1. a) Discuss the emerging trends/areas in food science and technology.

**Ans:** Current advancements in food sector are implementing the artificial intelligence applications. Smart packaging systems like Nano packaging and edible packaging films are in use to a greater extent. Labeling the processed food for smart packaging and computerizing the food industry with robotics and automations would lead the industry to a totally new era. Scientific developments in the food industry have resulted in significant increases in productivity and adaptability for products as per the market needs. The industry has advanced from the full range of food examination at the atomic and small scale auxiliary level, through crude material handling to food designing. The advancements are moving towards novel preparing techniques, computerization, quality control and confirmation, microbiological security issues, progresses in conservation and bundling advances and tangible examinations.

b) Discuss the role of sugars in the followings giving appropriate example:

i) In Bakery products

**Ans:** Aside from making some foods more palatable and providing kilojoules, sugar has a number of important properties that contribute uniquely to a food’s appearance, texture and shelf-life. It’s therefore an important ingredient in both the foods we make at home, and the manufactured foods on our supermarket shelves. Reducing or removing sugar from a product often requires replacement with a number of substitute ingredients to achieve the same quality, taste and texture profile. Below are some of the important roles sugar plays when it is added to foods:

As a bulking agent – sugar contributes to the texture of food, such as in meringue and biscuits. This is an important role of sugar in most baking applications.

As a preservative – sugar helps to prevent or slow the growth of bacteria, moulds and yeast in jams and other preserves. It also helps to prolong the shelf life of many foods on our supermarket shelves by acting as a humectant – maintaining and stabilising the water content in foods.

Enhancing flavour – adding a little sugar to nutritious foods such as sour fruits (frozen berries or rhubarb), or porridge, helps to make them more palatable. Sugar also enhances fruit flavours in foods.

For colour – on heating, sugar breaks down to produce the colour and desirable flavour that characterises many cooked foods. This is caused by sugars reacting with proteins as they break down in the cooking process, called the Maillard reaction. A sprinkling of sugar and cinnamon on top of fruit muffins makes for a browned crunchy topping and gives a nice texture.

Adds viscosity – sugar provides body in drinks and semi-liquid foods like syrups, chutneys and sweet sauces.

As an anti-coagulant – when it’s heated, sugar delays the coagulation of proteins (or the change to a semi-solid state), such as in baked custards and other desserts.

Food and beverage manufacturers world-wide are looking for ways in which they can reduce the sugar content of their products in response to perceived consumer demand. This often poses some technical barriers due to sugar’s role in providing more than just taste.

This complex combination of texture and taste makes the reduction or elimination of sugar more challenging than simply dropping a non-nutritive sweetener into a product in place of sugar. Even a straight swap involves significant challenges with getting the appropriate flavour and stability in foods exposed to high temperatures.

Sugar also provides bulk, density, and viscosity in food products. Therefore removing or reducing sugars from high-sugar-containing products and replacing them with lower energy sweeteners requires that they be replaced by other molecules that can control these physical changes in the product. A variety of bulking agents such as insoluble fibres (gum systems) and polydextrose can be used, though these do not all reduce the energy content of the food (which is often the original intention of reducing sugar content).

Sugar also reduces the water activity in foods and beverages, making water unavailable for use by bacteria and fungi, thereby reducing microbiological activity and mould formation. For this reason, many foods and beverages containing high concentrations of sugars do not need to be refrigerated. When sugar is removed from a product, or replaced with a non-nutritive sweetener, its preservative properties are lost. Preservatives may therefore need to be added to these products, which is often less acceptable for consumers.

In breakfast cereals, sugar often plays an important functional role other than taste. Small amounts of sugar provide lubrication for “dough” being processed into extruded breakfast cereal products. It’s also used for helping to bind pressed and moulded products such as Weetbix. Simply removing sugar from these products would necessitate the use of other, less “natural” compounds in order to make the same product.

ii) In preservation

**Ans:** Sugar is used in the canning and freezing of fruits to improve flavor and texture, and to preserve natural color and shape.

Through osmosis, sugar replaces some of the water in the fruit. This natural process preserves the fruit’s inherent color, texture and shape by preventing the fruit’s remaining water from leaving its cellular structures. As a result, the fruit’s texture is protected against weakening during freezing and canning.

In addition, sugar, upon entering the cells, helps minimize oxidation, and prevents the fruit’s firm texture from becoming mushy.

Sugar also increases the shelf life of products. For example, a fruit canned in a light syrup might not last as long as one canned with a heavy syrup. The same goes for those canned using alternative sweeteners.