

Basket for Generic and Open Elective (GE/OE) Category Courses (Chemistry)

Sem	Course Category	Name of Course	Course Code	Teaching Scheme(hrs.)			Total Credit	Examination Scheme								
				(Th)	TU	P		Theory				Practical				
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.		
I	GE/OE	Food Adulteration	BGO1T01	2	-	-	2	3	80	20	40	-	-	-		
I	GE/OE	Cosmetic Chemistry	BGO1T02	2	-	-	2	3	80	20	40	-	-	-		
II	GE/OE	Kitchen and Nutrition Chemistry	BGO2T03	2	-	-	2	3	80	20	40	-	-	-		
II	GE/OE	Basics of Environmental Pollution	BGO2T04	2	-	-	2	3	80	20	40	-	-	-		
III	GE/OE	Chemistry in Everyday life	BGO3T05	2	-	-	2	3	80	20	40	-	-	-		
IV	GE/OE	Molecules of Life	BGO4T06	2	-	-	2	3	80	20	40	-	-	-		

B.Sc. Semester – I
BGO1T01: Food Adulteration
Theory: 2 credits

Course Outcomes

After successful completion of the course, students will be able to:

- 1. Understand the adulteration of common foods and their adverse impact on health.*
- 2. Comprehend certain basic skills of detecting adulteration in common foods.*
- 3. The students are able to understand role and importance of food additives.*
- 4. Apply their knowledge of food safety and regulations.*
- 5. Prevent food adulteration in the day to day life.*

Unit I: Introduction and Types of Adulterants (7.5 h)

Adulteration – Introduction and definition. Types of adulteration- Intentional adulteration, Incidental adulteration, Metallic adulteration and Packaging Hazard.

Methods of food adulteration- Mixing, substituting, using decomposed food, additions of toxic substances and misbranding. Reasons for food adulteration,

Types of Adulterants – Poisonous substances, foreign matter, cheap substitutes, Spoiled parts. General Impact of food adulteration on Human Health.

Unit II: Adulteration of Common Foods and Methods of Detection (7.5 h)

Adulteration of Common Foods, Methods of Detection of Adulterants in the following Foods: Milk, Oil, Grain, Sugar, Spices and Condiments, Processed Food, Fruits and Vegetables, Additives and Sweetening agents (at least two methods of detection for each food item).

Quality management system - Quality control, Quality assurance, Quality Improvement and assessment.

Unit III: Food Additives (7.5 h)

Introduction, definition, principles categories of food additives on the basis of functional use – Preservatives, Colours, Antioxidants, Anti-caking and anti-foaming agents, Flavouring agent, Buffering agents, raising agents, bulking Nutritive additives, sweetening agents, thickening and jellying agents, enzymes, firming agents, acidity regulators, leavening agents, emulsifiers and stabilizers. (Role and examples), safe levels of additive uses.

Unit IV: Laws and Procedures on Adulteration (7.5 h)

Mitigation measures for addressing food adulteration. Highlights of Food Safety and Standards Act 2006 (FSSAI), Food Safety and Standards (International standards, ISO standards and Indian standards). Auditing and accreditation (BIS, QCI, AGMARK), Importance and application of food

regulation in the Indian and Global context, responsibilities for maintaining and enforcing food safety FSSAI, CODEXALIMENTARIUS, HACCP. ISO 22000 series, TQM and codes of GMP.

References

1. A first course in Food Analysis, A.Y. Sathe, New Age International (P) Ltd., 1999.
2. Food Safety, case studies – R. V. Bhat, NIN, 1992.
3. DART- Detect adulteration with rapid test. FSSAI, Imprinting Trust, assuring safe and nutritious food, Ministry of Health and Family Welfare, Government of India.
4. Rapid detection of food adulterants and contaminants Theory and Practice, S. N. Jh, 2016, Kindle Edition.
5. Domestic Tests for Food Adulterations, H. G. Christian, Forgotten books.
6. A Laboratory Manual of Food Analysis, S. Sehgal, Wiley Publishers.
7. Food Safety and Standards Act, 2006. Bare ACT, November 2020, Commercial law publishers.
8. Food science and nutrition by Sunetra Roday, Oxford university, 3rd addition.
9. Malik R. K. and K. C. Dhigra, Hand book of food industries, Small industry, Research institute.
10. [https://fssai.gov.in/upload/uploadfiles/files/Manual_Food_Additives_25_05_2016\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Manual_Food_Additives_25_05_2016(1).pdf)
11. Fox B. A. and A. G. Cameron, Food science and chemical approach Hodder and Stoughton educational, 1982.
12. Fitch and Francis, foods and principles of cookery, Prentice-Hall, Inc 1960.

