Introduction: Food Technology as a Discipline.

Food technology is a broad discipline which contains within it many specializations such as in food microbiology, food engg, & food chemistry.

* Because food interacts directly with people, some food scientists are also interested in the psychology of food choice. These individuals work with the sensory properties of foods.
* food engineers deal with the conversion of raw agricultural products such as wheat into more finished food products such as flour or baked goods.
* Biochemist often work with foods to understand how processing or storage might chemically affect foods & their biochemistry.
* Nutritionists are involved in food manufacture to ensure that foods maintain their expected nutritional content.
* Other food scientists work for the govt. in order to ensure that the foods we buy are safe, wholesome & honestly represented.

Preparation for a career in food Technology:

The Core of Food Technology courses, includes the following, most of which include both lecture & labs components:

* Food Chemistry
* Food Analysis
* Food Microbiology
* Food Processing
* Food Engg.

Activities of food Technologists

food technologists study the microbiological, physical & chemical properties of food & ingredients to make sure they are safe for consumers. Responsibilities of the food technologists include :—

(1) evaluating the nutritional value, colour, flavour & texture of food.
(2) testing food samples for particular types of moulds, yeast & bacteria that may be harmful.
(3) ensuring that food manufacturing processes conform with govt., processing, consumer & industry standards.
(4) producing new food products and improvement of existing
(5) exploring alternative manufacturing methods.
(6) working closely with other food production staff including microbiologists, engineers, packaging specialists and buyers.
(7) establishing low-cost wholesale food production methods.
(8) investigating & setting standards for safety & quality.
(9) altering the nutrient content of foods, particularly reducing the calorie content or adding vitamins or minerals.
(10) Controlled-atmosphere (CA) storage of fruits & veg. fruits such as apples, after they are harvested, still have living respirating systems. They continue to mature & ripen. They require O_2 from the air for this continued respiration, which results in softening.
(11) when foods are heated to destroy pathogens & spoilage organisms, other changes in food component can affect colour, texture, flavour & nutrient values; thus, food technologists must optimize heat process for specific products to be effective but not excessive.

Characteristics of food industry

The food industry is very large, and if food production, manufacturing, marketing, restaurants & institutions are combined, it is the largest industrial enterprise.

A food producing industry grows, processes, transports & distributes our food stuffs. Approx, 3 million people work on farms & other areas & are directly involved in the production of the raw food materials that are processed into foods.

As the chain of activities proceeds, people are engaged in such functions as produce, buying, cattle feeding, dairy plant & grain operations & warehouse management.

Food processing operations convert raw commodities into canned, frozen, dehydrated, fermented & modified forms of food.

Size of the Industry → Largest producer of milk in the world - 105 million tonnes per annum.

→ 3rd largest producer of food grain accounting for 230 million tonne per annum. → India is the largest in the livestock population about 485 million tonnes per annum.

→ It is the 2nd largest producer of fruits & vegs. which accounts for 150 million tonnes per annum.

Geographical distribution → Delhi, Mumbai, Kolkata, Gujarat, Hyderabad, Pune, all the major cities in the country.

Output per annum → The Indian food industry sales turnover is Rs. 140,000 Crore annually as at the start of year 2000.

% age in world mkt → The value of the Indian food industry has ↑ed from Rs. 3.09 trillion in 1993-94 to Rs. 3.99 trillion in 2000-01.

Mkt Capitalization → The country's GDP growth rate had increase from 3.5% in 2002-03 to 9% in 2006-07.

Over the past 3 & half decades the Indian agricultural & dairy sectors have achieved remarkable successes. The achievements of the green & white revolutions have contributed to the development of Indian food Processing Industry.

Components of the food industry

The food industry may be divided into segments or components in various ways. One of the simplest is a functional division into 4 major segments :—

- Raw material production
- Manufacturing
- distribution
- marketing.

- Raw material production includes such industries as farming, fishing and so on. Technologies involved in pdtion of the raw materials include the selection of plant & animal varieties, cultivation & growth, harvest & slaughte and the storage & handling of raw materials.
- Manufacturing converts the raw products into finished foods. Manufacturing required many unit operation & process that are at the core of food technology.
- Distribution deals with those aspects conductive to product sales, including : product form, weight & bulk, transportation, storage requirements & storage stability.
- Mkting is the selling of foods & involves wholesale, retail, institutions & restaurants.

