

Syllabus
for
M.Sc. Chemistry (With Specialization
in Fragrance and Flavour Chemistry)
(as per NEP)



Department of Chemistry
School of Basic Sciences
CSJM UNIVERSITY, CAMPUS
Kanpur

**M.Sc. Chemistry with specialization in
“Fragrance and Flavour Chemistry”**

Syllabus

Department of Chemistry
School of Basic Sciences
CSJM University Campus, Kanpur
Semesterwise–Distribution of Course
Total Marks- 2300, Total Credit- 108

	I ST YEAR/I ST SEM					
COURSE CODE	TYPE	COURSE TITLE	MIN CREDITS	CIA	ESE	MAX. MARKS
B280701T	CORE I	Inorganic Chemistry	4	25	75	100
B280702T	CORE II	Organic Chemistry	4	25	75	100
B280703T	CORE III	Physical Chemistry	4	25	75	100
B280704T	CORE IV	Analytical Techniques Part A	4	25	75	100
B280705P	PRACTICAL	LABCOURSE I	4	25	75	100
	PROJECT	RESEARCH PROJECT				-
	TOTAL		20			500
I ST YEAR/ II ND SEM						
B280801T	CORE V	Essential Oils, Dyes and Pigments	4	25	75	100
B280802T	CORE VI	Analytical Techniques Part B	4	25	75	100
B280803T	ANY TWO ELECTIVES TO BE CHOSEN	1. Natural Products, Cosmetics and Perfumery	4	25	75	100
B280804T		2. Food Technology and Agrochemicals	4	25	75	100
B280805T		3. Environmental Impact Assessment				
B280806P	PRACTICAL	LABCOURSE II	4	25	75	100
B280807R	PROJECT	RESEARCH PROJECT	8	25	75	100
		MINOR ELECTIVE FROM OTHER FACULTY (IN 1 ST YR- Ist/II nd SEM)*	4/5/6	25	75	100
	TOTAL		32			700
2 nd YEAR/III rd SEM						
B280901T	CORE VII	Extraction & Processing of Natural Fragrant Raw Materials & Production of Aroma Chemicals	4	25	75	100
B280902T	CORE VIII	Fragrance & Flavour – Raw Materials Familiarization, Evolution & Fundamentals of Creation	4	25	75	100
B280903T	CORE IX	Quality Assessment of Fragrant Raw Materials	4	25	75	100

B280904T	CORE X	Regulations & Licenses in Fragrance, Flavor & Cosmetics Production – Introduction	4	25	75	100
B280905T	CORE XI	Odour& Taste Memorization, Floral Fragrances& Basic Flavour Creation	4	25	75	100
B280906P	PRACTICAL	LAB COURSE- III	4	25	75	100
	TOTAL		24			600
2 nd YEAR/IV th SEM						
B281001T	CORE XII	Flavour Creation & Application in End Products	4	25	75	100
B281002T	COREXIII	Aroma Products(Eco friendly and hand crafted): packaging. entrepreneurship &information technology application	4	25	75	100
B281003T	CORE XIV	Quality Assessment by Instrumentation, Fragrance Matching & Quality Management Systems for Laboratories	4	25	75	100
B281004T	CORE XV	Industrial Exposure, Field Visits, and Entrepreneurial Insights	4	25	75	100
B281005R	CORE XVI	Dissertation on Production of Fragrant Raw Materials / Fragrance / Flavour Creation	12	50	150	200
B281006P	PRACTICAL	LAB COURSE- IV	4	25	75	100
	TOTAL		32			700
	Total after final semester		108			2300

NOTE:

1. *A Minor Elective from other faculty shall be chosen In1stYear(Either Ist/IInd Semester) as per availability.Student will enrol in research project in 1st semester and evaluation will take place at the end of the 2nd semester.
2. Research project can be done in form of Internship/Survey/Field work/Research project/ Industrial training, and a report/dissertation shall be submitted that shall be evaluated via seminar/presentation and viva voce.
3. The student straightaway will be awarded 25 marks if he publishes a research paper on the topic of Research Project or Dissertation

Dr. Shikha
11-11-2025

Ramisha

Aswena

**M.Sc. Chemistry with specialization in
“Fragrance and Flavour Chemistry”**

Syllabus

Semester I

Paper Code: B280701T

Paper Name: Inorganic Chemistry

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Acquire the knowledge and have ability to describe the bonding, MO theory, and molecular term symbols of inorganic molecules & ions.
- CO2 Understand the metal-ligand bonding, crystal field theory, spectro chemical series, and Jhan teller effect.
- CO3 Understand the fundamentals of electronic spectroscopy, Orgel and Tanabe- Sugano diagrams for transition metal complexes
- CO4 To learn about the formation and stability of metal complexes and their determination
- CO5 Understand the chemistry of inert & labile complexes and the substitution reaction of inorganic complexes. Mechanistic aspects of different types of reaction of metal complexes in solution.
- CO6 Learn the ancient history of Indian chemistry, use of chemistry in medicine and Metallurgy.

Course details:

Unit 1: Indian Knowledge System

The ancient history of Indian chemistry, Various treatises on Chemistry, the use of chemistry in medicines, Metallurgy, Use of chemistry for occult practices.

Unit 2: Chemical Bonding

Walsh diagram; Evidence of MO pictures from spectra and reactivity; Molecular term symbols (ground & excited state). $p\pi - d\pi$ bonding, $3C-2e$ bonding, μ -bond, δ -bond.

Asaxena

11-VIII-2023

Ramishra

Unit3: Metal ligand bonding & electronic spectra

Crystal field theory, Splitting of d orbitals. Crystal field stabilization energies in weak field and strong field environments, spectrochemical series and Jahn-Teller effects on energy levels spin-orbit coupling, quenching of orbital contribution. Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1 – d^9 states), calculations of Dq , B and β parameters, charge transfer spectra

Unit4: MetalLigand Equilibrium

Equilibria Stability of mononuclear, polynuclear mixed ligand complexes in solution, Stepwise and overall formation constants, trends in stepwise constants factors affecting the stability of metal complexes – chelate effect, determination of stability constants.

Unit5:Reaction Mechanism

Inert and labile complexes-Explanation of lability on the basis of CFSE. Substitution reactions (dissociative, associative, Id, & Ia mechanisms) in square planar, tetrahedral and octahedral geometries with special reference to d^n ion complexes.

BooksRecommended:

1. AncientIndianSciences–B.Seal.
2. ScienceinAncientIndia(ScienceofthePast)–Melissa Stewart.
3. D. F. Shriver, P. W. Atkins and C. H. Langford, *Inorganic Chemistry*, Oxford University Press, New York (1990.)
4. B. Douglas, D. McDaniel and J. Alexander, *Concepts and Models of Inorganic Chemistry*, 3rd Edn, John Wiley and Sons, Inc., New York (2001).
5. J.E.Huheey, E.A. Keiter and R.L. Keiter, *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th Edn, Harper Collins College Publishers, New York (1993).
6. T.P. Fehlner, J.–F. Halet and J.–Y. Saillard, *Molecular Clusters—A Bridge to Solid State Chemistry*, Cambridge University Press, Cambridge (2007).
7. M. Driess and H. Noth (Eds.), *Molecular Clusters of the Main Group Elements*, Wiley-VCH, Weinheim (2004).
8. O. Kahn, *Molecular Magnetism*, VCH, New York (1993).
9. P. Braunstein, L. A. Oro and P. R. Raithby (Eds.), *Metal Clusters in Chemistry*, Wiley-VCH, Weinheim (1999).
10. M.H. Chisholm (Ed.), *Early Transition Metal Clusters with π -Donor Ligands*, VCH, New York (1995).

