

# Microwave Oven

## Notes compiled by :

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## Introduction:

- A microwave oven (commonly referred to as a microwave) is an electric oven that heats and cooks food by exposing it to electromagnetic radiation in the microwave frequency range.
- This induces polar molecules in the food to rotate and produce thermal energy in a process known as dielectric heating
- Microwave ovens are a common kitchen appliance and is a good example of use of embedded systems in our homes

## Parts of a Microwave Oven

A microwave oven(Figure 1) consists of:

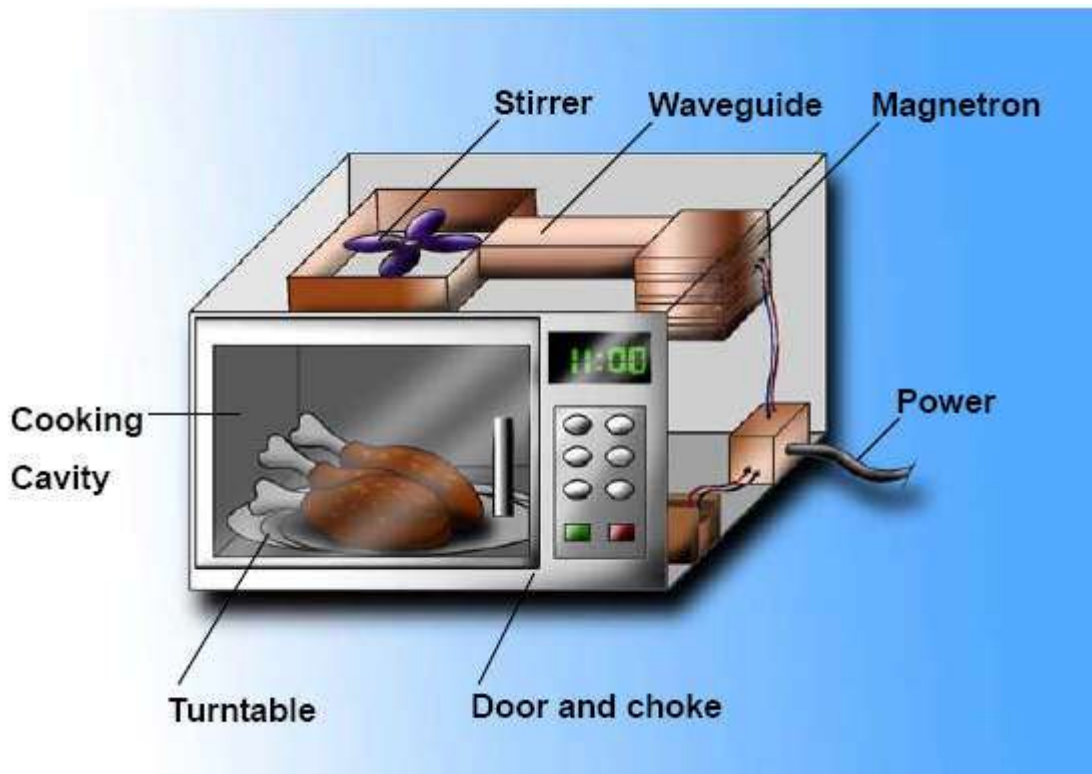
1. A high voltage transformer, which passes energy to the magnetron
2. A cavity magnetron,
3. A Control circuit with a microcontroller,
4. A waveguide, and
5. A cooking chamber
6. Turntable

The following is the details of each part which also helps us understand the working of the oven.

1. A **Transformer** transfers electrical energy through a circuit by magnetic coupling without using motion between parts. These are used for supplying power to the magnetron.
2. A **Cavity magnetron** is a microwave antenna placed in a vacuum tube and oscillated in an electromagnetic field in order to produce high GHz microwaves. Magnetrons are used in microwave ovens and radar systems.
3. A **control circuit** with a microcontroller is integrated on a circuit board. The microcontroller controls the waveguide and the entire unit so the microwaves are emitted at a constant rate.
4. A **Waveguide** is any linear structure that guides electromagnetic waves for the purpose of transmitting power or signals. Generally constructed of a hollow metal pipe. Placing a waveguide into a vacuum causes radio waves to scatter.

5. A **Cooking Chamber** is a microwave safe container that prevents microwaves from escaping. The door has a microwave proof mesh with holes that are just small enough that microwaves can't pass through but light waves can. The cooking chamber itself is a Faraday cage enclosure which prevents the microwaves from escaping into the environment. The oven door is usually a glass panel for easy viewing, but has a layer of conductive mesh to maintain the shielding.

6. **Turntable** spins slowly round so the microwaves cook the food evenly.



**Figure 1: The Microwave Oven**

### Working

- When you start cooking, the magnetron takes electricity from the power outlet and converts it into high-powered, 12cm (4.7 inch) radio waves.
- The magnetron blasts these waves into the food compartment through a wave guide.
- The food sits on a turntable therefore is cooked evenly.
- The microwaves bounce back and forth off the reflective metal walls of the food compartment, just like light bounces off a mirror. When the microwaves reach the food itself, they don't simply bounce off. Just as radio waves can pass straight through the walls of your house, so microwaves penetrate inside the food. As they travel through it, they make the molecules inside it vibrate more quickly.

- Vibrating molecules have heat so, the faster the molecules vibrate, the hotter the food becomes. Thus the microwaves pass their energy onto the molecules in the food, rapidly heating it up.

**References:**

- **Introduction to Embedded Systems by Shibu KV**
- <https://www.scienceabc.com/>