B.Sc. Semester – I
BGO1T02: Cosmetic Chemistry
Theory: 2 credits

Course Outcomes: *By the end of this course, students will be able to:*

- *Understand the basic principles of cosmetic chemistry.*
- *Identify and describe the function of various cosmetic ingredients.*
- *Formulate and evaluate different types of cosmetic products.*
- *Apply knowledge of skin and hair biology to cosmetic product development.*
- *Understand the regulatory and safety considerations in the cosmetic industry.*

Unit I: Introduction to Cosmetic Chemistry (7.5h)

- (A) Overview of the cosmetic industry:** Historical development of cosmetics, Basic principles of cosmetic formulation, Types of cosmetics (skincare, haircare, color cosmetics, etc.).
- (B) Cosmetic Ingredients:** Categories of cosmetic ingredients: Emollients, Humectants, Surfactants, Preservatives, Colorants, Fragrances, Natural vs. synthetic ingredients. Functions and mechanisms of action of key ingredients.

Unit II: Skin-Hair Biology and Products (7.5h)

- (A) Structure and function of the skin:** Skin types and conditions, Structure and function of hair, Hair types and conditions.
- (B) Skincare Products:** Formulation of cleansers, moisturizers, sunscreens, and anti-aging products. Key ingredients and their roles in skincare products. Evaluation and testing of skincare products (e.g., stability, efficacy, safety).
- (C) Haircare Products:** Formulation of shampoos, conditioners, hair dyes, and styling products. Key ingredients and their roles in haircare products. Evaluation and testing of haircare products (e.g., performance, safety).

Unit III: Colour and Fragrances in Cosmetics (7.5h)

- (A) Colour:** Formulation of makeup products (foundations, lipsticks, eye shadows, etc.). Pigments and colorants used in cosmetics. Safety and stability of color cosmetics. Trends and innovations in color cosmetics.
- (B) Fragrances:** Basics of fragrance chemistry. Types of fragrances (natural and synthetic). Role of fragrances in cosmetics and personal care products. Regulatory considerations for fragrances.

Unit IV: Regulatory Safety Considerations, Sustainability and Ethics (7.5 h)

- (A) *Regulatory and Safety Considerations:*** Cosmetic regulations and standards (FDA, EU, etc.). Safety assessment of cosmetic ingredients. Good Manufacturing Practices (GMP) in the cosmetic industry. Labeling and claims in cosmetics.
- (B) *Sustainability and Ethics:*** Sustainable sourcing of ingredients. Green chemistry principles in cosmetic formulation. Ethical considerations in the cosmetic industry (e.g., animal testing, fair trade).

References

1. "Introduction to Cosmetic Formulation and Technology" by Gabriella Baki and Kenneth S. Alexander
2. "Harry's Cosmeticology" by Ralph Gordon Harry, Martin M. Rieger, and Edward Sagarin
3. Baki, G., & Alexander, K. S. (2015). 'Introduction to cosmetic formulation and technology'. Wiley.
4. Harry, R. G., Rieger, M. M., & Sagarin, E. (2000). 'Harry's cosmeticology' (8th ed.). Chemical Publishing Co.
5. Sakamoto, K., Lochhead, R., Maibach, H., & Yamashita, Y. (Eds.). (2017). 'Cosmetic science and technology: Theoretical principles and applications'. Elsevier.
6. "Cosmetic Science and Technology: Theoretical Principles and Applications" edited by Kazutami Sakamoto, Robert Lochhead, Howard Maibach, and Yuji Yamashita

Weblinks

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B.Sc. Semester – II
BGO2T03: Kitchen and Nutrition Chemistry
Theory: 2 credits

