

**Syllabus  
for  
(Open Elective Course)**

**Open elective courses offered by the Department of Chemistry for other Departments of the University.**

Course Code	Course Title	Course Type	Maximum Marks			Credit Distribution			Credit	Total Credits
			Internal*	Final	Total	L	T	P		
CHM001	Biomolecules	Open Elective	25	25	50	2	0	0	2	2
CHM002	Nanoscience and Polymers	Open Elective	25	25	50	2	0	0	2	2
CHM003	Essential oils, Perfumery, and Aromatherapy	Open Elective	25	25	50	2	0	0	2	2
CHM004	Industrial Inorganic Chemistry	Open Elective	25	25	50	2	0	0	2	2
CHM005	Green Chemistry	Open Elective	25	25	50	2	0	0	2	2
CHM051	Chemistry in Everyday Life	Open Elective	25	25	50	2	0	0	2	2
CHM052	Life and Contributions of Some Famous Scientists	Open Elective	25	25	50	2	0	0	2	2
CHM053	Skin and Hair Care Products	Open Elective	25	25	50	2	0	0	2	2
CHM054	Qualitative Examination of Food Stuffs	Open Elective	50	50	100	3	0	0	3	3
CHM055	Introduction to Biofuels	Open Elective	25	25	50	2	0	0	2	2
CHM056	Sustainable Development	Open Elective	25	25	50	2	0	0	2	2

\*(Midterm 15 marks +Assignment 5 marks + Attendance 5 marks)

**Open Elective Course**  
**Course Title: Biomolecules**  
**Course Code: CHM001**

Credits = 2  
M.M. = 50  
L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Understand structure and function of biomolecules such as carbohydrates, proteins, and vitamins
<b>CLO 2:</b>	Decipher the role of micronutrients and biologically important molecules

**Unit I: Organic Biomolecules**

Carbohydrates: Classification (aldoses and ketoses), monosaccharide (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen), Importance of carbohydrates.

Proteins: Elementary idea of amino acids, polypeptides, proteins, Functions of proteins.

Vitamins: Classification and functions.

**Unit II: Bio-inorganic Chemistry**

Evidence regarding the presence of inorganic elements in biological systems, Biochemical role of calcium and magnesium, Biological role of Haemoglobin, Myoglobin and Vitamin B<sub>12</sub>, Elementary idea of Nitrogen fixation.

**Books Recommended:**

1. Organic Chemistry by I. L. Finar Vol-II, ELBS Publications. 6<sup>th</sup> Edn.; 2002.
2. Bio-organic Chemistry J. Rohr, Springer, 2000.
3. Bio-organic Chemistry. A Chemical Approach to Enzyme Action, Herrmann Dugas Springer, 3<sup>rd</sup> Edn.; 1999.
4. Bio-inorganic Chemistry -An introduction; Ochai, Allyn and Bacon; Abbe books, 1977.

**Reference Books**

5. Inorganic Bio-chemistry, Eichhorn; —Vol. 1 & 2; Elsevier, 1973.
6. Inorganic Chemistry – Puri, Sharma and Kalia. Milestone publishers, 32<sup>nd</sup> Edn.; 2014
7. Introduction to Bioorganic Chemistry and Chemical Biology. D. V. Vranket and Gregory Weiss; Taylor and Francis. 1<sup>st</sup> Edn.; 2012.
8. Bio-inorganic Chemistry ; K. Hussain Reddy; New Age International (P) Ltd; 1<sup>st</sup> Edn.; 2009

**Open Elective Course**  
**Course Title: Nanoscience and Polymers**  
**Course Code: CHM002**

Credits =2

M.M. = 50

L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Gain basic knowledge about nanomaterials
<b>CLO 2:</b>	Learn applications of some basic polymers

**Unit I: Nanotechnology**

Introduction to Nanoscience and Nanotechnology, Idea of size, Nanotechnology in Nature.  
Properties of materials at nanoscale: Optical, electrical and magnetic properties.  
Common application of Nanoscience in agriculture, medicine, water treatment and food packaging

**Unit II: Polymers and their Applications**

Introduction and classification of polymers, importance of polymers over other materials  
Common uses of some polymers  
Polyethylene  
Polyvinyl chloride  
Teflon  
Rubber  
Polyamide,  
Polyacrylonitrile

**Books Recommended:**

1. Nanotechnology, J. Ramsden, Elsevier, 1<sup>st</sup> E dn.; 2011.
2. Nanotechnology Importance and Application, Fulekar, I K International Publishing House, 2010.
3. Springer Handbook of Nanotechnology, B. Bhushan (Editor), 3<sup>rd</sup> Edn.; 2010.

