Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited – 2022 'B++' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

CHOICE BASED CREDIT SYSTEM

Name of the Program:

Five Year Integrated M. Tech. in Cosmetic Technology

Part III (Semester- V & VI)

(Syllabus to be implemented from June 2026)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Syllabus of Five-Year Integrated M. Tech. in Cosmetic Technology

(Choice Based Credit System)

Preamble:

In this program, there will be a clear study about the formulation, manufacturing, analysis of functional products. This area is mainly dependent on the subject of Pharmacy and Chemistry. The cosmetic technology program mainly revolves around industrial training and educational tours. This program includes studying raw materials, testing methods and laboratory procedures that are available worldwide.

Objective of the Program:

To formulate precise and effective cosmetic formulations by application of gained knowledge.
To apply new research and development in the field of cosmetics to reduce environmental impacts.
To study the subjects which will have the skills, knowledge and scientific temperament for career in the field of cosmetics.

Program Outcome:

Upon completion of program students will have opportunities to work in cosmetic field related to research & development, marketing & academics of cosmetic as well as pharmaceutical industries.
Students will be able to formulate a research design and complete a substantial work of new products.
Students will be familiar with relevant governmental regulations which will help to confirm product compliance in domestic as well as international market.
Program will provide self-employment opportunities.

Eligibility Criteria:

For Five Year Integrated M. Tech. in Cosmetic Technology following candidates are eligible.

1. Students with H.S.C. with Science Stream.
2. Students with B.Sc. (B group) subject: Chemistry, Zoology, Botany, Microbiology, Biotechnology, Biochemistry, Bioinformatics etc. are eligible for the direct admission to third year after successful completion of Orientation/ Induction program. Orientation/Induction program will be conducted by the School in SEM V of third year.
3. Students with D. Pharmacy are eligible for the direct admission to second year.
4. Students with B. Pharmacy are eligible for the direct admission to third year.
5. Students after completion of fourth year are eligible to award B. Tech. degree.

Title of the Program: Five Years Integrated M. Tech. in Cosmetic Technology
Fees for Program: As per university norms.
Strength of the Students: 30
Admission/Selection procedure: As per university norms.
Duration of the Program: 4+1 (Integrated)
Period of the Program: (from June to April each academic Year)
Teacher's qualifications: M. Pharm. / M. Tech. (Cosmetic Technology) / M. Sc. / PhD.
Standard of Passing: As per university norms.

Nature of question paper with scheme of marking:
Each theory papers of 3 credits will have 75 marks out of which 45 marks will be for term end examination University Examination and 30 marks for college assessment.
Each practical paper of 2 credit will have 50 marks out of which 30 marks will be for Term End examination and 20 marks for college Assessment.
The candidate has to appear for internal evaluation of 30 marks and external evaluation (University Examination) of 45 marks for each theory paper with 3 credits.
The candidate also has to appear for internal evaluation of 20 marks and external evaluation (University Examination) of 30 marks for each practical paper of 2 credits.
For DSE courses, each theory papers will have 50 marks out of which 30 marks will be for term end examination University Examination and 20 marks for college assessment. Also, each practical paper will have 25 marks out of which 15 marks will be for Term End examination and 10 marks for college Assessment.
For VSC courses, University assessment for 30 marks and college assessment for 20 marks.

List of Laboratory Equipments Instruments, Measurements etc.: Brookfield Viscometer, Potentiometer, Colorimeter, pH meter, conductometer, Microscope, Refractometer, Stability Chamber, Shaking Incubator, Ball Mill, etc.