Course Outcomes

After the completion of this course, student will be able to

- 1. Understand the chemical composition of food, including macromolecules, nutrients, and additives, and their significance in cooking, nutrition, and medical applications*
- 2. Apply knowledge of macromolecules, cooking chemistry, and food additives to analyse and optimize cooking processes, ensuring the preservation of nutritional value and sensory quality in prepared foods.*
- 3. Evaluate the classification and sources of nutrients in food, considering macronutrients, micronutrients, and additives, to make informed dietary choices that support overall health and well-being.*
- 4. Critically analyse the role of food additives in food preservation and flavour enhancement, considering their chemical composition and potential impacts on human health and food quality.*

Unit - I: Nutrition in Food (7.5h)

Introduction to nutrition, definition of food, nutrients and nutrition, Relation of food and health, Balance diet, Food and its functions (Physiological, psychological and social function), Classification of nutrients (Micronutrients and macronutrients), Understanding the role of carbohydrates, proteins, fats and oils in food systems, Chemical structures and functions of macromolecules (carbohydrates, proteins, fats and oils).

Unit - II: Chemistry of Cooking (7.5 h)

Introduction and definition of cooking, Objective of cooking food, Methods of cooking- Dry heat method of cooking, moist heat method of cooking, cooking under pressure, microwave cooking, solar cooking and infrared cooking. Physical and Chemical changes during cooking (Caramelisation, crystallization, gelatinization, emulsification, coagulation and pyrolysis), Stability of nutrients during cooking. Food sterilization - pasteurization of milk, Safety protocols and best practices in kitchen chemistry.

Unit - III: Classification and sources of nutrients (7.5h)

Chemistry of spices and condiments- Definition, classification on the basis of active principles present in spices (Pungent spices, aromatic seeds and fruits, aromatic barks, phenolic spices and colour spices), function of spices and condiments in the cookery.

Carbohydrate- Definition, occurrence, sources and classification with examples.

Protein- Definition, occurrence, sources and classification with examples

Fat-Oil - Definition, occurrence, sources and classification of fatty acid with examples

Vitamins - Definition, occurrence, sources and classification(water soluble and fat soluble)

Unit – IV: Water and beverages (7.5h)

Water – Water contents of common foods (free water and bound water), Function of water in cookery, effect water content of food on the nutritive value, types of water (hard water and soft water), disadvantages of hard water.

Beverages – Introduction and definition, functions of beverages, classification of beverages with examples – cold and hot, alcoholic and non-alcoholic, Types of Tea (green tea, black tea and oolong tea), Cold beverages (carbonate drinks and alcoholic drinks), effect of beverages on human body.

References

1. The Science of Cooking: Understanding the Biology and Chemistry behind Food and Cooking; Joseph J. Provost, Keri L. Colabroy, Brenda S. Kelly, Mark A. Wallert.
2. Dairy Chemistry and Animal Nutrition – M.M. Roy.
3. Fundamentals of Dairy Chemistry -B.H. Webb, A.H. Hooson, J.A. Alford, CBB Publishers
4. Milk and Milk Products-C.H. Eckles, H. Macy, Tata McGraw Hill Publishing Company
5. Essential Guide To Food Additives by Victoria Emerton and Eugenia Choi
<https://books.rsc.org/books/edited-volume/21/Essential-Guide-to-Food-Additives>
6. Food Additives Data Book by Jim Smith and Lily Hong-Shum.
6. Food Additives by A. Larry Branen, P. Michael Davidson, Seppo Salminen and John H. Thorngate III
7. Food and Nutrition Handbook for Extension Workers by Ministry of Agriculture, Animal Industry and Fisheries.
8. Textbook on Nutrition & Dietetics for Post Basic BSc Nursing Students by I. Clement.
9. Food science and nutrition by Sunetra Roday, Oxford university, 3rd addition.
10. Malik R. K. and K. C. Dhigra, Hand book of food industries, Small industry, Research institute.
11. Fox B. A. and A. G. Cameron, Food science and chemical approach Hodder and Stoughton educational, 1982.
12. Fitch and Francis, foods and principles of cookery, Prentice-Hall, Inc 1960.