**Reference Books**

4. Essentials of Nanotechnology. J Ramsden, 2009.
5. Nanotechnology Fundamentals and Applications, Manasi Karkare, I K International Publishing House, 2008.
6. Introduction to Nanoscale Science and Technology, M. Ventra, S, Evoy, J.R. Heflin. Springer; 2004.

**Open Elective Course**  
**Course Title Essential Oils, Perfumery, and Aromatherapy**  
**Course Code: CHM003**

Credits =2

M.M. = 50

L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Acquire knowledge about essential oils, their extraction through different techniques like hydrodistillation and steam distillation. They will also learn about various analytical techniques like gas chromatography mass spectrometry.
<b>CLO 2:</b>	Learn about the role of essential oils and other fragrance chemicals in various types of alcoholic and non-alcoholic perfumes. They will also learn about various fragrance notes like top note, middle note and base note.

**Unit I: Essential Oils and their Extraction**

Essential oils, chemical composition, methods of extraction, hydrodistillation, steam distillation, Solvent Extraction, CO<sub>2</sub> Extraction, Maceration, Enfleurage, Cold Press Extraction. Analytical methods for essential oil analysis; Gas chromatography mass spectrometry. Economically important essential oils, their quality profile and market value.

**Unit II: Value Addition of Essential Oils**

Role of essential oils in perfumery. National and international markets. Ingredients used for the preparation of alcoholic and non-alcoholic perfumes. Solid and gel perfumes. Basic techniques of essential oil blending, base note, middle note and top notes. Use of following essential oils in perfumery: lavender, rosemary, ylangylang, geranium, rose, lemon, orange, vanilla, patchouli, vetiver, clarysage, basil, bergamot, cardamom, clove oil, eucalyptus, fennel, frankincense, ginger, jasmine, lemon grass.

Use of essential oils in aromatherapy, classification of aromatherapy; Cosmetic, massage, medical and olfactory aromatherapies.

**Books Recommended:**

1. Handbook Of Essential Oils Science Technology And Applications; Baser K H C, Taylor & Francis, 3<sup>rd</sup> Edn; 2020.
2. Essential Oils for Beginners: The Guide to Get Started with Essential Oils and Aromatherapy, Althea Press (26 September 2013).

**Open Elective Course**  
**Course Title: Industrial Inorganic Chemistry**  
**Course Code: CHM004**

Credits =2

M.M. = 50

L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to

<b>CLO 1:</b>	Learn about chemical classification in terms of applications; fertilizers and important silicon based compounds
<b>CLO 2:</b>	Learn about inorganic solids in terms of their applications

**Unit I: Primary Inorganic Materials and Mineral Fertilizers**

Introduction; Importance of the chemical industry; Primary inorganic materials; Bulk and commodity chemicals; Fine and speciality chemicals

Mineral fertilizers; Nitrogen fertilizers, ammonium nitrate and urea; Phosphorous containing fertilizers

Industry important organo-silicon compounds; industrial silicone products

**Unit II: Inorganic Solids**

Inorganic solid, zeolites and catalysts, inorganic fibers; Construction materials; Enamel and ceramics

Fillers - synthetic and natural, applications; Metallic hard materials

Inorganic pigments; TiO<sub>2</sub>, lithopone, ZnS, ZnO and Fe<sub>2</sub>O<sub>3</sub>; Corrosion protection pigments; Luminescent and magnetic pigments

**Books Recommended:**

1. Industrial Inorganic Chemistry by K H Buechel, H -H Moretto, P Woditsch; Wiley-VCH 2nd Edn;
2. Inorganic Chemistry: An Industrial and Environmental Perspective by T W Swaddle, AP 1997.

**Open Elective Course**  
**Course Title: Green Chemistry**  
**Course Code: CHM005**

Credits = 2  
M.M. = 50  
L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	To understand the field of green chemistry. And get awareness about the 12 principles of green chemistry.
<b>CLO 2:</b>	Develop an understanding of cleaner production and green synthesis methods

**Unit I: Introduction to Green Chemistry**

**(Contact hours 14)**

Definition and Concepts. Need and Goals of Green Chemistry. Principles of Green Chemistry with their explanations and common examples

**Unit II: Green Chemistry and Practical Applications.**

**(Contact hours 16)**

Biodegradable alternative of conventional plastics: use of poly lactic acid from corn. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting. Use of safer chemicals: Use of green solvents and chemicals in designing a process. Disinfection of water (use of O<sub>3</sub> and super critical water oxidation). Green chemistry in sustainable development: (Bio-diesel, bio-ethanol and biogas),

**Books recommended:**

1. Anastas, P. T., Warner, J. Green Chemistry: Theory and Practice; Oxford University Press: London, 1998.
2. Doble, Mukesh, Ken Rollins, and Anil Kumar. Green chemistry and engineering. Academic Press, 2010.
3. Ahluwalia, V. K., and Mazaahir Kidwai. New trends in green chemistry. Springer Science & Business Media, 2012.
4. Harris, Noel. Green chemistry. Scientific e-Resources, 2019.