Rules and regulations and ordinance if any: NA

Medium of the language: English

Third Year structure as per NEP-2020

<table>
<tr><th rowspan="3">Level/ Difficulty</th><th rowspan="3">Sem.</th><th colspan="3">Faculty</th><th rowspan="3">Generic/ Open Elective GE/OE</th><th rowspan="3">Vocational and Skill Enhancement Courses (SEC/VSC)</th><th rowspan="3">Ability Enhancement Course (AEC), IKS, VEC</th><th rowspan="3">Field Project/RP/CC/ Internship/ Apprenticeship /Community Engagement & Services</th><th rowspan="3">Credits</th><th rowspan="3">Cumulative Credits</th></tr>
<tr><th colspan="2">Major</th><th>Minor</th></tr>
<tr><th>DSC</th><th>DSE</th><th>--</th></tr>
<tr><td rowspan="6">5.5/ 300</td><td rowspan="3">V</td><td>DSC 1-7 (3+2)</td><td rowspan="3">DSE1-1 (2+1) or DSE1-2 (2+1)</td><td>--</td><td>--</td><td rowspan="3">VSC3 (2) (Hands on Training related to DSE)</td><td rowspan="3">IKS 2 (2) (Related to major subject)</td><td rowspan="3">--</td><td rowspan="3">22</td><td rowspan="6">44 UG degree (132)</td></tr>
<tr><td>DSC 1-8 (3+2)</td><td>--</td><td>--</td></tr>
<tr><td>DSC 1-9 (3+2)</td><td>--</td><td>--</td></tr>
<tr><td rowspan="3">VI</td><td>DSC 1-10 (3+2)</td><td rowspan="3">DSE1-3 (2+1) or DSE1-4 (2+1)</td><td>--</td><td>--</td><td rowspan="3">VSC4 (2) (Hands on Training related to DSE)</td><td rowspan="3">--</td><td rowspan="3">FP2/CEP2/OJT1 (2)</td><td rowspan="3">22</td></tr>
<tr><td>DSC 1-11 (3+2)</td><td>--</td><td>--</td></tr>
<tr><td>DSC 1-12 (3+2)</td><td>--</td><td>--</td></tr>
<tr><td></td><td>Total Credits 3 years</td><td>66-8#</td><td>6</td><td>12+8#</td><td>08</td><td>16</td><td>16</td><td>08</td><td>132</td><td></td></tr>
<tr><td colspan="11">Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major</td></tr>
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Semester	Code	Title of the Paper	Semester Examination			L	T	P	Credits
			UA	CA	Total				
		Major (DSC)							
Sem-V	CT-DSC1-01501	Cosmetic Technology-V	45	30	75	3	--	--	3
	CT-DSC1-01502	Cosmetic Pharmacology & Bioassay Techniques	45	30	75	3	--	--	3
	CT-DSC1-01503	Instrumental Methods of Analysis-I	45	30	75	3	--	--	3
	CT-DSC1-01501-P	Cosmetic Technology-V (Practicals)	30	20	50	--	--	4	2
	CT-DSC1-01502-P	Cosmetic Pharmacology & Bioassay Techniques (Practicals)	30	20	50	--	--	4	2
	CT-DSC1-01503-P	Instrumental Methods of Analysis-I (Practicals)	30	20	50	--	--	4	2
		Major (DSE) (Any One)							
	CT-DSE1-01501	Principle of Cosmeceutics –I	30	20	50	2	--	--	2
	CT-DSE1-01501-P	Principle of Cosmeceutics –I (Practical)	15	10	25	--	--	2	1
	CT-DSE2-01502	Physical Chemistry-I	30	20	50	2	--	--	2
	CT-DSE2-01502-P	Physical Chemistry-I (Practical)	15	10	25	--	--	2	1
		Vocational / Skill Enhancement Course							
	CT-VSC-01501	Physical Pharmaceutics Practicals-I	30	20	50	--	--	4	2
		Ability Enhancement Course (AEC)IKS, VEC							
	CT-IKS-01501	IKS	30	20	50	2	--	--	2
	Total for Semester-V		330	220	550	13	--	18	22