TextBooks

11. J.D. Lee, *Concise Inorganic Chemistry*, Chapman and Hall, London (1991).

Aswene
V. Shukla
17-VIII-2025
R. Srinivas

Semester I

Paper Code: B280702T

Paper Name: Organic Chemistry

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- | | |
|-----|---|
| CO1 | Learn the different types of heterocyclic molecule and their chemistry and biological property. |
| CO2 | Learn modern synthetic methods for the preparation of heterocyclic compound and their structural elucidation. |
| CO3 | Learn the properties & side effects of different heterocyclic compounds. |
| CO4 | Learn the basic photochemistry & different types of photochemical reaction. |
| CO5 | Learn the different types of organometallic compounds and their uses in organic synthesis. |
| CO6 | Learn the different types rearrangement reaction in organic synthesis. |

Course details:

Unit I

Heterocyclic synthesis & Pericyclic

Introduction, synthesis, and properties of Thiophene, Furan, Pyridine, Pyrrole, Quinoline and Indole. Cycloaddition, Electrocyclic, Sigmatropic and Cheletropic reactions.

Unit II

Rearrangement and Reactions

Pinacol/Pinacolone Rearrangement, Wagner-Meerwein Rearrangement, Wolff Rearrangement, Hofmann Rearrangement, Curtius Reaction, Lossen Rearrangement, Schmidt Reaction, Beckmann Rearrangement, Favorskii Rearrangement and Claisen Rearrangements, Aldol Reaction, Perkin Reaction, Stobbe Reaction, Reimer-Tiemann Reactions.

A. Saxena

V. Chulka
11-VIII-2023

Unit III

Reagents in Organic synthesis

Grignard reagent, NaBH_4 , LiAlH_4 , Gilman's reagents, Lithium dimethyl cuprate, DDQ, oxidising agents: SeO_2 .

Unit IV

Organic Synthesis

Disconnection approach (one and two group), C-C, C-X disconnection, 1, 3 and 1, 5-difunctional compounds.

Recommended Text Books:

1. Carey, F.A. & Sundberg, R.J. *Advanced Organic Chemistry, Parts A & B*, Plenum: U.S. (2004).
2. Carruthers, W. *Modern methods of Organic Synthesis*, Cambridge University Press (1971).
3. Warren, S. *Organic Synthesis: The Disconnection Approach*, John Wiley & Sons (1984).
4. J. March. *Advanced Organic Chemistry, Reaction Mechanisms and Structure*, John Wiley.
5. W. Carruthers. *Some Modern Methods of Organic Synthesis*, Cambridge University Press.
6. I.L. Finar, *Organic Chemistry*, ELBS, U.K.
7. Morrison R.T. & Boyd R.N.; *Organic Chemistry*, Prentice Hall India.
8. Clayden, J.; *Organic Chemistry*, Oxford University Press.

✓ Shukla
11-VIII-2025

A. Saxena

R. Mishra

Semester I

Paper Code: B280703T

Paper Name: Physical Chemistry

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- | | |
|-----|---|
| CO1 | Understand concept of kinetics of reaction and theories related to it |
| CO2 | Gain knowledge about rate of reaction, chain reactions, catalysis and enzyme kinetics |
| CO3 | Concept of electrochemistry and electrochemical reactions |
| CO4 | Mechanism related to corrosion and corrosion preventive methods |
| CO5 | Concept of Colloidal chemistry, surface chemistry and their various applications |

Course details:

Unit I

Colloids and Surfaces

Introduction, types of colloidal system, Characterization of colloidal particles, emulsions, application of colloids in different industries (agricultural, chemical, pharmaceutical, petroleum recovery, coating, painting, food and cosmetics etc.)

Unit II

Reaction dynamics

Molecularity and order of reaction, Integrated rate equations, temperature dependent of reaction rate, activation energy, methods of determining reaction rates, complex reactions- chain reactions, reversible and irreversible reactions, Catalyzed and Enzyme catalyzed reactions, Heat of reaction and Equilibrium constant from thermodynamics.

Unit III

Electrochemistry

Electrochemistry of solution, electro catalysis, Debye-Huckel theory for activity coefficient of electrolytic solution, determination of activity coefficient, ionic strength, Donnan –membrane equilibrium, Electrochemical and Concentration cells, Corrosion: classification, factors affecting corrosion and prevention, Polarization, Overvoltage, Decomposition voltage.

Asarene

V. Shukla
11-VIII-2025

Ramish

Unit IV

Chemical equilibrium

Introduction, Law of chemical equilibrium, Lechateliers principle, application, equilibrium constant from thermodynamics consideration, Concepts of acids and bases, pH and pOH of solutions, Buffer solution, Solubility product.

Recommended Text Books

1. *Chemical kinetics*, K.J.Laidler, 3rd Edn. Harper International.
2. *Electrochemistry*, Bockris and Reddy, Vol. 1 & 2 Plenum.
3. *Solid State Chemistry*, H.V. Keer, Wiley Eastern.
4. *Physical Chemistry*, P.W. Atkins, Oxford Univ. Press.
5. *Physical Chemistry of surfaces*, A.W. Adamson & A. Gast
6. *Introduction Interfaces and Colloids*, J.C. Berg.
7. *Intermolecular and Surface Forces*, J.N. Israelachvili.

Aswene
V. Shukla
17-VIII-2025
Ramish

Semester I

Paper Code: B280704T

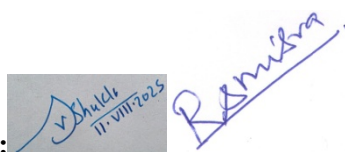
Paper Name: Analytical Techniques Part A

Credits: 4

Course outcomes: After completion of this course the students will be able to:

- CO1 Purification, separation, and identification of compounds needs special techniques.
- CO2 Knowledge of solvent extraction.
- CO3 Basics and application of electron microscopies like SEM and TEM
- CO4 Separation of mixtures using different chromatographic techniques.

Course details:



Handwritten signature and date: 11-VIII-2025

Unit I

Basics of Filtration processes

Introduction to unit processes and unit operations, Screening, Mixing, Coagulation and Flocculation Sedimentation: Type of settling, Filtration for wastewater treatment. Type of filters - rapid sand filter, slow sand filter, high-rate filter, pressure filter. Gravitational settling, Centrifugal impaction, Inertial impaction, Diffusion, Electrostatic precipitation.

Unit II

Electron Microscopy

Introduction, Principle and Instrumentation of SEM and TEM.

Unit III

Separation Techniques

Solvent extraction (liquid-liquid extraction), general principles, relationship between extraction and distribution coefficient, distribution ratio, multiple extractions, extraction of metal organic complexes and ion association complexes.