Another way of dividing the food industry is along major product lines :—

- Cereal & bakery
- Meat, fish & poultry
- Dairy products.
- fruit & vegetables
- Sugar & confectionery
- fats & oils
- Non alcoholic beverages/ alcoholic beverages.

food is most often consumed in a different form than that in which it is produced. for example half of the total milk produced ~~is~~ is consumed as fluid milk. Approx. 17% going into the manufacture of butter, over 31% into cheese, about 9% into ice-cream & other frozen desserts, and so on. Other examples of commodity conversions include the transformation of cereal grains into breakfast cereals, soybeans into edible oils & cereal starches into sugar syrups. Thus, One way to define the food industry is to say that it converts or changes raw agricultural commodities into more finished foods.

International Activities

food has became a global commodity. foods are traded & shipped worldwide. It is not unusual to find dozens of types of fine foods from around the world in a modern grocery store. Many U.S. food companies have set up industries in other countries & many fast foods outlets suchas McDonald's have opened stores around the world.

Agricultural imports to the US amounted to approx. 10% of all imports. These have included coffee, tea, cocoa, spices & other pdts not grown in this country. Most major American food companies have international divsion with manufacturing facilities in many parts of the world. Among these are Coca-Cola, Pepsico, Kellog's, Heinz & Hershey company, Schwan Food Company etc

Unit operation in food Processing :- The no. of different food products & the operations & steps involved in their production are of great importance. The process used by the food industry can be divided into common operations, called unit operations. Examples of Unit operations common to many food products include cleaning, concentrating, controlling, drying, evaporating, fermentation, heating/cooling, material handling, mixing, packaging, pumping, Separating & others. Most unit operations are utilized in the making of a variety of food products.

Common Unit Operations :-

1) **Material Handling** → includes such varied operations as hand & mechanical harvesting on the farm, refrigerated trucking of perishable produce, box car transportation of live cattle, & conveying of flour from rail car to bakery storage bins.
Throughout such operations care must be taken to maintaining sanitary conditions, minimizing product losses, maintaining raw material quality, minimizing bacterial growth, & timing all deliveries so as to minimize holdup time, which can be costly as well as harmful to product quality.

2) **Cleaning** → foods by the nature of the way they are grown or produced on farms in open environments often require cleaning before use. Cleaning ranges from simple removal of dirt from egg shells with a brush to the removal of bacteria from a liquid food by passing it through a porous membrane. Grains must be cleaned of stones before use.

Cleaning can be done with brushes, high-velocity air, steam, water, vacuum, magnetic attraction of metal contaminants, mechanical separation & so on, depending on the product & the nature of the dirt.

#Steps involve in cleaning in Food Industry :—

Step 1 → Preparation
- i) Remove loose dirt & food particles.
- ii) Rinse with warm, potable water

Step 2 → Cleaning
- i) Wash with hot water (60°C) & detergent.
- ii) Rinse with clean potable water.

Step 3 → Sanitising (bacteria killing stage)
- i) Treat with very hot, clean, potable water (75°C) for at least 2 min.
- ii) Apply sanitiser as directed.

Step 4 → Air drying.
- i) Leave benches, counters & equipments to air dry. The most hygienic way to dry equipments is in a draining rack.

3) Separating :→ The unit operation of separating can involve —
- → separating a solid from solid — as in the peeling of potatoes or the shelling of nuts.
- → separating a solid from liquid — as in the many types of filteration.
- → separating a liquid from solid — as in pressing juice from a fruit.
- → separating a liquid from liquid — as in centrifuging oil from water.

4) Pumping :- One of the most common operations in the food industry is the moving of liquids & solids from one location to another by pumping. There are many kinds of pumps & the choice depends on the character of the food to be moved. Pumps operate by some mechanism & consume energy to perform mechanical work for moving the product.

Types of pumps are -

i) Centrifugal pump
ii) Gear pump
iii) Piston pump
iv) Axial-flow pump
v) Screw pump.

5) Mixing :→ Mixing is a unit operation that involves one material mixed with other to form homogeneous product. The type of operation & equipment used during mixing depends on the state of materials being mixed (liquid, semi-solid, solid or Gas). For such operations various kind of mixers are used.