Semester	Code	Title of the Paper	Semester Examination			L	T	P	Credits
			UA	CA	Total				
		Major (DSC)							
Sem-VI	CT-DSC1-01601	Cosmetic Technology-VI	45	30	75	3	--	--	3
	CT-DSC1-01602	Chemistry of Perfumes	45	30	75	3	--	--	3
	CT-DSC1-01603	Instrumental Methods of Analysis-II	45	30	75	3	--	--	3
	CT-DSC1-01601-P	Cosmetic Technology-V (Practicals)	30	20	50	--	--	4	2
	CT-DSC1-01602-P	Chemistry of Perfumes (Practicals)	30	20	50	--	--	4	2
	CT-DSC1-01603-P	Instrumental Methods of Analysis-II (Practicals)	30	20	50	--	--	4	2
		Major (DSE) (Any One)							
	CT-DSE1-01601	Principle of Cosmeceutics –II	30	20	50	2	--	--	2
	CT-DSE1-01601-P	Principle of Cosmeceutics –II (Practical)	15	10	25	--	--	2	1
	CT-DSE2-01602	Physical Chemistry-II	30	20	50	2	--	--	2
	CT-DSE2-01602-P	Physical Chemistry-II (Practical)	15	10	25	--	--	2	1
		Vocational / Skill Enhancement Course							
	CT-VSC-01601	Physical Pharmaceutics Practicals-II	30	20	50	--	--	4	2
		Field Project/ RP/CC/Internship/ Apprenticeship/ Community Engagement & Services (Any One)							
	CT-FP-601	Field Project-III	30	20	50	--	--	4	2
	CT-RP-601	Project (RP-III)							
	CT-CC-601	Co-curricular Courses							
	CT-IP-601	Internship							
	CT-AP-601	Apprenticeship							
	CT-CEP-601	Community Engagement							
	Total for Semester-VI		330	220	550	13	--	24	22

Third Year syllabus (according to the Semester Pattern Examination-CBCS)
w. e. f. Academic Year 2026-27

L=Lecture, T=Tutorial, P=Practical, CA=College Assessment, UA = University Assessment

Code: DSC 1-7
Cosmetic Technology-V

Learning Objectives:

1. The students will be familiar with specific actives used in cosmetic formulations, their technical aspects and evaluation methods.
2. They will know common natural raw materials, especially the basic functional group involved, them physical and chemical properties and their applications in hair care products.

Learning Outcomes:

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course, are described:

1. Able to formulate hair care preparation e.g.: Shampoo, hair colorants, hair tonics and conditioner.
2. Able to select safer hair cosmetics.
3. Able to select suitable hair care preparation.

Unit 1: Shampoos (12L/20M)

Introduction, Detergency, Evaluation of detergents as shampoo bases, raw materials for shampoos, Principle and auxiliary surfactants, formulation of shampoo, clear liquid shampoos, Anti-dandruff shampoo, Medicated shampoo, Synthetic shampoo, Herbal shampoo, Baby shampoo, Aerosol shampoos, Acid balanced Shampoos, safety of shampoos.

Unit 2: Hair setting lotions, sprays and dressings (09L/15M)

Use and purpose of hair dressings, Mechanism of hair styling, women hair dressings, setting lotions, heated curlers and blow drying, hair sprays, Men's hair dressing – formulation brilliantines, non-oily fixatives, aerosols, emulsion gels, effect of styling products, evaluation of performance.

Unit 3: (12L/20M)

A) Hair Tonics & Conditioners: Introduction–formulation of medicated hair tonics, conditioners, evaluation of conditioning, hair thickeners, rinses.

B) Hair strengtheners: Introduction, Chemistry behind curly hair, chemistry behind hair straightening, hot comb method, caustic preparations, chemical hair reducing preparations, Naturals way of straightening.

Unit 4 : Hair colorants (12L/20M)

Introduction – Hair colouring systems, characteristics of an ideal hair colourants, the process of hair colouring. Temporary hair dyes dye stuffs – commercial, semi-permanent products and their formulations, permanent hair dyes, Bases couplers of modifiers, formation of colour in the hair. Toxicity and dangers of Para dyes. Formulation of permanent hair dyes, other dyes for hair – Aromatic polyhydroxy compounds, vegetable hair dyes, metallic hair removers, Bleaching and lightening.