Unit IV

Chromatographic Techniques

Classification, basic principles, theory of chromatography, Ion-exchange chromatography: ion exchange process, synthesis and structure of ion-exchange resin, resolution, retention parameters, ion-exchange capacity, and separation of lanthanides; Paper and thin-layer chromatography, various techniques of development, visualization and evaluation of chromatograms, Liquid-gas chromatography, HPLC: introduction, methodology, instrumentation and industrial application.

Recommended Text Books:

1. *Vogel's Textbook of Quantitative Chemical Analysis*, Bassette and co-workers, Longman Group UK
2. *Fundamentals of molecular spectroscopy*, Banwell, C.N.
3. *Instrumental methods of analysis*, Willard M.H., Merrit, L.L., Dean J.A., Settle, F.A.
4. *Principles and practice of analytical chemistry*, Fifeild F.W., Kaley D., Blackie Academic and Professional, 4th Edition, 1995.

Aswene  Ramishra

Semester I

Paper Code: B280705P

Paper Name: Lab Course I

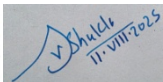
Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Able to determine the hardness, alkalinity/acidity and inorganic ions in water
- CO2 Purification and distillation of water
- CO3 Chromatographic separations by TLC, Paper and Column
- CO4 Conductometric titrations and CMC determination using Conductivity meter
- CO5 Physical parameter determination Like pH, Viscosity, Optical activity, Melting Point etc. using various equipment

Course details:

1. Determination of total acidity/alkalinity of given water sample.
2. To determine the total hardness of water.
3. Determination of chloride content of a water sample by Mohr's method.
4. Purification and distillation of tap water/organic solvent.
5. Preparation of phenol formaldehyde resin.
6. To separate the given organic compounds mixture by TLC/Paper chromatography.
7. To separate the different organic compounds by column chromatography.
8. To prepare 2,4,6-tribromo aniline.
9. To prepare phthalimide from phthalic anhydride.
10. To determine the relative viscosities of given liquids by Ostwald viscometer.
11. Determination of brix, specific gravity and pH of molasses.
12. Determination of total reducing sugar in molasses by Lane & Eynon method.
13. Determination of RS Brix/Pol/Purity and RS (reducing sugar) in sugar.
14. Conductometric titration of different acid-base mixtures.
15. Determination of CMC (critical micelle concentration) of a surfactant in water by surface tension measurements at different concentrations.

Aswena  *Ramkumar*

Semester II

Paper Code: B280801T

Paper Name: Essential Oils, Dyes and Pigments

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- | | |
|-----|--|
| CO1 | Source and Chemistry of Essential oils |
| CO2 | Various techniques used for the extraction of EOs, recognizing physical and chemical properties |
| CO3 | Uses of Essential oils in various industries |
| CO4 | Basic concepts, composition and classification of dyes, process of dyeing and its application |
| CO5 | Explore natural pigments, their sources, chemistry, and applications in traditional and industrial sectors. |

Course details:

Unit I

Essential Oils

Sources, Classification, chemistry of essential oil-bearing materials, Methods of production of some important essential oils (rose, jasmine, khus, sandal wood etc.), Grading and Standardization, Physico-chemical characteristics.

Unit II

Dyes

Introduction, General characteristics of colour and constitution, Classification, Basic operations in dyeing, some commercial dyes (azo dyes, acidic dyes, basic dyes, mordant, vat dyes, indigo dyes, dispersive dyes etc.)

Unit III: Natural Pigments

Introduction to natural pigments, Sources: minerals, plants, insects, microbial pigments, Chemistry and properties of common pigments: indigo, alizarin, turmeric, chlorophyll, anthocyanins, cochineal, etc. Extraction, purification, and stabilization techniques.

Asaxena
V. Bhulke
11-VIII-2025
Ramam

Recommended Text Books

1. *Essential Oils, Vol. I-V*, Guenther.
2. *The Essential Oil Book*, Edited by Colleen, K. Dodt.
3. *Introduction to Paint Chemistry*, G.P.A. Turner, Chapman & Hall.
4. *Basics of Paint Technology, Part I & II*, V.C. Malshe and Meenal Sikchi.

5. *Chemistry and Application of Dyes*, Editors-Waring, R. David, Geoffrey.
6. *Textbook of Dye Chemistry*, Georgiev, London Scott Greenwood.
7. *Industrial Dyes: Chemistry, Properties and Applications*, Edited by Klaus Hunger.
8. *Handbook on Natural Pigments in Food and Beverages*—Reinhold Carle, Ralf Schweiggert

Asarene

✓
11-VIII-2023

Ramisa

Semester II

Paper Code: B280802T

Paper Name: Analytical Techniques Part B

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Basic concepts of IR, UV-Visible, NMR and Mass Spectroscopy
- CO2 Apply the learned concept of IR, UV-Visible, NMR and Mass Spectroscopy in various fields
- CO3 Concept behind the Polarography and its application in analysis of various kinds of organic, inorganic and biological materials
- CO4 The principal, Basic concept and application of Electron Spin Resonance Spectroscopy in various areas
- CO5 Bragg's law, its relation to crystal structure, different methods on interpretation and application in various fields

Course details:

Unit I

Spectroscopic Techniques

Introduction, Principles, Instrumentation and Application of IR, UV-Visible, NMR and Mass spectroscopy

Unit II

Electron Spin Resonance

Introduction, Technique, Instrumentation and Applications of ESR.

Unit III

Polarography

Origin of polarography, Current-voltage relationship, Theory of polarographic waves (DC and sampled D polarograms), Instrumentation, Qualitative and Quantitative applications.

A. Saxena

V. Shukla
17-VIII-2023

Ramika

Unit IV

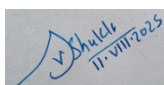
X-ray Diffraction

Introduction, Bragg's law, Miller indices, Instrumentation, and its applications.

Recommended Text Books

1. Hollas, J. M. *Modern Spectroscopy* 4th Ed., John Wiley & Sons (2004).
2. Kemp, W. *Organic Spectroscopy* 3rd Ed., W. H. Freeman & Co. (1991).
3. Silverstein, R. M., Bassler, G. C. & Morrill, T. C. *Spectroscopic Identification of Organic Compound*, John Wiley & Sons (1981)
4. Ebsworth, E. A. O. *Structural Methods in Inorganic Chemistry* Blackwell Scientific Publications (1991).
5. Drago, R. S. *Physical Methods in Chemistry*, W. B. Saunders Co., U.K. (1977)

Asarene



Ramkumar

Semester II

Elective Papers

Paper Code: B280803T

Paper Name: Natural Products, Cosmetics and Perfumery

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Learn the different types of alkaloids, terpenes & terpenoids etc. and their chemistry and biological importance and as lead molecules for new drug discovery
- CO2 Learn the constituent present in natural products responsible for anti-diabetic, anti-malarial, activity.
- CO3 Learn the constituent present in natural products used as pain killer, local anaesthetic, violent poison etc.
- CO4 Learn advanced methods of structural elucidation of compounds of natural origin.
- CO5 Understand isolation, purification and characterization of chemical constituents from the natural source.

