ECE 212
Electromagnetic Fundamentals

Lecture 1: Course Intro

PREPARED BY

DR. SHERIFF HEKAL

Course Information

Course Name: **Electromagnetic Fundamentals**

Course Code: ECE 212

Course Materials are on my website:

http://www.bu.edu.eg/staff/sherifsalah3-courses

Teaching Staff & Contact

Instructors	Location	Teaching Load
Dr. Hanaa Raafat	Floor no: 2 New Building	Part 1 - Lectures
Dr. Sherif Hekal	Room no: SB 5-05 New Building	Part 2 - Lectures
Teaching Assistant	**Location**	**Teaching Load**
Eng. Mohamed Ibrahim	Floor no: 2 (TA room) New Building	Part 1 & 2 - Tutorials

My rules

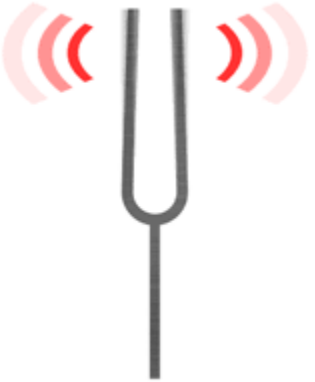
- No eating
- No drinking
- Silence except for asking questions
- Shutdown your Mobile, Tablet, etc. and put in your pocket.

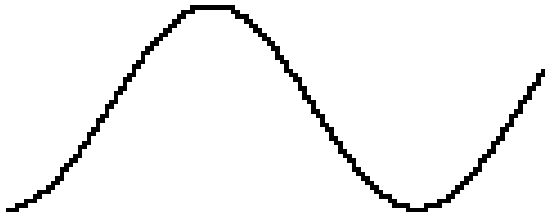
Introduction to Waves

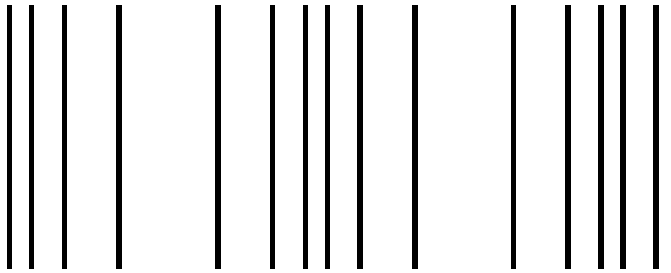
Essential Question:
What are the characteristics of mechanical and electromagnetic waves?

What are Waves?

Rhythmic disturbances that carry energy without carrying matter







Types of Waves

- **Mechanical Waves – need matter (or medium) to transfer energy**
  - A medium is the substance through which a wave can travel. Ex. Air; water; particles; strings; solids; liquids; gases

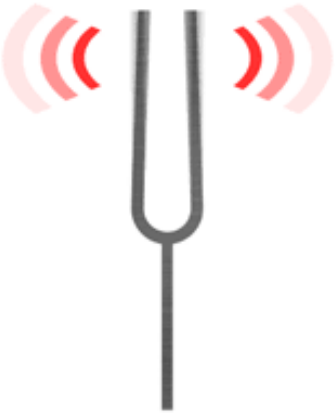
- **Electromagnetic Waves – DO NOT NEED matter (or medium) to transfer energy**
  - They do not need a medium, but they can go through matter (medium), such as air, water, and glass