Books recommended:

1. Text Book of Cosmeticology by Harry
2. Cosmetic Science and technology by Sagari

Code: DSC 1-7 (Practical)
Cosmetic Technology-V

(60H/50M)

1) Shampoos at least two preparations
2) Hair setting preparations (Men & Women both)
3) Hair tonics
4) Hair conditioners
5) Hair colour preparations
6) Hair waving preparations

Code: DSC 1-8

Cosmetic Pharmacology & Bioassay Techniques

Learning Objectives:

Upon studying of the subject Pharmacology & Bioassay Techniques student shall be able to:

1. Understand the Pharmacodynamics and Pharmacokinetics of drug molecule (concept of Absorption, Distribution, Metabolism and Excretion)
2. To know basic cause and pathogenesis of certain disease that effect skin, teeth, hair and sweat gland etc.
3. To learn bioassay techniques

Learning Outcomes:

Students will get familiar with:

1. Exact etiology and pathogenesis of various diseases related to skin appendages.
2. Treatments available for such disease.
3. Basics Mechanism of action of drug molecule utilized to treat diseases related to Skin, teeth, hair, sweat gland, inflammation etc.

Unit: 1 Cosmeceutical Pharmacology (12L/20M)

Introduction to scope of pharmacology in cosmetics: Introduction, terminologies, pharmacokinetics, pharmacodynamics. Pharmacology of cosmeceuticals: anti-aging, antiwrinkle, anti-acne, anti-inflammatory, antidandruff, bleaching and sunscreen.

Unit: 2 Basic Immunology (09L/20M)

Fundamentals of antigen, antibody, Allergy and antigen–antibody reaction, types of Hypersensitivity reaction.

Unit: 3 Cosmetic Toxicology (12L/20M)

A) Study of side effects of cosmetic ingredients & products coming in contact with below body parts- Nails, Hair, Sweat gland, Sebaceous gland, Teeth.

B) Dermatitis–various types and their clinical feature.

Acute Toxic contact dermatitis, Allergic contact dermatitis, Irritant contact dermatitis, phototoxic contact dermatitis.

Unit: 4 Cosmetic Evaluation Techniques (12L/15M)

A) Study of Bioassay techniques in cosmetics: Introduction and Principles of antioxidant assay, antityrosinase assay, antimicrobial assay and evaluation of sunscreen activity

B) Methods for animal testing for safety evaluation of cosmetics

C) Dermatological testing as per BIS specification patch testing, repeated insult patch testing cumulative irritation test photo allergic test phototoxicity test.

Books Recommended:

1. Human Physiology–by C. C. Chatterjee.
2. Roxburis Common Skin Diseases.
3. Clinical Dermatology–An individual approach by John T. Ingrans.
4. The merck manual of Diagnosis and Therapy.
5. Unwanted Effects of Cosmetics and Drugs used in Dermatology By. J. P. Nater, Groot & Liem.
6. Harry's Cosmetology.

Code: DSC 1-8 Practicals
Cosmetic Pharmacology & Bioassay Techniques

(60H/50M)

1. Determination of Anti-acne activity of cosmetic product.
2. Determination of Minimum Inhibitory Concentration (MIC).
3. Determination of Antioxidant activity.
4. Evaluation of Anti-tyrosinase activity of depigmenting cosmetic ingredients.
5. Evaluation of Anti-dandruff activity against dandruff causing bacteria/ fungus.
6. Determination of Sun Protection Factor (SPF) of sunscreen formulation.
7. Microbial Limits Testing of finished product for contamination of harmful bacteria.
8. Evaluation of detergent irritation test by hand immersion test.

