip.	Used in simple LED flasher circuits for school projects.
Variable Capacitor	Stores electric charge; capacitance can be varied by applying voltage.		- Capacitance values can be varied. - Used for tuning circuits.	Used in DIY radio projects to tune to different stations.

Key Points:

- **Capacitance**: The amount of charge a capacitor can store. Measured in Farads (F), microFarads (uF), nanoFarads (nF), or picoFarads (pF).
- **Polarity**: Electrolytic capacitors have polarity and must be connected correctly, while non-electrolytic capacitors do not have this requirement.

Types of Sensors

Sensor Type	How It Functions	How Resistance Varies
Light Sensing (LDR)	Senses the amount of light in the environment.	Resistance decreases as light intensity increases. In bright conditions, the resistance is low, allowing more current to flow.
Moisture Sensing (Metal Rods)	Senses the amount of moisture in the soil or environment.	Resistance decreases as moisture levels increase. In damp conditions, the resistance is low, allowing more current to flow.
Temperature Sensing (Thermistor)	Senses the temperature of the environment.	Resistance decreases as temperature increases. In warm conditions, the resistance is low, allowing more current to flow.

Key Points:

- **Light Sensing (LDR)**: Light-dependent resistors (LDRs) are used for both light and dark sensing. Their resistance changes based on the amount of light they are exposed to.
- **Moisture Sensing (Metal Rods)**: Metal rods act as sensors whose resistance changes based on the moisture content between them.
- **Temperature Sensing (Thermistor)**: Thermistors are temperature-sensitive resistors whose resistance changes based on the temperature of the environment they are placed in.

Transistors and Thyristors

Component	Function	Similarities	Differences	Real-World Applications & Examples
Transistor	Used to switch and amplify electronic signals and power. Acts as an automatic switch and amplifier.	Both are semiconductor devices used for controlling current. Both have the ability to control current in circuits.	- Three terminals: base, collector, emitter. - Controlled by current at the base. - Can be turned on and off repeatedly.	Used in simple DIY electronic projects like LED flashers and alarms.
Thyristor	Used to control high power and is often used in alarm systems. Once triggered, it remains on until manually reset.		- Three terminals: anode, cathode, gate. - Controlled by current at the gate. - Once triggered, remains on even when no current flows into the gate.	Used in projects like intruder alarms and other sensor-based systems.

Key Points:

- **Terminals**: Transistors have base, collector, and emitter terminals, while thyristors have anode, cathode, and gate terminals.
- **Control**: Transistors are controlled by the base, whereas thyristors are controlled by the gate.
- **State**: Transistors can be turned on and off repeatedly, while thyristors, once triggered, remain on until manually reset.

Types of Sensor Circuits

Sensor Type	Function of Transistor Switch Circuit	How Circuit Functions	How Current is Channelled	Real-World Applications & Examples
Light Sensing	Turns on a Bulb / LED / Buzzer when it senses light.	- Uses a Light-dependent resistor (LDR) as a sensor. - Variable resistor adjusts sensitivity. - In bright conditions, low resistance in LDR allows current to flow into the base of the transistor, lighting up the bulb.	Current flows from the LDR into the base of the transistor, activating the Bulb / LED / Buzzer.	Used in DIY projects to create alarms that go off when a light is turned on, like a "door-open" alarm for a locker.
Dark Sensing	Turns on a Bulb / LED / Buzzer in dark conditions.	- Similar to the light-sensing circuit but configured to activate in darkness. - In dark conditions, high resistance in LDR allows current to flow into the base of the transistor, lighting up the bulb.	Current flows from the LDR into the base of the transistor, activating the Bulb / LED / Buzzer in darkness.	Used in DIY projects to create night lights that turn on automatically when it gets dark.
Moisture Sensing	Lights up a Bulb / LED / Buzzer when it senses moisture.	- Uses metal rods as sensors. - In damp conditions, low resistance between rods allows current to flow into the base of the transistor, lighting up the LED.	Current flows from the metal rods into the base of the transistor, activating the Bulb / LED / Buzzer.	Used in school projects to create alarms for plant watering systems.
Temperature Sensing	Lights up a Bulb / LED / Buzzer	- Uses a thermistor as a sensor.	Current flows from the thermistor into	Used in DIY projects to create alarms that go

Sensor Type	Function of Transistor Switch Circuit	How Circuit Functions	How Current is Channelled	Real-World Applications & Examples
	when it senses warm conditions.	- In warm conditions, low resistance in the thermistor allows current to flow into the base of the transistor, sounding the buzzer.	the base of the transistor, activating the Bulb / LED / Buzzer.	off when the temperature rises, like a "room-overheat" alarm.

Key Points:

- **Transistor**: Acts as a switch controlled by the base current.
- **Sensor**: Different types of sensors (LDR, metal rods, thermistor) are used to detect light, darkness, moisture, and temperature, respectively.
- **Current Flow**: The sensor's resistance changes based on conditions, allowing or preventing current from flowing into the transistor's base, which in turn activates or deactivates the output (bulb, LED, buzzer).
- **Variable Resistor**: Often included in the circuit to allow the user to adjust the sensitivity of the sensor. By changing the resistance of the variable resistor, the user can fine-tune the conditions under which the transistor switch activates or deactivates the output.

Potential Divider

Topic	Explanation
Function of Potential Divider	A potential divider circuit uses two resistors to divide the input voltage into two parts, which can be tapped at the junction of the resistors.
Voltage Split	The voltage is divided based on the ratio of the resistances of the two resistors. The voltage across each resistor is proportional to its resistance.
Rule of Thumb	The voltage is divided based on the ratio of the resistances of the two resistors. The voltage across each resistor is proportional to its resistance. For example, if - *R*1 and 2*R*2 have the same resistance, the voltage will be split evenly across them - If 1*R*1 has twice the resistance of 2*R*2, then 1*R*1 will have twice the voltage drop compared to 2*R*2.