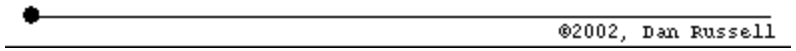
Mechanical Waves

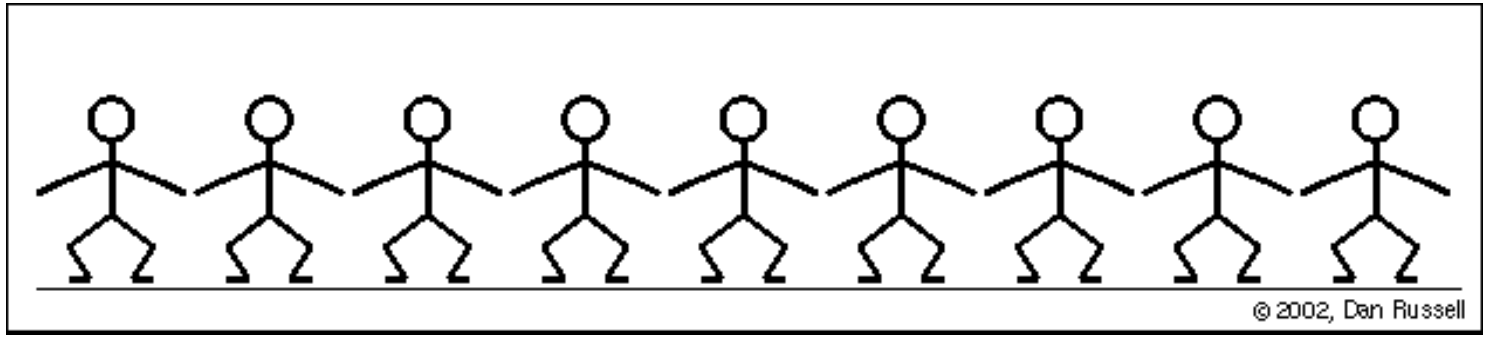
Waves that need matter (medium) to transfer energy:

Examples: Sound waves, ocean waves, ripples in water, earthquakes, wave of people at a sporting event

Some examples of Mechanical Waves







Electromagnetic Waves

- Waves that DO NOT NEED matter (medium) to transfer energy

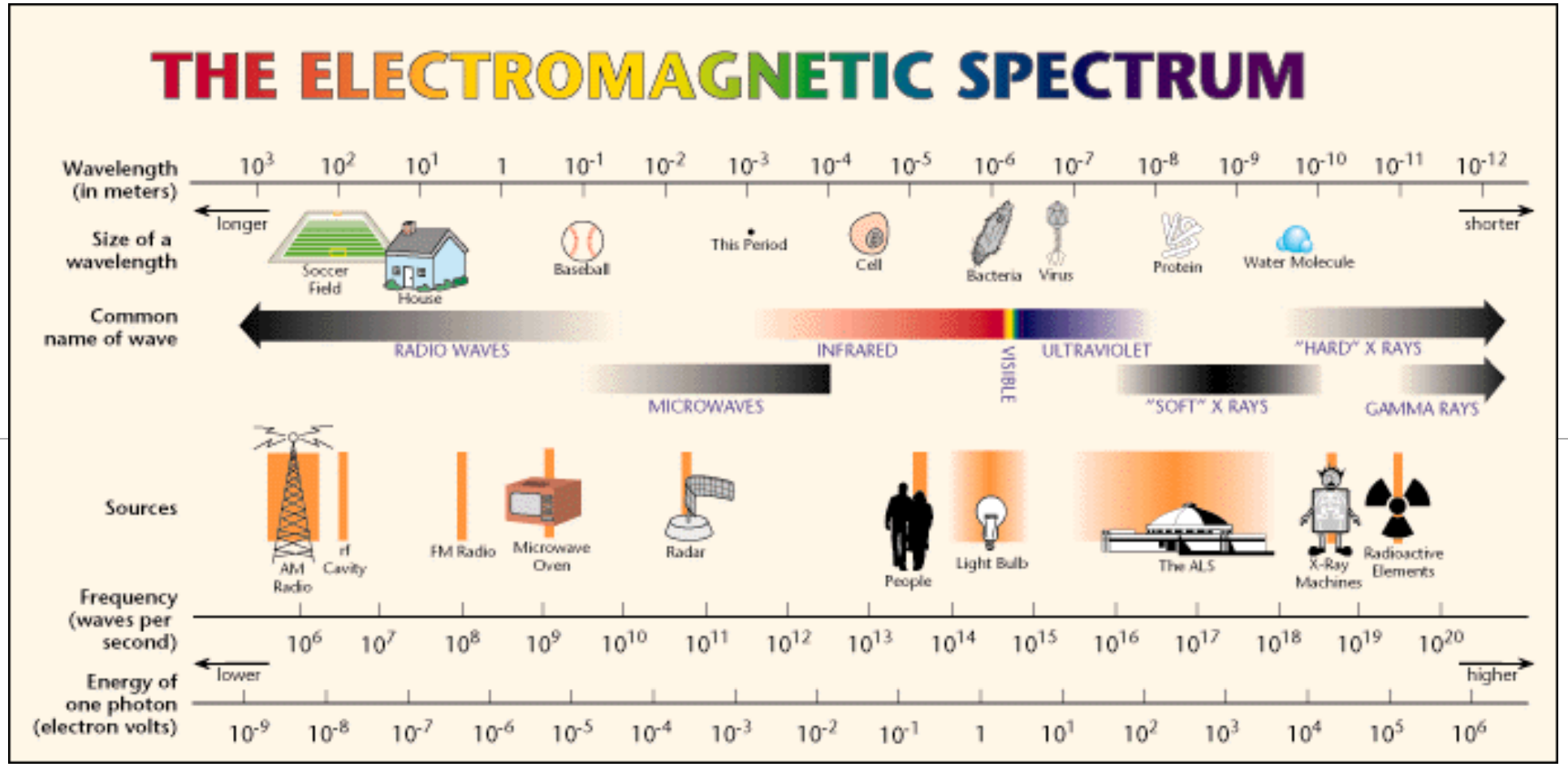
  - Examples: radiation, TV & radio waves, X-rays, microwaves, lasers, energy from the sun, visible light