Types of mixers are -

i) Conical blender
ii) Ribbon blender
iii) Agitator

6) Heat Exchanging :→

i) Heating :- Heating of food is done for many different reasons. Many foods are heated to destroy micro-organisms & preserve the food. Others are heated to remove moisture & develop flavour. Still others are heated during normal cooking to make them more tender & more palatable. Foods are heated by conduction, convection, radiation or a combination of there.

food may be heated or cooked using direct injection of steam, direct contact with flame, electronic energy as in microwaves and so on. All of these methods are currently used in food industry. Such processes as baking, cooking, frying, food concentration & food dehydration, all uses the unit operation of heating.

ii) Cooling :- While heating is the addition of heat energy to foods, cooling is the removal of heat energy. This may be done to the degree where food is chilled to refrigerator temp., or beyond this range to where the food is frozen. Mainly, food is refrigerate & freeze to prolong their keeping quality. But there are some foods that remains in frozen state, for eg→ ice-cream.

7) **Evaporation**:- Evaporation in the food industry is used principally to concentrate foods by the partial removal of water from liquid food by boiling. Liquid products can be concentrated from 5% dry solids to 72%, depending on the viscosity of the concentrates. It is used to concentrate food, to increase the solid content of food, to change the colour of food & to reduce the water content of liquid food product.

Evaporation is used in many food, drink & milk applications. foreg- it is used to process milk, coffee, fruit juices, vegetable pastes & concentrates, sauces, sugar & edible oil.

The simplest kind of evaporation occurs when the sun evaporates water from sea water & leaves behind salt; this process is used commercially. Grapes & other fruits can be evaporated using the energy from the sun. Another simple form of evaporation occurs when a heated kettle is used to boil water from a sugar syrup, as in candy-making.

Various types of evaporators are used at industrial level to remove water from food stuff. like —

- Batch evaporator
- Rising film evaporator
- falling film evaporator
- Natural Circulation evaporator.

8) Drying :- In drying, the object also is to remove water with minimum damage to the food. Where-as evaporators will concentrate food two fold or three fold, driers will take foods very close to total dryness — in many cases less than 2% or 3% water. Driers are used to prepare such products as dried milk powder & instant coffee. Drying inhibits the growth of bacteria, yeast & mold through the removal of water and reduces its weight & bulk. Micro-organisms require water for growth, & when they are growing on food, they get water from the food. If water is removed from the food, the multiplication of micro-organisms will stop.

The amount of water removed from a given weight of material during a given time interval is called the drying rate. When food is dried in air, the more rapid is the rate of drying.

Driers that are used to dry the product at industrial level are —

1) Drum drier
2) Spray drier
3) Vacuum drier
4) Freeze drier
5) Air drier
6) Solar drying. is an ideal application for solar energy.

9) Packaging :- food is packaged for several purposes. A primary reason is to protect it from microbial contamination, physical dirt, insect damage, light, moisture pickup, flavor pickup, moisture loss, flavor loss, preserving taste & quality during the shelf life of a food product.

The food packaged material should be made of high quality & it should be free from any chemical contamination. foods are packaged in metal cans, glass & plastic bottles, paper & paperboard, a wide variety of plastic & metallic films, and combination of these. Also a food package makes distribution easier for food products. Packaging is done by continuous automatic machines sometimes at speeds of more than 1000 units per minutes.

Energy Conservation :- Many food processing unit operations require considerable amounts of energy. Thus, the cost of energy is a significant part of the cost of producing foods. This has focused attention on unit operations, equipment design, & overall processes of optimizing energy use. There is now much interest in the analysis of heating and cooling processes & the recovery & reuse of heat units. The energy requirement for material handling & cleaning are influenced by types of fruits & veg. & by agricultural products before they reach processing plants

There are simple measures to conserve energy throughout the food production chain. These include common everyday practices such as increasing boiler & steam efficiency, optimizing refrigeration & space condition through improved temp. control, reducing lighting excessive to the task performed, scheduling regular maintenance on sensors & controlling devices & so on. Today it is common to employ energy conservation specialists & involve plant engineers in general energy management.