

DISCIPLINE SPECIFIC ELECTIVE COURSE - 11 (DSE-11): Basic Principles of Food Chemistry

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
Basic Principles of Food Chemistry (DSE-11)	04	03	--	01	Class 12 th with Physics, Chemistry	--

Learning Objectives

The objectives of this course are as follows:

- To make students understand the sources, importance, stability and transformations of food components during handling and processing.
- To make students aware about nature and importance of additives in food chemistry.

Learning outcomes

By studying this course, the students will be able to:

- Develop a strong understanding of basic fundamentals of food chemistry
- Discuss and demonstrate how alterations /transformations during processing and handling affect the quality and stability of food
- Develop an elementary idea on the nature and importance of additives in food chemistry.
- Apply the knowledge gained to real world problems

SYLLABUS OF DSE-11

Unit 1: Introduction (Hours:3)

What is food chemistry; An overview of the following: alterations during handling or processing (texture, flavour, colour), chemical and biochemical reactions leading to alteration in food quality (browning, oxidation, hydrolysis, protein denaturation), cause and effect relationship pertaining to food handling; factors governing stability of food (chemical and environmental factors) and role of food chemists.

Unit 2: Water (Hours:3)

Definition of water in food, structure of water and ice, types of water, sorption phenomenon, water activity and packaging, water activity and shelf-life.

Unit 3: Carbohydrates **(Hours:6)**

Introduction, sources, functions, deficiencies, structure and importance of polysaccharides in food chemistry (Agar and Agarose, Pectin, Hemicellulose, Cyclodextrins, Gums, Alginate, Starches, modified starches), Non-enzymatic browning and its prevention, caramelisation, formation of acrylamide in food, role of carbohydrates as sweeteners and comparison with artificial sweeteners.

Unit 4: Proteins **(Hours:6)**

Introduction, sources, classification, functions, deficiencies, physico-chemical & functional properties of proteins, nature of food proteins (plant and animal proteins).

Unit 5: Lipids **(Hours:6)**

Introduction, sources, classification and physical properties, functions, deficiencies, effect of frying on fat, reaction of lipids: hydrogenation, interesterification, hydrolysis, auto-oxidation and its prevention; flavour reversion, fat replacers: fat mimetics and fat substitutes.

Unit 6: Vitamins and Minerals **(Hours:6)**

Vitamins: Introduction, sources, classification: water soluble and water insoluble vitamins, essential vitamins, physiological function, deficiencies, causes of variation and loss in foods, vitamin like compounds, effect of food processing.

Minerals: Introduction, sources, classification: major minerals and trace elements, physiological function, deficiencies, factors affecting mineral content of food, fortification and enrichment of foods with minerals, effect of food processing.

Unit 7: Food Additives **(Hours:15)**

Additives: Introduction, importance, classification, antioxidants, emulsifiers, stabilizers, gelling agents, gums, thickeners, sweeteners, acidulants, preservatives, humectants, food toxins

Colouring Agents and Pigments: Introduction, natural food colourants: anthocyanins, carotenoids, chlorophyll, caramel, betalains; examples of pigments in common food; Nature-identical colourants: β -Carotene, canthaxanthin and riboflavin; artificial colouring agents; artificial/synthetic colourants: Azo dyes (e.g. amaranth dye, tartrazine, citrus red, Allura red); quinoline (e.g. quinoline yellow); phthalein (e.g. erythrosine); triarylmethanes and indigoid (e.g. indigo carmine), FD&C Dyes and lakes; properties of certified dyes, colours exempt from certification.

Food Flavor: Sensation of taste and odour, chemical dimension of basic types of taste (Salty, Sweet, Bitter, Sour, Umami taste), other sensations like astringency, coolness, pungency/pungency); non-nutritive sweeteners (aspartame, saccharin, sucralose, cyclamate) and nutritive sweeteners, molecular mechanism of flavour perception, biogenesis of fruits and vegetable flavors, taste inhibition, modification and enhancement, common vegetable and spice flavors.

Practical component

Practical:

Credits: 01

(Laboratory periods:15 classes of 2 hours each)

(At least four experiments to be performed)

1. Determination of moisture in food products by hot air oven-drying method.
2. Paper chromatography of synthetic food dyes.
3. Quantitative determination of food dyes in powdered drink mixes by spectrophotometric method.
4. Colorimetric determination of Iron in vitamin / dietary tablets.
5. Determination of rancidity of edible oils by Kriess Test.
6. Estimation of Vitamin C in a given solution/ lemon Juice/chillies by 2, 6-dichlorophenol by Indophenol Method.
7. Isolation of casein from milk.
8. Qualitative estimation of cholesterol by Liebermann-Burchard method.
9. Detecting the presence of Vanaspati and rancidity in the given Ghee sample through qualitative tests.

Essential/recommended readings

Theory:

1. DeMan, J.M., Finley, J.W., Hurst, W.J., Lee, C.Y. (2018), **Principles of Food Chemistry**, Fourth Edition, Springer.
2. Msagati, T.A.M. (2013), **Chemistry of Food Additives and Preservatives**, Wiley-Blackwell.
3. Fennema, O.R. (2017), **Food Chemistry**, Fifth Edition, CRC Press.
4. Attokaran, M. (2017), **Natural Food Flavors and Colorants**, Second Edition, Wiley-Blackwell.
5. Potter, N.N., Hotchkiss, J.H. (1995) **Food Science**, Fifth Edition, Chapman & Hall.
6. Brannen, D., Davidsin, P.M., Salminen, T. Thorngate III, J.H. (2002), **Food Additives**, Second Edition, CRC Press.
7. Coultate, T. (2016), **Food: The Chemistry of its Components**, Sixth Edition, Royal Society of Chemistry.
8. Belitz, H. D.; Grosch, W. (2009), **Food Chemistry**, Springer.
9. [Course: Food Chemistry \(iasri.res.in\)](http://iasri.res.in)

Practical:

1. Ranganna, S. (2017). **Handbook of analysis and quality control for fruits and vegetable products**, Second Edition, McGraw Hill Education
2. Sawhney, S.K., Singh, R. (2001), **Introductory Practical Biochemistry**, Narosa Publishing House