B.Sc. Semester – II
BGO2T04: Basics of Environmental Pollution
Theory: 2 credits

Course Outcomes:-

1. Evaluate the classification of pollutants and understand the sources and effects of noise pollution.
2. Explicate the importance of water and thermal pollution.
3. Learn the basics of solid waste management and soil pollution.
4. Understand the effects of air and radioactive pollutions.

Unit-I: Environmental Pollution (7.5h)

Environmental Pollution: Definition, types, Classification of Pollutants- on the basis of physical properties and forms of their existence, Primary and secondary pollutants, degradable and non-degradable pollutants.

Noise Pollution: Sources and effects, Decibel scale, control measures of noise pollution. Ambient noise level of monitoring.

Unit-II: Water Pollution (7.5h)

Water Pollution: sources, effect of water pollution on flora and fauna, human beings and materials, Eutrophication, Heavy metal pollution- Minamata episode, water, pollution control measures, water quality indices.

Thermal Pollution: Causes, effects and control measures.

Marine Pollution: sources, causes and mitigation of marine pollution.

Unit-III-Soil and Solid Pollution (7.5h)

Soil Pollution: Sources and types, soil pollutants- metals, inorganic ion and salts, organic substances, effects of soil pollution on soil health and productivity, effects of pesticides, soil pollution control measures,

Solid Waste Pollution: sources, Classification and characteristics of solid waste, segregation, collection and transportation and disposal of solid waste, Solid Waste management, **Biomedical Waste:** Categories of biomedical waste, types of container used for the disposal of biomedical waste, biomedical waste management.

Unit-IV: Air and Radiation Pollution (7.5h)

Air Pollution: Sources, Effects (Human health, vegetation and animals, Building material and structures), Indoor pollution, vehicular pollution, Bhopal gas tragedy, Air Quality Standards-

Radioactive Pollution: Types and sources of radiations, biological effects and control measures. of radiations, E-waste (sources and its health effect), recycling and disposal methods.

References

1. Text Book of Environment: K M Agrawal, P.K.Sikdar, and S.C.Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C.Dash and P.C.Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C.Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K.Asthana, S.Chand Publication, New Delhi.
5. A Text book of Environmental Chemistry and Pollution Control: S.S.Dara, S.Chand and Company Ltd, New Delhi.
6. Environmental Chemistry: B.K.Sharma, Goel Publication, Meerut.
7. Environmental Chemistry: A.K.Dey, New Age International Publishers, 2001.
8. Man and Environment: P.R.Trivedi and Gurdeep Raj, Akashdeep Publishing House, New Delhi.
9. Fundamentals Concepts in Environmental Studies: Dr.D.D.Mishra, S.Chand Publication, New Delhi.
10. Environmental Pollution: Khitoliya, R.K. S.Chand Publication, New Delhi.
11. Air pollution and it's Control: Rao, M.N and Rao, H.V.N., Tata McGraw-Hill Publishing Company, New Delhi.
12. Principles of Environmental Chemistry, 3rd edition, J.E.Girard, Jones and Bartlett Learning Company, Burlington
13. The Science of Environmental Pollution, 3rd edition, Frank.R.Spellman, CRC Press, Taylor and Francis Group.

B.Sc. Semester – III
BGO3T05: Chemistry in Everyday Life
Theory: 2 credits

Course Outcomes:

1. Evaluate chemicals available in food products and additives.
2. Explicate the importance of colouring agents, paints and pigments.
3. Learn the basics of chemistry of food ingredients.
4. Understand the effects of pollutants around us.

UNIT-I: Chemistry of food products (7.5 h)

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.

Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.

Food additives: Food preservatives like benzoates, propionates, sorbates, disulphites. Their action, significance and health effects.

Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Their action, significance and health effects.

Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate.

UNIT-II: Chemistry of colours (7.5 h)

Dyes: Colour and constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl orange.

Paints & Pigments: White pigments (white lead, ZnO, lithopone, TiO₂). Blue, red, yellow and green pigments. Paints and distempers: Requirement of a good paint. Emulsion, latex; luminescent paints. Fire retardant paints and enamels, lacquers. Solvents and thinners for paints.

