Glossary

- In a food processing plant, heating and cooling of foods is conducted in equipment called heat exchangers.

- Noncontact type heat exchangers: Scraped surface, Shell and Tube, Tubular and Plate

- Contact type: Steam infusion and Steam injection
- Thermal properties such as specific heat, thermal conductivity, and thermal diffusivity of food and equipment materials (such as metals) play an important role in determining the rate of heat transfer.
- A mathematical description of the actual mode of heat transfer, such as conduction, convection, and/or radiation is necessary to determine quantities, such as total amount of heat transferred from heating or cooling medium to the product
- Specific heat is the quantity of heat that is gained or lost by a unit mass of product to accomplish a unit change in temperature, without a change in state:

$$c_p = \frac{Q}{m(\Delta T)}$$

- Thermal conductivity gives the amount of heat that will be conducted per unit time through a unit thickness of the material if a unit temperature gradient exists across that thickness. In SI units, thermal conductivity is

$$k = \frac{\text{J}}{\text{s m } ^{\circ}\text{C}} = \frac{\text{W}}{\text{m } ^{\circ}\text{C}}$$

- Thermal diffusivity, a ratio involving thermal conductivity, density, and specific heat, is given as,

$$\alpha = \frac{k}{\rho c_p}$$

- Conduction is the mode of heat transfer in which the transfer of energy takes place at a molecular level.

- During heating and cooling of gases and liquids the fluid streams exchange heat with solid surfaces by convection.

Table: Some approximate values of convective heat-transfer coefficient	
Fluid	**Convective heat-transfer coefficient ($W/[m^2 K]$)**
Air Free convection Forced convection	 5-25 10-200
Water Free convection Forced convection	 20-100 50-10,000
Boiling water	3000-100,000
Condensing water vapor	5000-100,000

- Radiation heat transfer occurs between two surfaces by the emission and later absorption of electromagnetic waves (or photons)