  - Electromagnetic waves are considered transverse waves because they have similar characteristics; therefore, they have the same parts.

More to come on Electromagnetic waves…

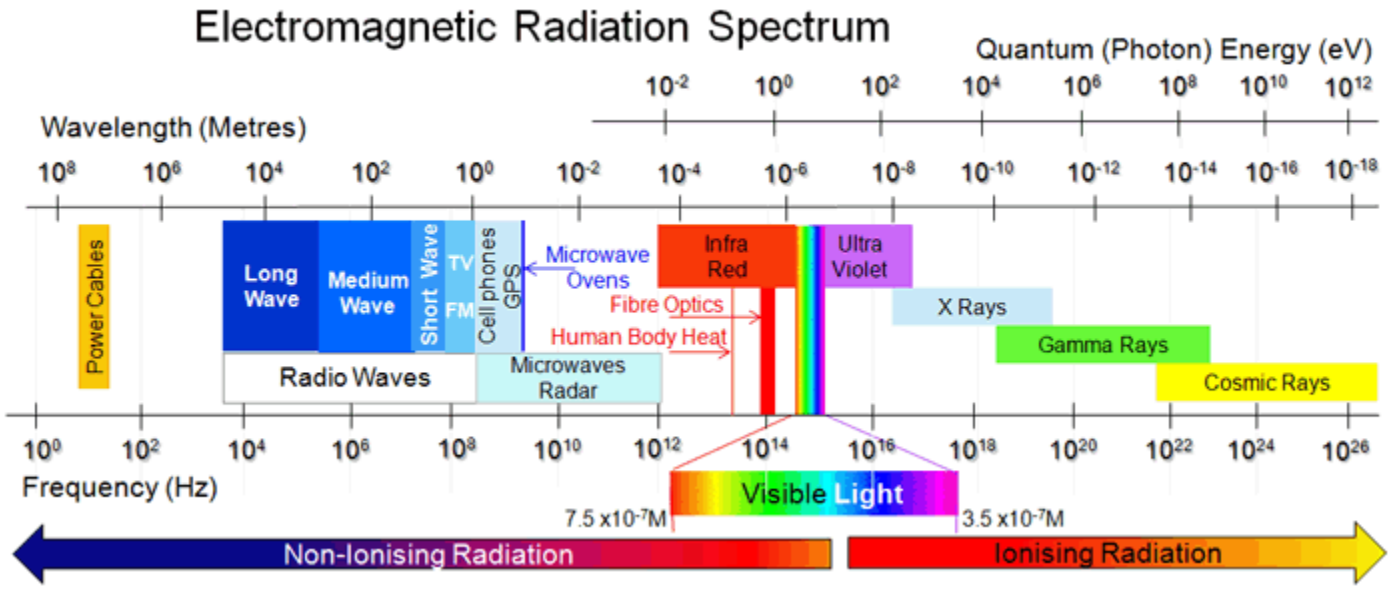
Electromagnetic Spectrum

THE ELECTROMAGNETIC SPECTRUM ILLUSTRATES THE RANGE OF WAVELENGTHS AND FREQUENCIES OF ELECTROMAGNETIC WAVES.