Code: DSC 1-9
Instrumental Methods of Analysis-I

Learning Objectives:

1. To understand the basic principles of spectroscopy and interaction of electromagnetic radiation with matter.
2. To develop knowledge of IR and UV-Visible spectroscopy for qualitative and quantitative analysis.
3. To learn fundamental chromatographic techniques for separation and identification of compounds.
4. To build basic experimental and analytical skills relevant to cosmetic analysis

Learning Outcomes:

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

1. Explain fundamental concepts of spectroscopy and electromagnetic radiation.
2. Apply IR and UV-Visible spectroscopy for functional group identification and quantitative analysis.
3. Perform and interpret chromatographic techniques such as paper chromatography and TLC.
4. Demonstrate basic laboratory and analytical skills in spectroscopic and separation techniques.

Unit 1: Basics of Spectroscopy and Electromagnetic Radiation (12L/20M)

Introduction to spectroscopy and its importance in cosmetic analysis, Electromagnetic radiation: properties, electromagnetic spectrum, Energy level diagrams (electronic, vibrational, rotational), Interaction of radiation with matter (absorption, emission, scattering)

Unit 2: Infrared (IR) Spectroscopy (12L/20M)

Principle of IR spectroscopy, Molecular vibrations: stretching and bending, Hooke's law and force constant, Factors affecting vibrational frequencies (mass, bond strength, hydrogen bonding, conjugation), Conditions for absorption and selection rules, Functional group region and fingerprint region, Characteristic absorptions of common functional groups (alcohols, aldehydes, ketones, acids, amines), Introduction to sample preparation techniques (KBr pellet)

Unit 3: UV-Visible Spectroscopy (09L/15M)

Basic principles and electronic transitions, Chromophores and auxochromes, Beer–Lambert law, Instrumentation of UV-Visible spectrophotometer: light source, monochromator, detector, Applications in quantitative analysis, Introduction to spectrophotometric titrations

Unit 4: Basics of Chromatographic Techniques (12L/20M)

Introduction and general principles, Classification: adsorption, partition chromatography, Separation mechanisms, Paper Chromatography (PC): principle, Rf value, applications, Thin Layer Chromatography (TLC): principle, plate preparation, visualization methods, Factors affecting separation, Applications in cosmetic ingredient analysis (dyes, preservatives)

Reference Books:

1. Instrumental Methods of Chemical Analysis by H. Kaur
2. Introduction to Spectroscopy by D. L. Pavia
3. Badger & Banchero: Introduction to chemical Engineering.
4. Coulson and Richardson's & Vol. I & II: Chemical Engineering.

Code: DSC 1-9 Practicals
Instrumental Methods of Analysis-I

(60H/50M)

1) Determination of λ_{max} of a given organic compound using UV-Visible spectrophotometer.
2) Verify Beer–Lambert law and construct a calibration curve using a standard solution using UV-Visible spectrophotometry.
3) Determination of concentration of unknown sample using calibration curve method from UV-Visible spectrophotometer.
4) Separation of amino acids by Paper Chromatography and calculation of Rf values.
5) Separation of plant pigments by Thin Layer Chromatography (TLC).
6) To separate and identify components using thin layer chromatography (TLC).
7) To study the effect of different solvent systems on TLC separation.

Code: DSE 1-1

Principle of Cosmeceutics –I

Learning Objectives:

Upon completion of this course the students will be familiar with:

1. Statethephysicochemicalpropertieslikesolubilityandinterfacialphenomena.
2. They will know physicochemical concepts to be considered during formulation of solution, emulsion and suspension.
3. Students will be familiar with evaluation method and assessment of emulsion shelf life of solution, emulsion and suspension.

Learning Outcomes:

At the end of the course students will be able to

1. Explain the role of surfactants and interfacial phenomenon.
2. Understand the physical properties of solutions and disperse systems.
3. Understand of physicochemical properties of drugs including solubility.
4. Gain basic knowledge of pharmaceutical suspensions and emulsions.

