**Video 20: Thyristor, Triac|| Phase angle control**

* **Thyristor is a controllable diode. It conducts after triggering gate.**
* **It is used for controlling the power consumption of AC appliance.**
* **It is found in DC power controls.**
* **Inverse parallel of thyristor is called Triac. It is found in AC power controls.**
* **Thyristor and Triac is used for controlling phase angle.**

**Video 21: OpAmps (Operational Amplifier)**

* OpAmps is used to amplify signals from sensors like microphones and temperature sensors.
* It prevents interference between circuit parts.
* It filters the unwanted frequencies.

**Video 22 &23: Transistors**

Components: BJT, MOSFET

**BJT (Bipolar Junction Transistor)**

* BJT used as switch and amplifier.
* It has three terminals and they are: emitter, base, collector.
* It acts like a switch to control current flow in a circuit. Any LEDs can be turned off and of rapidly or slowly.
* Acts as an amplifier when a small input current at the base to control a larger current between the collector and emitter.
* Two types of BJT: NPN & PNP.

**MOSFET**

* MOSFET has three terminals : Drain, Gate, Source.
* Two types of MOSFET can be found: N channel and P Channel.
* MOSFET works almost same as BJT but it can take bigger loads and use efficiently.

**Video 24: Stepper motors**

* Stepper motors rotation can be controlled with microcontroller.
* It is different than DC motors because of the controlling the number of steps and positions.
* This motor is used in 3D printer.

**Video 25: Servo motors**

* Servo motors rotation can be controlled with microcontroller.
* It can rotate in certain position and in many angles.
* It can be rotate in clockwise or counter clockwise and this also can be controlled.
* This type of motor used in robots and in many robotics projects.

**Video 26: 555 timer IC**

* This ICfunctions as a **multivibrator**, producing precise timing intervals or pulses.
* So, it can be used to LED blinks.
* It can be used in PWM and timers.

**Video 27: ADC (Analog to Digital Converters)**

**Components: ADS7816, Arduino uno, Flash ADC**

* ADC converts the analog waves to digital waves.
* ADS7816 is used with Arduino, but flash ADC is faster.
* Resolution (bits) defines how many distinct levels are possible. So more bits mean finer precision.

**Video 28: IGBT**

* IGBT= Insulated Gate Bipolar
* 2 types of IGBT: N channel and P channel
* It has 3 terminals: Gate, Collector, Emitter
* It is basically a mix of BJT and MOSFET. Gets input like MOSFET and output like BJT.
* MOSFET is for low voltage and low current, whereas IGBT for high voltage and high current.

**Video 29: Solar panel & Charge controller**

* Solar converts sunlight into electrical energy.
* Charge controller regulates voltage and current coming from the solar panel to prevent overcharging or damaging the battery.
* It is for safety and efficiency.
* It is used in portable solar kits for charging phones, lights, or small appliances.

**Video 30: Timers (Arduino)**

* By using Arduino uno, it can measure time and other hardware counter.
* It is used to autorun code at intervals.
* It is useful in real time tasks.
* Commands are TCNT, TCCR, OSR, TIMSK.

**Video 31: Schottky diode and Zener Diode**

* Schottky diode is fast switching diode and it has a very low forward voltage drop.
* It is used for high frequency rectification.
* Zener diode is used for voltage regulation.
* It is used in reverse bias because it holds the constant voltage which is known as Zener voltage.

**Video 32: Relays & Optocouplers**

* Relay is used for switching big loads like high current and voltages with low power losses. So, it’s a switch.
* But the relay is slow.
* Optocoupler is faster and for lesser loads.