**2.3** **Electromagnetic Radiation**

**Reading material**

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| Now that you know about the basic principles of remote sensing and how they are applied, in this second session, we will briefly touch upon the physics and show what satellite signals are.  In this session you will explore electromagnetic radiation, including wave characteristics and spectrum. |
| **The concept of remote sensing**  Electro-magnetic radiation which is reflected or emitted from an object is the usual source of remote sensing data. Satellites or spacecrafts always consists of sensors which, therefore, capture and record that emitted or reflected radiation.    Source : https://www.earthdata.nasa.gov/learn/backgrounders/remote-sensing |
| **Electromagnetic radiation** or **EMR** is a key component in the process of remote sensing. Remote sensing works depending on about four types of radiating features of EMR– absorption, transmission, reflection, and emission.  While electromagnetic radiation falls upon any object surface, it might be absorbed by the object or transmitted, reflected, or sometimes the object emit might radiation from itself (such as in the form of heat). |
| Source: https://eo-college.org |
| **EMR waves characteristics**  All types of EMR are transmitted, or propagated, as waves. In common with all waves, the two most fundamental properties of electromagnetic waves are length and frequency. The longer the wave length the lower the frequency and vice versa.  **Electromagnetic wave** consists of an **electrical field (E)** which varies in magnitude in a direction perpendicular to the direction in which the radiation is traveling, and a **magnetic field (M)** oriented at right angles to the electrical field. Both these fields travel at the **speed of light (c).**    Source: John R. Jensen (2014): Remote Sensing of the Environment: An Earth Resource Perspective    Source: John R. Jensen (2014): Remote Sensing of the Environment: An Earth Resource Perspective |
| * velocity is the speed of light, c=3 x 108 m/s * wavelength (ג) is the length of one wave cycle, is measured in metres (m) or some factor of metres such as   + centimeters (cm) 10-2 m   + micrometers (µm) 10-6 m   + nanometers (nm) 10-9 m * frequency (v) refers to the number of cycles of a wave passing a fixed point per unit of time. Frequency is normally measured in hertz (Hz), equivalent to one cycle per second, and various multiples of hertz. * unlike c and ג changing as propagated through media of different densities, v remains constant. |
| The **amplitude** of an electromagnetic wave is the height of the wave crest above the undisturbed position.  The **electromagnetic spectrum** may be defined as the entire range of radiation wave lengths. |
| A simple explanation of electromagnetic spectrum and how does it affect us in our everyday life.  What is Light? Maxwell and the Electromagnetic Spectrum - YouTube (time duration 3:55)  <https://www.youtube.com/watch?v=pj_ya0e20vE> |

**Exercise materials and tasks**

**Quiz questions**

Instructions: As a recap of this session’s content, we have prepared the following quiz. Enjoy!

1. Which statements are true?

1. **The distance between the peak and trough of a wave is called 'amplitude'.**
2. **The distance between two following peak is referred to as 'wavelength'.**
3. **The vectors describing an electromagnetic wave travel at the speed of light.**

2. We see different colours because they have different frequencies.

1. **True**
2. False

3. The percentage of energy reflected by a particular type of surface at its various constituent wavelengths is termed its ‘spectral signature’.

1. **True**
2. False

4. In which unit is frequency normally measured in?

1. Meters/seconds (m/s)
2. **Hertz (Hz)**
3. Meters (m)