Unit:1 **(06L/10M)**

Solubility: Mechanism of solute – solvent interaction, ideal solubility and Hildebrand solubility parameter (HSP)– wood Scatchard equation, salvation and association, quantitative approach to the factors influencing solubility of drugs, Critical solution temperature.

Unit:2 **(09L/15M)**

Interfacial Phenomenon:

a) Cohesion, adhesion and spreading, adsorption at solid and liquid interfaces, adsorption isotherm's applications.

b) Electrical properties at interface, origin of charge, electric double layer, Nerst and Zeta potential, effect of electrolyte.

Unit:3 **(09L/15M)**

Suspension: Particle interaction and behavior, flocculation and deflocculation, sedimentation parameters, Role of wetting, controlled flocculation and structured vehicle in formulation, Formulation and evaluation of suspension stability.

Unit:4 **(06L/10M)**

A) Emulsion: Types, detection, thermodynamic considerations, mechanism of droplet stabilization, theories of emulsification, properties and stability of emulsion, assessment of emulsion self-life.

B) Nano-emulsions: Introduction, Components of Nano emulsions, Method of Preparations, Applications and advantages in cosmetics.

Books Recommended:

1. Martin, Swarbrick. Commerate & cuhn Physical Pharmacy.
2. Burger & Lee, Physical and Technical Pharmacy.
3. Rawlins: Bentley's Text Book of Pharmaceutics.
4. Shilton and Ridgway: Physical Pharmaceutics.
5. Remington's Pharmaceutical Practices.

Code: DSE 1-1
Principles of Cosmeceutics-I-Practical

(30H/25M)

1] Determination of surface tension.
2] Determination of Interfacial Tension and spreading Coefficient.
3] To find critical micellar concentration (cmc) of the given surfactants.
4] Effect of phase – volume ratio on stability of emulsion.
5] Evaluation of emulsion stability and shelf life.
6] To study and verify Freundlich Adsorption Isotherm.
7] To calculate sedimentation parameters of suspension.
8] Determination of globule size of emulsion-effect of emulgent

Code: DSE 1-2
Physical Chemistry -I

Learning Objectives

1. To understand the fundamental concepts of thermochemistry and energy changes in chemical reactions.
2. To study physical properties of liquids and the role of intermolecular forces in determining material behavior.
3. To explain osmotic phenomena and apply them for molecular weight determination.
4. To develop knowledge of electrochemistry and its analytical applications such as conductometric and potentiometric titrations.

Learning Outcomes

1. Students will be able to explain thermochemical processes and calculate different heat changes in reactions.
2. Students will be able to analyze physical properties of liquids and relate them to molecular structure and interactions.
3. Students will be able to apply osmotic pressure principles for determining molecular weight of substances.
4. Students will be able to understand electrochemical principles and perform conductometric and potentiometric analysis.

Unit I: Thermochemistry and Energy Changes (09L/15M)

Introduction to thermochemistry, heat of reaction at constant volume, heat of reaction at constant pressure, heat of combustion, heat of neutralization, heat of solution and their determination, laws of thermochemistry.

Unit II: Physical Properties of Liquids and Molecular Interactions (06L/10M)

Physical properties of liquids, surface tension, viscosity, intermolecular forces and their impact on states of matter, physical properties and chemical constitution, parachor, dipole moment.

Unit III: Osmotic Phenomena and Molecular Weight Determination (06L/10M)

Osmosis, osmotic pressure, semi-permeable membrane, measurement of osmotic pressure, laws of osmotic pressure, molecular weight calculation using osmotic pressure method.

Unit IV: Electrochemistry and Electroanalytical Techniques (09L/15M)

Faraday's laws of electrolysis, conductivity of solutions, equivalent conductivity and its determination, principles of conductometric titration, EMF of galvanic cell, standard oxidation potential of an electrode, glass electrode, calomel electrode, redox electrodes, principles of potentiometric titration.