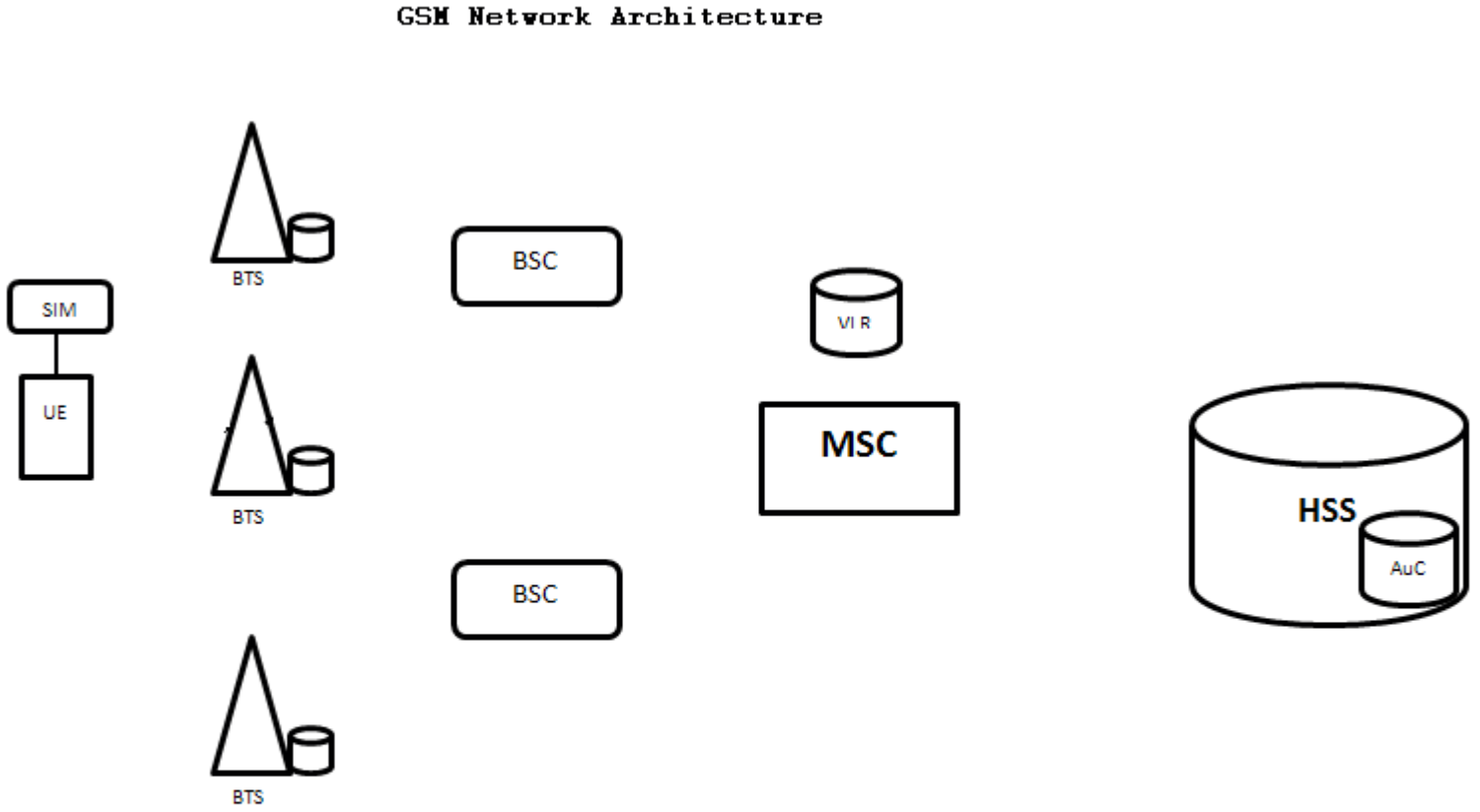


Applications

EMWs and its applications



Applications



SIM – Subscriber Identity Module
UE – User Equipment
BTS – Base Transceiver Station
BSC – Base Station Controller

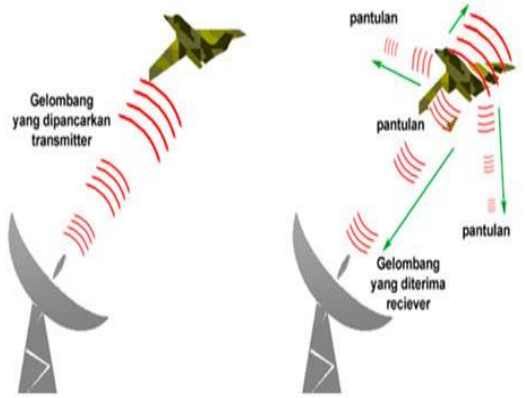
MSC- Mobile service Switching Center
VLR - Visitor Location Register
HSS - Home Subscriber Server
AuC – Authentication Center