Artificial food colorants: Coal tar dye, non-permitted colours and metallic salts. Common food colorants and their health effects.

UNIT III: Chemistry of food ingredients (7.5h)

Carbohydrates: Structure, function and Chemistry of some important mono and disaccharides.

Proteins: Composition of proteins. Classification, denaturation and structure elucidation of protein.

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils.

Vitamins: Classification and Nomenclature. Sources, deficiency diseases and structures of Vitamin A₁, Vitamin B₁, Vitamin C, Vitamin D, Vitamin E & Vitamin K₁.

Enzymes: Enzymes as catalysts, properties and mechanism of enzyme catalysis.

UNIT IV: Toxic chemicals around us (7.5 h)

Air toxicants: Causes and harmful effects of Greenhouse gases, CFCs, PAN. Heavy metals in particulate and aerosols.

Water toxicants: Soaps and detergents. Soaps and detergents in water bodies and their effects. Fertilizers and eutrophication. Pesticide pollution and remediation. Sewage water and industrial effluent treatment process.

Solid toxicants: Microplastics and their effects. Problems of plastic waste management. Strategies for the development of environment friendly polymers.

References

1. B. K. Sharma: introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
4. Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E.Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Physical Chemistry – P I Atkins and J. de Paula – 7 th Ed. 2002, Oxford University Press.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2.
9. Polymer Science and Technology, J. R. Fried (Prentice Hall).

B.Sc. Semester – IV
BGO4T06: Molecules of Life
Theory: 2 credits

Course Outcomes: At the end of the course students would be able to

1. Draw the structures of essential biomolecules
2. Understand the role of biomolecules in various life processes
3. Understand the structure and importance of proteins and nucleic acid.
4. Understand the general idea about the polymer and way of synthesis of synthetic drugs and dyes.

Unit I: Oils and fats (7.5h)

Introduction, Structures of Fats and Oils, Physical properties of Fats and Oils. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants: Acid value, Saponification value, Iodine value, significance and principle involved in their determination.

Unit II: Sugars and detergents (7.5h)

Introduction, Classification, Properties and Biological importance. Natural and synthetic sugars, structures of glucose, reducing and non-reducing sugars, Introduction to structures of maltose, sucrose, lactose, starch, cellulose, ribose and deoxyribose without involving structure determination. Synthetic detergents, Alkyl and aryl sulfonate

Unit III: Amino acids, peptides, proteins & nucleic acids (7.5h)

Classification, structure and stereochemistry of amino acids. Acids base behavior, isoelectric point and electrophoresis. Structure and nomenclature of peptides and protein. Classification of proteins. Protein denaturation. Structure determination of proteins (primary and secondary).

Nucleic acids: Introduction, constituents of nucleic acids. Ribonucleosides and Ribonucleotides. Double helical structure of DNA.

Unit IV (7.5h)

Polymers: Introduction, Definition, Types of polymer (Natural, synthetic and semi-synthetic polymers) types of polymerization processes, properties of polymers, Structure and applications of Polyethylene, Teflon, PVC, Polystyrene, etc.

Synthetic drugs: Definition, Classification, properties and uses of :Aspirin, Paracetamol, Dettol, Chloroquine, Phenobarbitone, Chloramphenicol, Chloramine T.

Synthetic dyes: Classification of Dyes based on chemical constitution. Structure and uses of Congo red, Crystal violet, Phenolphthalein and Alizarin dye.

References

1. Polymer Science, V.R. Gowarikar, N.V. Vishwanathan, Jaydev Shridhar, New age International publisher.
2. Morrison, R. T.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Nelson, D. L.; Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. Berg, J. M. Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.
6. A Textbook of organic chemistry, K. S. Tewari, N. K. Vishoi. Vikas Publishing House Pvt. Ltd.
7. Polymer Chemistry , Arora M. Anmol Publication, Delhi.
8. Organic Chemistry, Robert Thomson Morrison, Robert Neilson Boyd. New York University.
9. A Textbook of Organic Chemistry, Arun Bahl, B. S. Bahl. S. Chand Publication.