**Open Elective Course**  
**Course Title: Chemistry in Everyday Life**  
**Course Code: CHM051**

Credits =2

M.M. = 50

L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Understand how drugs are important in everyday life of human society
<b>CLO 2:</b>	Acquire the knowledge of importance of preservatives in food industries

**Unit I: Medicines and their Use**

**Chemicals in medicines:** Introduction and classification of drugs: Analgesics, Tranquilizers, Antiseptics, Disinfectants, Antimicrobials, Antifertility drugs, Antibiotics, Antacids, Some lifesaving drugs: Epinephrine Hydrochloride (Adrenaline), Dexamethazone Sodium phosphate, Meperidine Hydrochloride (Pethidine), Diazepam, Aspirin, Drug addiction.

**Unit II: Chemicals for Food Preservation**

Preservatives: Need for preservatives, Classification and types, Natural preservatives.

Artificial sweetening agents: Classification, types and their effects, Common uses of sweetening agents.

Antioxidants: Classification and types, Natural antioxidants and applications.

**Books Recommended:**

1. DRUGS A Very Short Introduction; Oxford University Press; 2001
2. Pharmacology: An Introduction to Drugs; Michael C. Gerald; Prentice Hall; 1974
3. The Chemistry of Food; Jan Velisek; Willey Blackwell; 2014



**Open Elective Course**  
**Course Title: Life and Contributions of Some Famous Scientists**  
**Course Code: CHM052**

Credits =2  
M.M. = 50  
L T P=2 0 0

**Prerequisites:**

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Reveal the sacrifices and contribution of scientists during early periods of sciences
<b>CLO 2:</b>	Struggle and contributions of modern scientists in chemistry and physics

**Unit I: Early Science and Scientists (Scientific**

Introduction to Science.

Hippocrates as an inspiration source of science.

Aristotle: Early life and contributions.

Avicenna, and Jabir ibn Hayyan: Works and scientific contributions.

Copernicus and Galileo: Science of stars and telescopic discoveries.

**Unit II: Life and Work of Modern Scientists**

Life and works of Antoine Lavoisier, Micheal Faraday, G. N. Lewis.

Life and works of Marie Curie, Rosland Franklin, Fritz Haber, Linus Pauling.

Life and works of Isaac Newton, Neils Bohr, Albert Einstein, Abdus Salaam, Ahmed Zewail.

Life and works of some famous national scientists: C. V. Raman, S. N. Bose, Meghnand Saha, Srinivasa Ramanujan, Rivalries, and politics in science.

**Books Recommended:**

1. The 100 Most Influential Scientists of All Time; Britannica Educational Publishing; 2010.
2. Great Physicists: The Life and Times of Leading Physicists from Galileo to Hawking ; William H. Cropper ;2004.
3. Humphry Davy: Science and Power, Cambridge University Press, Cambridge, David M. Knight; 2003.

**Reference Books**

4. Master Mind: The Rise and Fall of Frtiz Haber, the Nobel Laureate Who Launched the Age of Chemical Warfare, Harper Collins, New York, Baniel Charles; 2005.
5. Journey into Light: Life and Science of C. V. Raman; Oxford University Press; G. Venkataraman,; 1989.
6. Nucleus and Nation: Scientists, International Networks, and Power in India. University of Chicago Press; Robert S. Anderson 2010.

**Open Elective Course**  
**Course Title: Skin and Hair Care products**  
**Course Code: CHM053**

Credits =2  
M.M. = 50  
L T P=2 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Learn about the skin structure and various types of skin. They will also learn about principles of skin care formulations and building blocks of skin care products like face wash, cold cream, vanishing cream, sunscreens etc.
<b>CLO 2:</b>	Learn about the basic structure of hair and principles of formulation of various hair care products. They will also learn about the role of various herbs in hair care products.

**Unit I: Skin Care Products**

Skin: Basic structure and function of skin. Cosmetics and classification of cosmetics. Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, vanishing cream, sun-screens, and lotions. Sun protection, Classification of Sunscreens and SPF.

Role of herbs in skin care products: Essential oils, Aloe Vera, turmeric, Henna and amla.