Applications

TYPICAL FREQUENCIES

FM RADIO	88 - 108 MHZ
TV BROADCAST	200 MHZ
GSM PHONES	900 MHZ
GPS	1.2 GHZ
PCS PHONES	1.8 GHZ
BLUETOOTH	2.4 GHZ
Wi-Fi	2.4 GHZ

GLOBAL POSITIONING SYSTEM



Gambar 2 Pemantulan gelombang mikro oleh pesawat

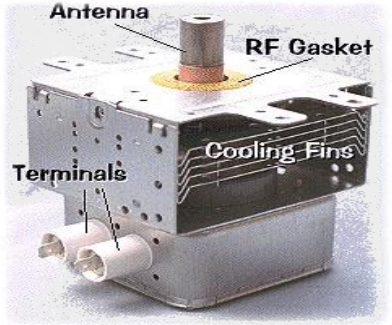
RADAR (RADIO DETECTION AND RANGING)

MICROWAVE OVEN

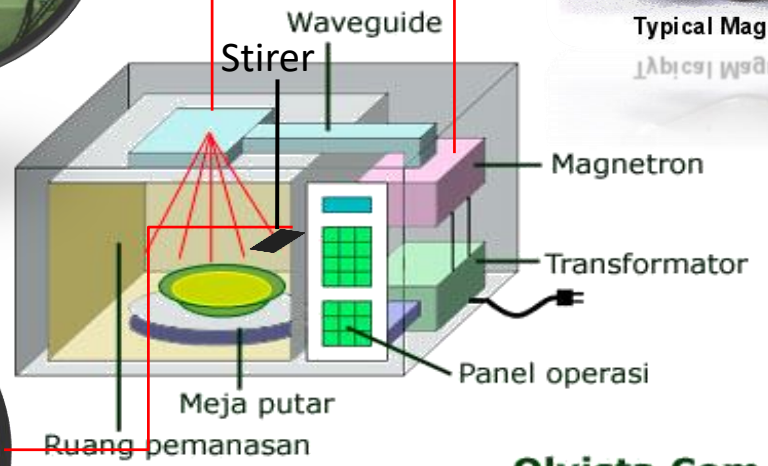
Microwave Oven

A component which designed to arrow the microwave to food chamber

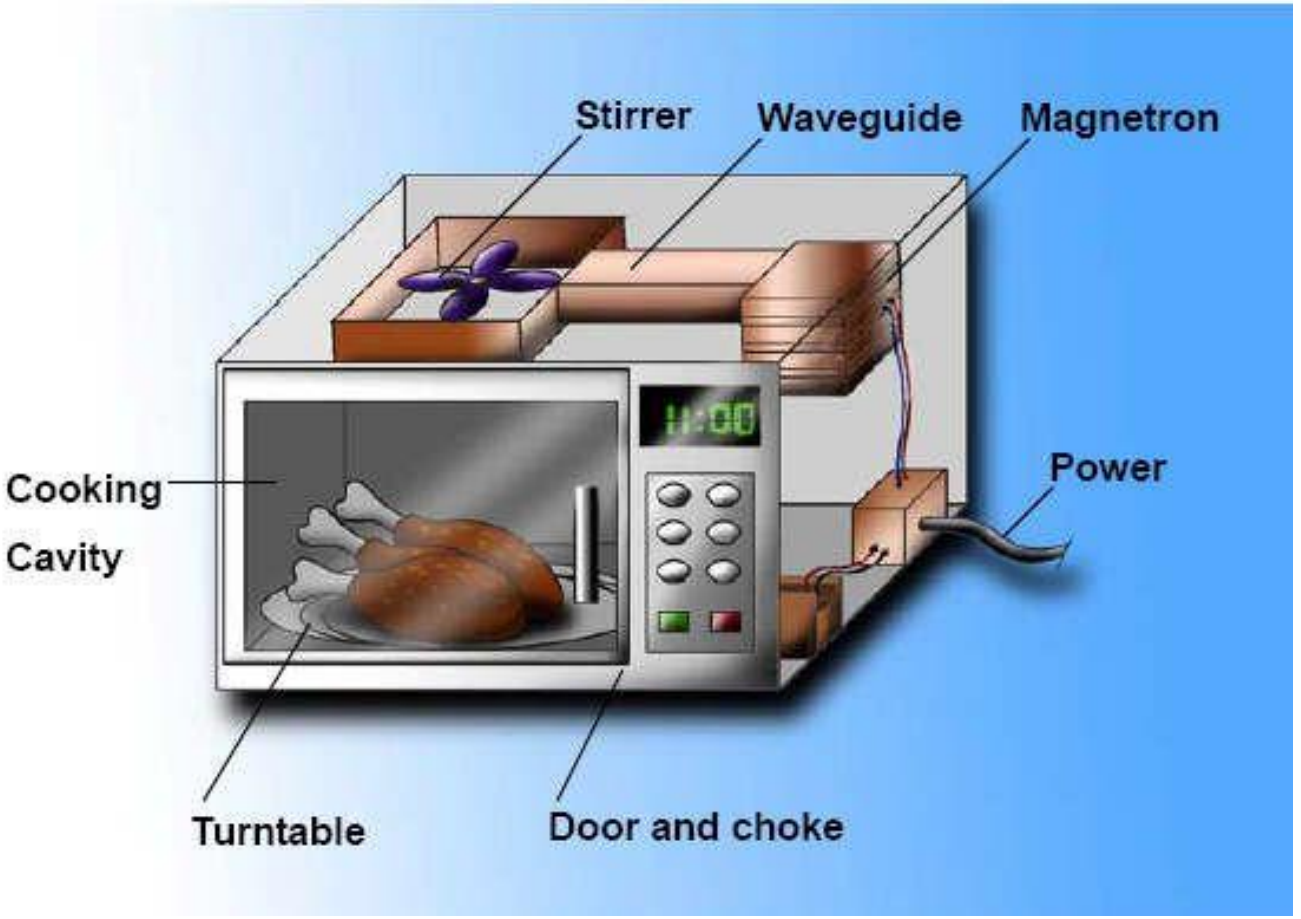
Electric energy is changed to be microwave radiation



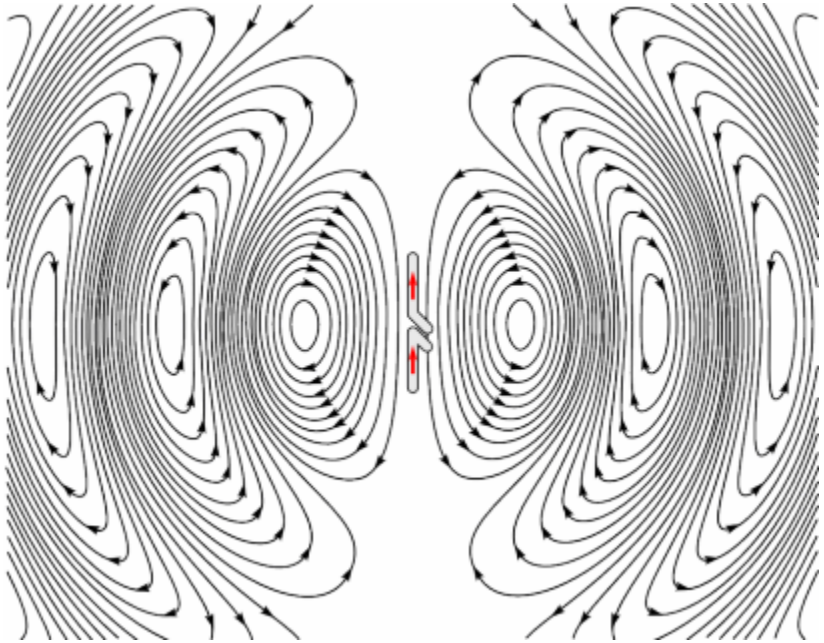
A component which its function is to spread microwave in food chamber