Course details:

Unit I

Carbohydrates

Disaccharides and Polysaccharides (Maltose, Cellulose, Lactose and Sucrose)

Unit II

Natural Products

A general introduction, isolation, synthesis and structure of Alkaloids: Nicotine, Morphine. Terpenoids: Camphor, Menthol, Steroids: Cholesterol and Ergocalciferol. Flavonoids: Quercetin and Kaempferol.

K. S. S. S.

V. Shukla
11-VIII-2025

R. S. S.

Unit III

Cosmetics

Raw materials, Cosmetics for Skin (toners, cleansing agents, moisturizers, sunscreens, talcum powder, bleaching products) and Hair Cosmetics (shampoos, conditioner, colorants, herbs used in hair cosmetics).

Unit IV

Perfumes

Introduction, Composition and Extraction of Perfume (flowers, clove, heena and rice bran) and Identification of compounds used in perfumery.

Recommended Text Books:

1. Carey, F. A. & Sundberg, R. J. *Advanced Organic Chemistry, Parts A & B*, Plenum: U.S. (2004).
2. Carruthers, W. *Modern methods of Organic Synthesis*, Cambridge University Press (1971).
3. J. March. *Advanced Organic Chemistry, Reaction Mechanisms and Structure*, John Wiley.
4. W. Carruthers. *Some Modern Methods of Organic Synthesis*, Cambridge University Press.
5. I. L. Finar, *Organic Chemistry*, ELBS, U.K.
6. Morrison R. T. & Boyd R. N.; *Organic Chemistry*, Prentice Hall India.
7. Clayden, J.; *Organic Chemistry*, Oxford University Press.

K. Saxena

V. Shukla
11. VIII. 2025

R. Mishra

Elective Papers

Paper Code: B280804T

Paper Name: Environmental Impact Assessment

Credit 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 About the environmental science, biodiversity, and ecosystem.
- CO2 Conventional and non-conventional energy resource, global warming, ozone layer depletion, water pollution and air pollution
- CO3 BOD, COD, DO, TDS, concept of hard water and soft water.
- CO4 Fundamentals of unit operations for wastewater treatment and disinfection.
- CO5 Advanced treatment operations, reverse osmosis, electro dialysis and ion exchange method

Course details:

Unit I

National Environmental Policy: The Environment Protection Act 1986. Objectives of Anti-pollution Acts. National Policy on EIA and Regulatory Framework: Rule, regulations of central and State Government. Central and State pollution control boards for Safeguard for Environmental Protection. Rules, regulations and guidelines given for disposal of hazardous waste, municipal solid waste and bio-medical waste.

Unit II

Basics of Sustainable Development: Scope and Importance of environmental studies, Need for public awareness, Segments of environment, biodiversities: Genetic diversity, Species diversity, Ecosystem diversity, Landscape diversity, Causes of pollution and detrimental effects, Eco systems- Types of ecosystems, energy flow in an ecosystem, Balanced ecosystem.

Unit III

Methodologies for Impact Assessment: Baseline collection of data, Significant impacts, Assessment of impacts of physical, biological and socio- economic environment, Impact prediction tools / techniques such as ad hoc method, checklist methods etc. Development of environment management plan – Post project monitoring, EIA report and EIS, Review process.

Asarene

V Shukla
11.VIII.2025

Ramika

Unit IV

Water Quality Assessment and Treatment: Water quality assessment by DO, COD, BOD, TDS, TSS and dissolved ions determination. Hardness of water, softening of water, Reverse osmosis, Treatment of boiler feed water by Calgon process, Ion-exchange resins and Zeolites

Unit V

Disinfection of Water and Advanced Water Treatment Techniques:

Chemical unit processes for Wastewater treatment

Disinfection: Objectives, Different Types - Bleaching Powder, Ozone Treatment, UV Irradiation, Chlorination – Types, Breakpoint chlorination, Dechlorination

Advanced treatment operations, Adsorption Isotherms, Advanced Oxidation Process, Membrane processes, Reverse osmosis, Electro dialysis, Desalination, Ion exchange: Removal of specific chemical contaminants as fluorides, arsenic, nitrates, and organics.

Recommended Text Books

1. *Environment and Ecology*, Gupta K.M., Umesh Publications, Delhi, 2008.
2. *Perspectives in Environmental Studies*, Kaushik A, Kaushik CP, New Age International Publishers, 2014.
3. *Environmental Engineering Science*, Nazaroff W.W., Alvarez-Cohen L., Wiley India Pvt. Ltd., 2004.
4. *Wastewater Engineering: Treatment and Reuse*, Metcalf and Eddy, Fourth Edition, Tata McGraw Hill.
5. *Larry W. Canter "Environmental Impact Assessment"*, Tata McGraw Hill Co. Singapore, 1996.
6. *Suresh K. Dhameja, "Environment Engineering and Management"*, S.K. Kataria & Sons Delhi, 2004.
7. *Relevant MoEF Notifications and CPCB/GPCB Acts & Rules*, New Delhi, 2006.
8. *Whyte, Anne, V. and Ian Burlon (eds), Environmental Risk Assessment*, John Wiley and Sons, 1980.
9. *Pares Distn. Environmental Laws in India (Deep. Deep, Late edn.)*
10. *The ISO 14000 Handbook*: Joseph Cascio.
11. *ISO 14004—Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004: 1996 (E))*.
12. *ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001: 1996b (E))*. (International organization for standardization – Switzerland).

Recommended Reference Books

1. *Raman N.S., Gajbhiye A.R., Khandeshwar S.R., Environ Impact Assessment*, I K International Publishing House Pvt. Ltd, 2014
2. *Anjaneyulu Y., Environmental Impact Assessment Methodologie*, B.S. Publications, 2010
3. *Krzysztof Barbusiński, Maciej Thomas and Krzysztof Filipek, Water and Wastewater Treatment: March 2022*

Aswene
✓ Shukla
17. VIII. 2025
Ramish

Semester II

Elective Papers

Paper Code: B280805T

Paper Name: Food Technology and Agrochemicals

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Nutrients of food like Proteins, carbohydrates, fats etc.
- CO2 Structure, sources and importance of vitamins, minerals, pigments and flavor in food
- CO3 Cause and prevention of foodborne bacterial diseases
- CO4 Knowledge of food additives and food preservation
- CO5 Importance, classification, mode of action, structure and properties of agrochemicals

Course details:

Unit I

Food Chemistry

Introduction, Classification, Properties of sugar and polysaccharides in foods, Proteins and amino acids, Vitamins and Minerals, Industrial application of enzymes, Water in food, Water activity and shelf life of food, Natural food flavours, Pigments in food and their industrial application.

Unit II

Food Microbiology

Food born infections and intoxications: bacterial with examples of infective and toxic type Clostridium, Salmonella, Staphylococcus. Govt. Regulatory practices and policies, FDA, ISI. Application of microbial enzymes (proteases and lipases) in dairy industry (cheese production)

Unit III

Food Processing and Preservation

Food additives, Contaminants, Food Preservation methods, Food packaging and preservation methods of fruits, vegetables, cereals and grains.