Books recommended:

1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry

4. Vogel- Quantitative Inorganic Analysis.
5. Bahl and Tuli: Essentials of Physical Chemistry

Code: DSE 1-2

Physical Chemistry- I Practical

(30H/25M)

1. Study of surface tension of liquids using a stalagmometer. 4 materials
2. Study of Viscosity of liquids using Ostwald's Viscometer. 4 materials
3. Study of variation of viscosity of liquid mixtures using an Ostwald's viscometer and its use to determine the concentration of such mixtures.
4. Study the total hardness of water
5. Study the temporary hardness of water.
6. Study the heat of solution of a salt in water.
7. Study the heat of neutralization of a strong acid by a strong base as well as weak acid and strong base using potentiometry.

Vocational and Skill Enhancement Course

Code: VSC3

Physical Pharmaceutics Practicals-I

(60H/50M)

1. To determine density of given liquid at a definite temperature using a density bottle
2. To determine the solubility of benzoic acid at room temperature & below room temperature (10°C) by volumetric method.
3. To study the effect of solubilizing agent on solubilization.
4. To determine HLB value of a given ester *(Glyceryl monostearate – GMS)*.
5. To prepare **different compositions of Glycerine & H_2O** and determine **surface tension by stalagmometer**.
6. To determine **wetting property of a substance** by **wet point method & flow point method**.
7. To Determine the Spreadability of a prepared cosmetic compound using Spreadability Apparatus.
8. To see the effect of change in concentration of a suspending agent on the Sedimentation Volume

Ability Enhancement Course

Code: IKS2

IKS

Semester VI

Code - DSC 1-10

Cosmetic Technology–VI

Learning Objectives:

1. To familiar with specific actives used in cosmetic formulations, their technical aspects and evaluation methods.
2. To will know common natural raw materials, especially the basic functional group involved, their physical and chemical properties and their applications in skin care products.

Learning Outcomes:

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course, are described:

1. Able to formulate skin care preparation and foot care products e.g.: Shaving preparation, sun protective preparation.
2 Able to select safer sunscreen and foot care cosmetics.

Unit 1: Shaving preparation: (12L/20M)

Introduction, Wet shaving preparation, Beard softening cream, Lather shaving creams, lather shaving sticks, Aerosoles of shaving foams, Brushless or non-lathering creams, Brushless shaving stick, Novel compositions or wet shaving dry-shaving preparation: Introduction pre-electric- shave lotion, collapsible foam pre-electric shave lotion, pre-electric shave gel stick. Pre-electric shave powder.

Unit 2: Sunscreen, Sun tan and Anti sun burn Preparations: (09L/15M)

Sunlight and the human body - Introduction, tanning -beneficial and adverse effects of sunlight, Solar radiation and its effect on skin Protective mechanism of the skin. Sunscreen and suntan preparations - Introduction. Sunscreen agents and their formulation.

Unit 3: A) Foot care preparations: **(12L/20M)**

Introduction: Influence of foot wear, foot ailments, foot infections, foot care and hygiene, Bathing the feet. Foot powders, foot sprays, foot creams, foot patches for the cosmetic use, corn and cullus preparations, chilblain preparations, Athletes foot preparations, other developments.

B) Manicure Preparations:

Cuticle remover, nail bleach, nail cream, Nail strengtheners, Nail white, Nail polish, Nail lacquer - Introduction, Ingredients of Nail lacquer, formulation, manufacture of nail lacquer, Base coats and top coats, Enamel remover, Nail drier, plastic finger nails and elongators, Nail mending compositions.

Unit 4: A) Dentifrices: **(12L/20M)**

Basic requirement of a dentifrice. Tooth - paste, Basic structure ingredients, formulation of toothpaste, manufacture of toothpaste, powders, manufacture of toothpowders, solid dentifrices, performance tests Abrasive action, lustre, the toothbrush and tooth brushing, Denture cleansers.