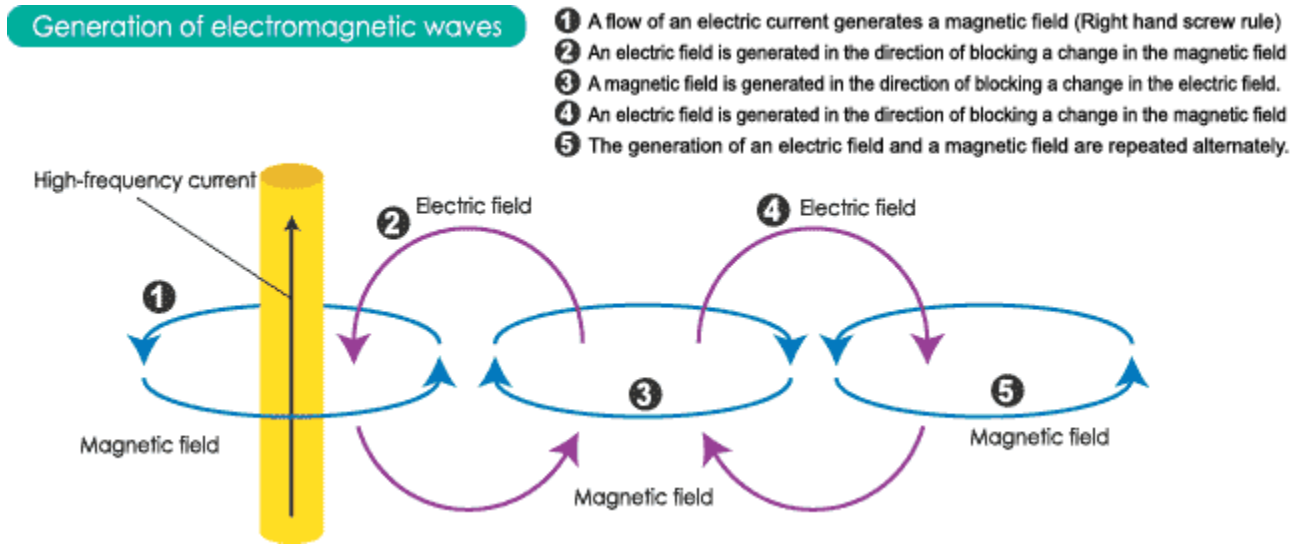
Microwave Oven



Examples of EMW propagation



EM radiation of dipole antenna



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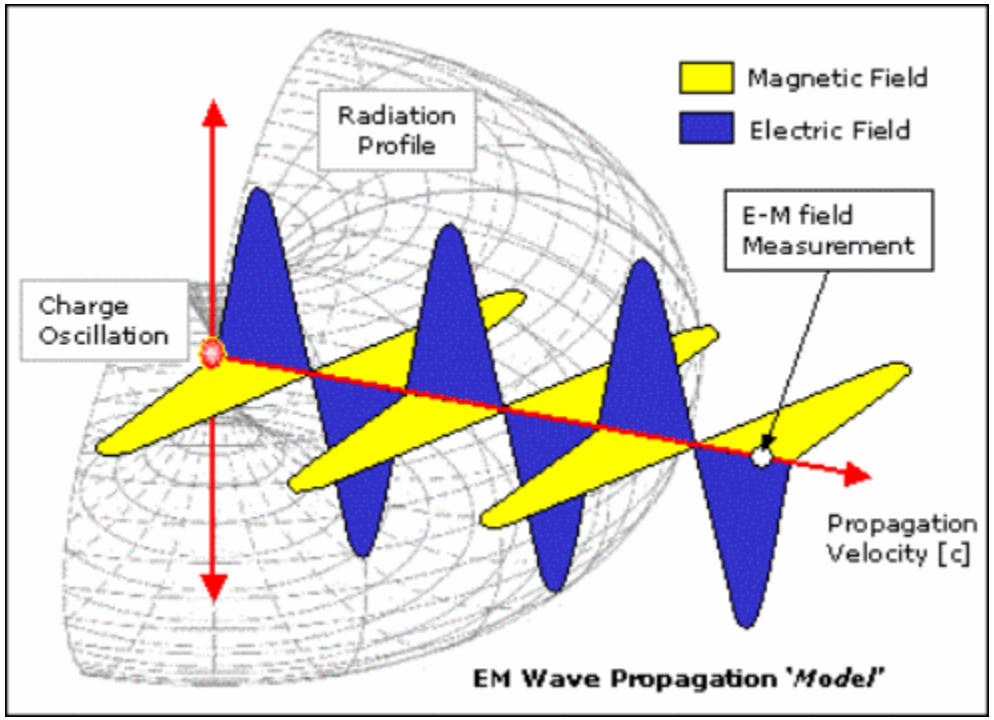

Syllabus

1. Review of Vector Analysis

2. Time-varying fields and the electromagnetic induction

3. The displacement current

4. Wave Equation from Maxwell's Equations