A. Saxena

*V. Shukla
11-VIII-2025*

R. Sharma

Unit IV

Agrochemicals and their effects

Introduction, Importance and general classification of agrochemicals, mode of action, Public health issues related to agrochemicals.

Classification, Physical and Chemical Properties of Pesticides & Insecticides

(BHC, DDT, Parathion & from natural sources i.e. neem seed etc.),
Herbicides (2, 4-dichlorophenoxyacetic acid & atrazine).

Recommended Text Books

1. *Food Microbiology*, 2nd edn., Adams.
2. *Fundamentals of Dairy Microbiology*, Prajapati.
3. *Microbiology of Fermented Foods, Vol. I & II*, Brian J. Wood, Elsevier Applied Science Publication.
4. *Principles of Food Chemistry*, John M. DeMan, Springer 1976.
5. *Introduction to Food Chemistry*, Richard Owusu-Apenten, CRC Press.
6. *Chemistry and Technology of Agrochemical Formulation*, Editor-A. Knowles, Springer.

A. Saxena

✓ Shukla
11. VIII. 2025

Ram Sharma

Semester II

Paper Code: B280806P

Paper Name: Lab Course II

Credits: 4

Course outcomes (CO): After completion of this course the students will be able to:

- | | |
|-----|--|
| CO1 | Isolation of different compounds (Caffeine and Lycopene) from plants |
| CO2 | Estimation of Casein, acidity of provided fruit, identification of DNA, acetic acid in vinegar |
| CO3 | Able to determine the acid value of oil, argemone oil in mustard oil, non-volatile extract of spices, salt % in curry powder |
| CO4 | Enzyme catalysis using UV-Visible spectrophotometer, CO ₂ determination in water sample |
| CO5 | Physical parameter determinations such as density, surface tension etc. with the help of various equipment |

Course details:

1. Isolation of caffeine from tea leaves.
2. Isolation of lycopene from tomato.
3. Estimation of casein in milk.
4. Determination of density of given liquid using pycnometer.
5. To determine the surface tension of given liquid by stalagmometer.
6. Determination of free CO₂ in given water.
7. Determination of dissolution of given Caplet or tablet.
8. To determine the amount of acetic acid present in a given sample of vinegar.
9. To prepare calcium stearate from stearic acid.
10. To determine the acidity of fruit provided.
11. To study the degradation of polymers through viscosity measurement (Ostwald viscometer).
12. To determine enzyme catalysis using UV-Visible spectrophotometer.
13. Extraction and identification of DNA from green peas and onions.

V Shukla
11-VIII-2025

Rashmi

Aswena

Semester II

Paper Code: B280807R

Credit 8

Paper Name: Research Project/Industrial Training and Seminar I

Course outcomes (CO): After completion of this course the students will be able to:

- CO1 Provide comprehensive learning platform to students where they can enhance their employability skills and become job ready along with real corporate exposure.
- CO2 Enhance knowledge in one particular technology.
- CO3 provide learners hands on practice within a real job situation.
- CO4 Ability to communicate efficiently.

Course Details:

Minimum 2-3 weeks training at an industry during summer. Report to be submitted after training.

Presentation of work done and things learnt at training in the coming semester. It

includes industrial training, seminar, and project work

✓ Shukla
11.VIII.2025

Ram Sharma

K. S. Chavhan

Semester III

Paper Code: B280901T

Paper Name: Extraction & Processing of Natural Fragrant Raw Materials & Production of Aroma Chemicals

Course Outcomes (CO):

After completion of this course, students will be able to:

- CO1: Understand the process and science of distillation for essential oils.
- CO2: Apply solvent extraction techniques for absolutes, oleoresins, and resinoids.
- CO3: Understand and implement isolate production via fractional distillation and crystallization.
- CO4: Perform value addition and rectification of essential oils.
- CO5: Understand the production of synthetic aroma chemicals.

Course Content:

Unit I: Distillation of Essential Oils

- a) Scientific principles of distillation
- b) Comparative overview of hydro-distillation, steam distillation, and hydro-steam distillation
- c) Functional anatomy of distillation units
- d) Maintenance, safety, and troubleshooting
- e) Practical demonstration

Unit II: Solvent Extraction Techniques

- a) Principles and science of solvent extraction
- b) Selection of appropriate solvents
- c) Description of lab and pilot-scale extraction units
- d) Production of concretes, resinoids, oleoresins, and herbal extracts
- e) Safety protocols, maintenance, and repair
- f) Practical demonstration

Unit III: Isolate Production

- a) Science behind isolate preparation
- b) Function of equipment used in fractionation and crystallization
- c) Production of isolates (citral, menthol, geraniol, etc.)
- d) Maintenance and safety
- e) Practical demonstration

Unit IV: Rectification of Essential Oils

- a) Techniques of rectification
- b) Types of fractional distillation and packing materials & c) Practical demonstration

Unit V: Synthetic Aroma Chemicals

- a) Types and processes of chemical transformation
- b) Practical exercises/self-lab sessions

Recommended Textbooks:

1. E. Guenther– *The Essential Oils*, Vol.I–VI
2. Dr.Brian Lawrence –*Essential Oils 2001–2004*
3. Dr.Baumgarten –*Organic Synthesis Collected Vol. V*
4. Noland Wiley– *Organic Synthesis Collected Vol. VI*
5. Roger Adams–*Organic Synthesis Collected Vol.I*
6. Dr.H.K.Bhalla–*Processing, Analysis & Application of Essential Oils*

Asarene

✓ Shukla
11.VIII.2025

Ramishra

Semester III

Paper Code: B280902T

Paper Name: Fragrance & Flavour – Raw Materials Familiarization, Evolution & Fundamentals of Creation

Course Outcomes (CO):

After completion of this course, students will be able to:

- CO1: Understand the history and evolution of perfumery.
- CO2: Classify natural and synthetic fragrant raw materials.
- CO3: Gain fundamental knowledge of fragrance/flavour creation and accord making.

Course Content:

Unit I: History and Evolution

- a) History of fragrance and flavour
- b) Milestones in the evolution of perfumery
- c) Basic structure and types of perfumes

Unit II: Raw Material Study & Classification

- a) Natural fragrant raw materials
- b) Synthetic fragrant raw materials
- c) Classification by odour and volatility
- d) Odour recognition, memorisation, and evaluation
- e) Fragrance and flavour classification
- f) Nose and tongue test
- g) Practical demonstration

Unit III: Creation & Accord Development

- a) Accord building and key ingredients for floral accords
- b) Familiarisation with modern fragrant materials
- c) Basic techniques of fragrance/flavour creation
- d) Practical exercises
- e) Formulation and evaluation of floral accords (e.g. rose, jasmine, lilac, lily of the valley, carnation, lavender)

Recommended Textbooks:

Asaxone

1. Dr. Olindo Secondini – *Handbook of Perfumers & Flavors*
2. Calkin & Jellinek – *Perfumery: Practice & Principles*

3. Frosch, Johanson, White – *Fragrances: Beneficial & Adverse Effects*
4. Steffen Arctander – *Perfume and Flavor Chemicals*, Vol. I–II
5. Herman – *Fragrance Application: A Survival Guide*

Asaxene

✓ Shukla
11.VIII.2025

Ramishra

Semester III

Paper Code: B280903T

Paper Name: Quality Assessment of Fragrant Raw Materials

Course Outcomes (CO):

- CO1: Understand the fundamental principles and chemistry of fragrant raw materials.
- CO2: Demonstrate knowledge of structure and nomenclature of aroma compounds.
- CO3: Learn sampling techniques and international quality standards.
- CO4: Conduct analytical evaluations using standard methods.
- CO5: Perform systematic odour and taste evaluations.