**Unit II: Hair Care Products**

HAIR: Basic structure of hair. Hair growth cycle. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, and anti-dandruff shampoo. Hair oils.

Role of herbs in hair care products: Amla, Hibiscus, Rosemary, Eucalyptus, Rose, Garlic and onion.

**Books Recommended:**

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4<sup>th</sup> Edn, Vandana Publications Pvt. Ltd., Delhi.
3. Text book of Cosmeticology by Sonja Nanda & Roop K. Char, Tata Publishers.

**Open Elective Course**  
**Course Title: Qualitative Examination of Food Stuffs**  
**Course Code: CHM054**

Credits =3  
M.M. = 100  
L T P  
3 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	Learn about various tests generally used in detecting the foreign additives in food samples
<b>CLO 2:</b>	Make them ready for various food testing laboratories and food industries

**Unit I: Food Analysis-I**

Milk: Constituents of milk, Qualitative examination: Physicochemical characteristics, preparation of sample for chemical examination, specific gravity of milk, Preparation of casein, Test for casein, Test for reducing sugars, Test for calcium and Phosphorous.

**Unit II: Food Analysis-II**

Cheese: Test for proteins, Grease spot test, Neumann's test.

Egg: Chemical tests for egg white, Chemical tests for egg yolk.

Meat: Test for myosin, Meat extract tests (Lead acetate and aldehyde tests with other tests if chemicals are available e.g; Xanthoproteic, Million Nasse's, Sakaguchi's tests)

**Unit III: Food Analysis III**

Wheat Flour: Preparation of gluten, Test for carbohydrates in the colloidal solution, Test for proteins in the gluten.

Bread: Preparation and qualitative examination.

Artificial sweeteners and

Determination of sugar content in beverages

Vitamin C determination by Indophenol Method

Sodium determination using ion-selective electrodes, Mohr titration, and test strips

**Recommended Books:**

1. Harding F, Editor. Milk quality. New York: Blackie Academic & Professional; 1995 Dec 31.
2. Rojas JA, Rosell CM, De Barber CB. Pasting properties of different wheat flour-hydrocolloid systems. Food hydrocolloids. 1999 Jan 1;13(1):27-33.
3. Hamelman J. Bread: a baker's book of techniques and recipes. John Wiley & Sons; 2021 April 6.
4. 3. Suzanne NS, Food analysis laboratory manual, Springer International Publishing 2017

**Reference Books**

5. Thom C, Fisk W. The book of cheese. Apple wood Books; 2007 Dec 15.
6. Kerth CR. The science of meat quality. Blackwell Publishing; 2013.
7. Sharma S. Experiments and techniques in biochemistry. Galgotia Publications; 2007.

**Open Elective Course**  
**Course Title: Introduction to Biofuels**  
**Course Code: CHM055**

Credits =3  
M.M. = 100  
L T P  
3 0 0

**Course Learning Outcomes:** After completion of this course, the students will be able to:

<b>CLO 1:</b>	To understand and explain the fundamental concepts and types of biofuels and to identify raw materials and production methods for biofuels
<b>CLO 2:</b>	To assess the environmental and economic impacts of biofuels and to analyse and discuss current trends and future prospects in the biofuel industry.

**Unit 1: Introduction to Biofuels**

**(15 Hours)**

Overview of biofuels: Definition and importance of biofuels,

Production of biofuels: raw materials: Biomass sources (plants, algae, waste), Production processes: fermentation, transesterification, anaerobic digestion

Types of biofuels: bioethanol: production, uses, and benefits, biodiesel: production, uses, and benefits, biogas: production, uses, and benefits.

**Unit 2: Environmental and Economic Impacts of Biofuels**

**(15 Hours)**

Environmental Impact of biofuels: Impact on air and water quality, land use and deforestation

Applications of biofuels: Use in transportation, use in electricity generation, industrial applications.

Future of biofuels: Research and development trends, role in global energy transition

**Reference Books:**

1. Demirbas, A. . Biofuels: Securing the Planet's Future Energy Needs. (2009)Springer.
2. Lee, J. W. (Ed). . Advanced Biofuels and Bioproducts.(2013) Springer.
3. Sims, R. E. H.. Bioenergy Options for a Cleaner Environment: in Developed and Developing Countries. (2010) Elsevier.
4. Pimentel, D. . Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks. (2008)Springer.
5. Soetaert, W., & Vandamme, E. J. . Biofuels. (2009)John Wiley & Sons.
6. Vertès, A. A., Qureshi, N., Blaschek, H. P., & Yukawa, H. . Biomass to Biofuels: Strategies for Global Industries. (2014)John Wiley & Sons.
7. Brown, R. C. . Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power.(2019) John Wiley & Sons.