Course Content:

Unit I: Fundamental of Aroma Chemistry

- a) Organic chemistry of fragrant raw materials
- b) Terpenoids: monoterpenes, sesquiterpenes, diterpenes
- c) Isoprene rule and special isoprene rule
- d) Functional groups: aliphatic, heterocyclic, phenolic, esters, alcohols, aldehydes etc.
- e) Biosynthesis and natural occurrence and practicals.

Unit II: Structure and Odour

- a) Structure–odour correlation
- b) Odour and taste evaluation techniques

Unit III: Sampling & Preparation

- a) Raw material selection and sampling (natural & synthetic)
- b) Standard solution preparation for analysis
- c) Sample handling and storage & practical

Unit IV: Analytical Methods & Standards

- a) Quality evaluation parameters: Refractive Index, Specific Gravity, Optical Rotation, pH, solubility, acid value, ester value etc.
- b) GC, GC-MS: instrumentation basics

As per

V. Shukla
11. VIII. 2025

Ramishra

- c) Olfactory evaluation and fragrance matching
- d) Standards: ISO, BIS, Indian Pharmacopoeial

Recommended Textbooks:

1. Dr. David G. Williams – *The Chemistry of Essential Oils*
2. B.W. Wencławiak – *Quality Assurance in Analytical Chemistry*
3. Salvatore Giamelli – *Aroma Science*
4. W.E. Williams – *Chemistry & Technology of Cosmetics and Toiletries*
5. Amparo Salvador & Alberto Chisvert – *Analysis of Cosmetic Products*
6. E. Guenther – *The Essential Oils*, Vol. I–VI
7. P.M. Muller – *Perfumes: Art, Science & Technology*
8. Robert R. Croteau – *Biochemistry of Plant Secondary Metabolism*
9. Bureau of Indian Standards / International Standard Organisation Guidelines / Standards.

Asarene

V Shukla
11. VIII. 2025

Ramisha

Semester III

Paper Code: B280904T

Paper Name: Regulations & Licenses in Fragrance, Flavour & Cosmetics Production – Introduction

Course Outcomes (CO):

After completion of this course, students will be able to:

- CO1: Understand regulatory frameworks in fragrance, flavour, and cosmetic industries.
- CO2: Comprehend compliance, safety, and labeling requirements.
- CO3: Identify national and international regulatory authorities.
- CO4: Understand license procurement for fragrance, flavour, and cosmetic production.
- CO5: Learn about global best practices and certification systems.

Course Content:

Unit I: Regulatory Framework Overview

- a) Importance of regulations
- b) National regulatory bodies: FSSAI, BIS, AYUSH, CDSCO
- c) International bodies: FDA (USA), EFSA (EU), IFRA, ISO, ASEAN, SCCS

Unit II: Regulatory Standards & Guidelines

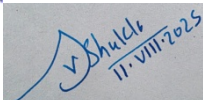
- a) IFRA Guidelines
- b) EU & US regulations on allergens in fragrances and cosmetics
- c) Labeling and safety for natural and synthetic materials
- d) FSSAI guidelines for flavours
- e) GRAS & FDA (USA) for food flavours
- f) FEMA, Codex
- g) Indian Cosmetic Rules, 2020
- h) EU Regulation (EC No. 1223/2009), ASEAN directives
- i) GMP and ISO compliance

Unit III: Testing, Claims & Labeling

- a) Toxicity, skin sensitization, irritation, and shelf-life testing
- b) Claim substantiation and advertisement regulations
- c) Ingredient disclosure, INC in nomenclature
- d) Legal definition of "natural" and "organic"
- e) Packaging laws and sustainability norms

Unit IV: Licensing & Certification

- a) Licensing requirements (India & International)
- b) Import/export permissions
- c) Overview of application and approval procedures

Asarene *Ramisha* 

Recommended Textbooks:

1. Norman E. Estrin – *Cosmetic Regulation in a Competitive Environment*
2. A.B.Pant, S.V.Shukla, Ashish Dwivedi – *Fragrance Regulatory Landscape*
3. Food Laws & Regulations (India)
4. *Flavorings– Production, Composition, Applications, Regulations*, Wiley

Asaxena

✓ Shukla
11.VIII.2025

Ram Sharma

Semester III

Paper Code: B280905T

Paper Name: Odour & Taste Memorization, Floral Fragrances & Basic Flavour Creation

Course Outcomes(CO):

- CO1:Memorise 400 fragrance and 150 taste materials.
- CO2:Understand formulation basics of floral fragrances and flavours.
- CO3:Gain insight into physico-chemical behaviour of raw materials.
- CO4:Conduct practical evaluation of fragrance and flavour creations.

Course Content:

Unit I: Familiarization & Memorization

- a) Source, properties, uses, odour/taste of 400 fragrant and 150 flavour materials
- b) Compatibility, dose level, and behavior on smelling strips with practical

Unit II: Floral Fragrance & Flavour Formulation

- a) Floral oil/absolute composition and scientific/trade names and availability & importance in different parts of the world with respect to uses.
- b) Ingredient selection & writing fragrance formulation & practical creation of
Practical creation of floral fragrances: rose, jasmine, lilac, lily of the valley, carnation, violet, hyacinth, gardenia, tuberose, lavender, cyclamen, narcissus, neroli, acacia & honeysuckle and their inter relationship during creation/formulation,
- c) Basics of flavour formulation with example of rose & vanilla.

Unit III: Evaluation Techniques

- a) Basics of organoleptic evaluation & its application to fragrances & flavours so created.
- b) Statistical and sensory methods
- c) Practical demonstration

Recommended Textbooks:

1. Heath Reineccius – *Flavor Chemistry & Technology*
2. John Wright – *Flavour Creation*
3. Wiley – *Common Fragrance & Flavor Materials*
4. Bedoukian – *Perfumery & Flavoring Materials*
5. Frey & Rousell – *Natural Flavor & Fragrance*
6. W.A. Poucher – *Soap, Perfume & Cosmetics*

✓ Shukla
11-VIII-2025

Ram Kumar

Asarene

Semester III

Paper Code: B280906P

Paper Name: Lab Course II

Credits: 4

Courseoutcomes (CO):After completion of this course the students will be able to:

CO1	Extraction of Essential Oils from Lemongrass/Citronella leaves
CO2	Extraction of Essential Oils from Basil leaves
CO3	Extraction of Essential Oils from Vetiver Root
CO4	Extraction of Essential Oils from Nagarmotha rhizomes
CO5	Making of Rose Water from rose petals
CO6	Making of Vetiver/Nagarmotha Hydrosol
CO7	Making of Oleoresin from Spices such as Clove/Cumin/Cardamom
CO8	Making of Resinoid from Gum Benzoin/Olibanum
CO9	Concrete from Rose/Jasmine by solvent extraction.
CO10	Solvent extraction of flower for making concrete and absolute using Rose/Jasmine/ Marigold flowers
CO11	Production of Citral from Lemongrass via fractionation
CO12	Conversion of Geranyl Acetate to Geraniol in Palmarosa
CO13	Isolation of total Geraniol from Palmarosa oil
CO14	Value addition from Citronella Oil to citronellal, citronellol
CO15	Conversion of Citronellal to Hydroxycitronellol
CO16	Determination of Oil content using Clevenger apparatus
CO17	Determination of concrete/resinoid using soxhlet apparatus
CO18	Determination of specific gravity in essential oil essential oil/ fragrance &flavour
CO19	Determination of refractive index in essential oil/ fragrance & flavour
CO20	Determination of optical rotation in essential oil/ fragrance & flavour
CO21	Determination of solubility in alcohol (70/80%) of essential oil/ fragrance & flavour

CO22	Determination of pH in rose water/hydrosol
CO23	Determination of acid value in essential oil/ fragrance & flavour
CO24	Determination of Saponification value in essential oil/ fragrance & flavour
CO25	Determination of Ester value in essential oil/ fragrance & flavour
CO26	Determination of Ester value after acetylation value in essential oil/ fragrance & flavour
CO27	Determination of major component of essential oil such as lemongrass/citronella or any other commercially important oil using Gas Liquid Chromatography
CO28	Determination of major component of essential oil such as lemongrass/citronella or any other commercially important oil using GC-MS

Semester IV

Paper Code: B281001T

Paper Name: Flavour formulation & Application in End Products

Course Outcomes (CO):

- **CO1:** Memorise flavour raw materials and understand their profiles in terms of taste & odour.
- **CO2:** Formulate basic flavour.
- **CO3:** Understand application of flavours in food and consumer products.

Course Content:

Unit I: Raw Material Memorisation

a) Source, components and uses of 150 flavour materials

Unit II: Flavour Formulation & Food Product Formulation

a) Ingredients selection, writing formulation & practical of 15 flavours: rose, vetiver, vanilla, orange, lemon, strawberry, banana, kewra, coconut, lime, peach, peppermint, spearmint, pineapple, chocolate.

b) Food product formulations: ice cream, beverages, bakery, dairy, toothpaste etc.

c) Ingredients and flavour application in food

d) Practical demonstrations

Aswena
V Shukla
11.VIII.2025
Ramisha

Unit III: Evaluation and Reports

(Recommended for assignments and case-based study)

Recommended Textbooks:

1. *Fenaroli's Handbook of Flavor Ingredients*
2. *Wiley-Flavorings: Production, Composition, Applications, Regulations*
3. *Wiley-Common Fragrance & Flavor Materials*
4. *Bedoukian-Perfumery & Flavoring Materials*

Asarene

✓ Shukla
11.VIII.2025

Ramishra

Semester IV

Paper Code: B281002T

Paper Name: Aroma Products (Eco friendly and handcrafted): packaging, entrepreneurship & information technology (IT) applications.

Course Outcomes (CO):

After completion of this course, students will be able to:

- **CO1:** Understand traditional and modern manufacturing techniques of agro based aroma products, including attars and hydrosols.
- **CO2:** Apply suitable packaging, storage, and transport methods for aroma products.
- **CO3:** Comprehend export documentation and global business practices in the aroma industry.
- **CO4:** Develop entrepreneurial capacity for establishing aroma-based enterprises.
- **CO5:** Utilize IT and Artificial Intelligence (AI) tools for innovation, traceability, and smart production in the fragrance and flavour industry.
- **CO6:** Integrate fragrance and flavour creation into product development tailored to different aroma product categories.

Course Content:

Unit I: Manufacturing Techniques for Agro based/handcrafted Aroma Products/intermediates like Hydrosol, Attar & Essential oils

a) Overview of traditional Attar manufacturing process with practical:

- History & Heritage of Attar of Kannauj
- Science behind the attar manufacturing
- Basic principle of attar manufacturing
- Uniqueness of Degbhupkas system for various products.
- Deg & Bhupka method for practical of attar, hydrosol (rose/basil/vetiver/jasmine) & essential oils manufacturing.

Unit II: Manufacturing of eco-friendly hand-crafted products

a) Crystallization Methods:

Factors affecting like cooling rate, solubility, and impurities for crystal size and quality during the crystallization process with practical of Menthol or thymol crystal.

A. Saxena

b) Waste to wealth products

- i. Market potential of Agarbatti, Dhoopbatti, Hawan Samagri.
- ii. Types of Agarbatti, Dhoopbatti, Hawan Samagri
- iii. Ingredients and formulation of Agarbatti, Dhoopbatti, Hawan Samagri.
- iv. Fragrance application & designing
- v. Practical use of Aroma-based products (Rosejam (Gulkand), Gulal, Facepack, Talcum powder, hair oil and other products)
- vi. How each product category requires specific fragrance/flavour – to be developed in collaboration with **taking aspects of papers of fragrance & flavour c**
- vii. Operation and preventive maintenance of equipments

Unit III: Packaging & Transport of Aroma Products

- a) Types and characteristics of packaging for oils, attars, hydrosols & other aroma products.
- b) Influence of packaging on shelf life, stability, and olfactory integrity
- c) Packaging regulations (national and international)
- d) Modes of transportation – air, sea, road – and legal requirements.

Unit IV: Export, Trade, Marketing & Entrepreneurship

- a) Export procedures and documentation (DGFT, FIEO, CHEMIXL, ECI & ECG C)
- b) Government schemes for MSMEs in aroma product for local & export market.
- c) International trade practices and strategies for niche branding
- d) Definition, scope and phases of entrepreneurship

Unit V: IT, AI & Digital Integration in Aroma Industry

- a) Application of IT in inventory, production, and quality control
- b) **ERP systems** (SAP, Oracle, Microsoft Dynamics) for MSMEs
- c) Supply chain models and e-commerce integration
- d) Intellectual Property Rights (IPR), trademarks, GI tagging, branding
- e) **IoT applications:**
 - Smart Agriculture and Precision Farming
 - Sensors and its uses
 - Drone Technology for Farming
 - Real-time monitoring of distillation (Deg-Bhapka)
 - Quality control of hydrosols

Asarene

✓ Shukla
11-VIII-2025

Ramishra

- Smartpackaginganddigitaltraceability
- **CaseStudies:**
- Smartfragrance/flavourdispensersystems
- AI-basedolfactorymappingandmarketprediction
- Digitallyoptimized Deg-Bhapka operation monitoringsystem

Recommended Textbooks&References:

1. MartinCharlesCarroll–*ExportPacking:AGuidetotheMethodsEmployedby Successful Shippers*
2. Mohammed Laeequddin&VinitaSahay– *Packaging forLogistics*
3. DougBarry–*A Basic Guide toExporting*
4. JacquelineM.McWilliams– *GreenPackagingacross Europe*
5. Richard Willsher– *Packing List*
6. KaylaFioravanti –*The Art,ScienceandBusinessof Aromatherapy*
7. EricRies–*The LeanStartup*
8. FFDCTrainingModules–*TraditionalAttarProduction&Hydrosol Manufacturing*
9. Dr.H.K.Bhalla–*Processing,Analysis&Applicationof EssentialOils*
10. IFRA& ISOGuidelines –*Standards forAromaProductSafetyand Quality*

Asarene

✓ Shukla
11.VIII.2025

Ramika

Semester IV

Paper Code: B281003T

Paper Name: Industrial application of quality assessment, Fragrance Matching & Quality Management Systems for Laboratories

Course Outcomes(CO):

- CO1: Understands significance of quality assessment for fragrance flavour industry.
- CO2: Perform fragrance matching and sensory evaluations.
- CO3: Implement quality management systems for laboratory accreditation.
- CO4: Apply theoretical knowledge in practical and case-based settings.
- CO5: Understand variation in BIS/ISO specification in industrial sample of fragrant raw material.

Course Content:

Unit I: Basics about BIS & ISO standards

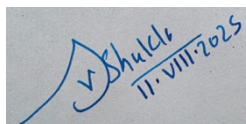
- a) Knowing BIS & ISO of 25 commercially important natural fragrant raw material.
- b) Knowing BIS & ISO of all aromatic chemicals as available

Unit II: Industrial application of physio-chemical test & instrumentation analysis in fragrance & flavor industry.

- a) Significance of physical testing method with case study
- b) Significance of chemical testing method with case study
- c) Significance of instrumental testing such as GC, GC-MS for standardization & purity with few case studies.

Unit III: Fragrance, Flavour matching using GC, GC-MS

- a) Understanding formulation in terms of GC & GC-MS analysis
- b) Writing formulations
- c) Sensory evaluation of formulation

 V. Shukla
11. VIII. 2025

 Ramisha

Unit IV: Fragrance & Flavour Matching

- a) Olfactory evaluation and matching techniques
- b) Utilization of GC, GC-Olfactometer & GC-MS for analysis and matching

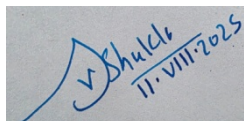
Unit V: Quality Systems (QMS)

- a) ISO/IEC 17025:2017, Good Laboratory Practices
 - b) SOPs and QMS manual preparation
 - c) Internal QC and proficiency testing
 - d) Audits: internal, NABL accreditation
- Instrumental analysis of a commercial sample & SOP drafting
 - Fragrance matching exercise

Recommended Textbooks:

1. Pavia, Lampman, Kriz & Vyvyan – *Introduction to Spectroscopy*
2. Skoog, Holler & Crouch – *Principles of Instrumental Analysis*
3. Willard, Merritt, Dean – *Instrumental Methods of Analysis*
4. ISO/IEC 17025:2017 – *Accreditation Standard*
5. WHO – *Quality Management System: Laboratory Model*
6. D.G. Watson – *Pharmaceutical Analysis*
7. Jellinek, J.S. – *Perfume Science: The Essence of Odor*
8. *Poucher's Perfumes, Cosmetics and Soaps* (Vol. I & II)
9. Calkin & Jellinek – *Perfumery: Practice and Principles*

Asarene

 V. Shukla
11.VIII.2025

 Ramisha

Semester IV

Paper Code: B281004T

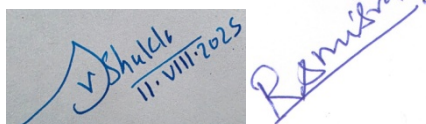
Paper Name: Industrial Exposure, Field Visits, and Entrepreneurial Insights

Objective:

To provide students with real-time exposure to industrial practices, production processes, packaging techniques, and entrepreneurial journeys, enhancing their practical understanding of the aroma, allied, and ancillary sectors.

Expected Outcomes:

- Understanding of end-to-end product development from raw material to market.
- Enhanced knowledge of infrastructure and challenges across allied industries.
- Practical exposure to business environments and innovation in aroma & packaging
- Improved confidence for entrepreneurial pursuits.



✓ Shukla
11.VIII.2025
Ranvika

Topics and Activities:

1. Commercial Farm Visits:

- Exposure to cultivation practices of aromatic and medicinal plants.
- Understanding sustainable harvesting, distillation, and post-harvest processes.
- Interaction with farmers and agri-entrepreneurs.

2. Industrial Visits (04):

- **Aroma/Essential Oil/Attar Manufacturing Unit:**
Real-world understanding of Deg-Bhaskar distillation/steam and blending
- **Leather bottle making craft:**
Insight into processing and crafting.
- **Bottle/Drum/Can/Container Manufacturing Unit:**
Visit of Bottle/Drum/Can/Container Manufacturing unit.

3. Exhibition/Seminar Participation:

- Attendance in national/international fragrance and flavour exhibitions or seminars.
- Interaction with industry experts, researchers, and technology developers.
- Documentation and report submission of key learnings.

4. Entrepreneurial Experience Sharing:

- Lectures by successful entrepreneurs from the aroma, cosmetics, or packaging sectors.
- Focus on challenges faced, strategies adopted, and lessons learned.

5. Success Stories Documentation:

- Study and presentation of at least two successful MSMEs/startups related to aroma/agro-processing/packaging.
- Identification of factors behind their growth and sustainability.

✓ Shukla
11.VIII.2025

Ram Sharma

6. Visit to Supporting Institutions & Marketplaces:

- Exposure to institutions such as MSME-DI, FFDC, CIMAP, IITR, NBRI, KVIC, CAP Dehradun, IHBT Palampur and SIDBI.
- Visit to raw material markets, fragrance stores, or industrial clusters for practical insights into supply chains.

K Saxena

✓ Shukla
11.VIII.2025

Ram Sharma

Semester IV

Paper Code: B281005R

Paper Name: Dissertation on Production of Fragrant Raw Materials/Fragrance/Flavour Creation

Course Outcomes(CO):

- Gain in-depth research experience in fragrance, flavour, or raw material production.
- Apply academic knowledge to real-world industrial or lab-based challenges.
- Develop a strong foundation in experimental design, data analysis, and report writing.

Details:

Each student will be assigned a topic based on their interest and faculty guidance. They are expected to:

- Conduct literature review and background research
- Design experiments or practical formulation
- Perform lab/fieldwork (where applicable)
- Analyze data and draw conclusions
- Prepare a detailed dissertation report
- Present findings for evaluation

✓ Shuchi
11.VIII.2025

Ramishra

Asavene

Semester IV

PaperCode: B281006P

Paper Name: Lab Course IV

Credits:4

Course outcomes (CO): After completion of this course the students will be able to:

CO1	Creation of Rose Fragrance
CO2	Creation of Jasmine Fragrance
CO3	Creation of Marigold Fragrance
CO4	Creation of Lavender Fragrance
CO5	Creation of Lilly of the Valley Fragrance
CO6	Creation of Lilac Fragrance
CO7	Creation of Carnation Fragrance
CO8	Creation of Rose Flavour
CO9	Creation of Vanilla Flavour
CO10	Creation of Banana Flavour
CO11	Creation of Coconut Flavour
CO12	Creation of Kewra Flavour
CO13	Creation of Aroma Products

V Shukla
11.VIII.2025

Ramisha

Asavene