B) Mouthwashes:

Introduction: Choice of antibacterial agents, flavouring of mouthwashes, Aerosol mouth freshener, oral thin films (OTF)

Books recommended:

1. Text Book of Cosmeticology by Harry
2. Cosmetic Science and technology by Sagari

Paper code - DSC 1-10

Cosmetic Technology-IV - Practical

(60H/50M)

1) Shaving preparations
2) Foot cream preparations
3) Sun screening preparations
4) Manicure Preparations
5) Tooth preparations
6) Mouth wash preparations

Code - DSC 1-11
Chemistry of Perfumes

Learning Objectives:

Upon completion of this course the students will be familiar with:

1. To provide student with the theory, knowledge, and practical skills necessary to enhance their performance as a natural perfumer.
2. To provide support and education on an adaptable worldwide basis.
3. The source, basic structure of a fragrance along with commonly used ingredients, fragrance strengths, notes And the role of perfumers.
4. The typical approach to fragrance selection, by notes or classification.

Learning Outcomes:

At the end of the course

1. Students will learn to recognize perfumery ingredients and study classic formulas before beginning to create their own perfumes.
2. students Able to identify Source, role or uses, note will know that will be helpful in selecting fragrance.
3. Recognization and Utilization of proper manufacturing methods (Types of reaction) for preparation of fragrance substance

Unit: 1 Perfumery Raw Materials & Extraction (09L/15M)

A) Raw materials: study of essential oil, Aroma chemicals and natural extracts used in perfumery.
B) Essential oils – Production equipment, water distillation, Steam distillation, steam and water distillation.
C) Flower oils – Extraction with cold fat and hot fat, alcoholic extracts, absolute of enflurages and chassis. Extraction with volatile solvents, selection of solvent and extraction apparatus.

Unit: 2 Fixatives & Perfume Composition (12L/20M)

A) Fixatives– Introduction, Definition: Fixative, Resinous Fixatives, Essential Oil, Fixatives, Synthetic Fixatives.
B) Sources, Classification, Chemical Composition and Uses-
I) Animal Source– Civet, Musk, Ambergris.
ii) Resinous Fixatives–Benzoin, Balsam, Myrrh.
iii) Essential oil Fixatives–Sandalwood, Lemon, Cinnamon.
iv) Synthetic Fixatives. Diethyl Phthalate, Benzyl Benzoate.
C) Selection and uses of fixatives.
D) Building of perfumes and body of the perfumes.

Unit: 3 Aroma Synthesis (Condensation & Esterification) (12L/20M)

Odorous materials manufactured synthetically by (Reaction and flow diagrams)

A) Introduction, Definition and mechanism of following reactions Condensation reaction-
i) Coumarin: - Perkin reaction, knoevenagel reaction, pechmann reaction
ii) Cinnamic aldehyde – aldol condensation reaction
B) Introduction, Definition and mechanism of following reactions esterification-
I) Benzyl acetate- Fischer esterification
ii) Benzyl Benzoate

Unit: 4 Aroma Synthesis (Nitration, Grignard & Hydrogenation) (12L/20M)

Odorous materials manufactured synthetically by (Reaction and flow diagrams) Introduction, Definition and mechanism of following reactions

A) Nitration – Musk ambrette, musk xylene and musk Ketone.
B) Grignard's Process –Phenyl ethyl alcohol
C)Hydrogenation – Citronellal, limonene, Eugenol

Books recommended:

1. Perfumes, Flavours and Essential oil Industries– SBP Board.
2. Manufacture of Perfumes, Cosmetics &Detergents–Giriraj Prasad
3. Perfumes: History &Chemistry Vol-I-Dr. D. D. Wasule
4. Cosmetics: Science &Technology–Sagarin.
5. Essential oils Vol. I by Gunther.
6. Perfumes, soaps &Cosmetics –Poucher

Code - DSC 1-11
Chemistry of Perfumes (Practical)

(60H/50M)

1] Distillation of water and alcohol
2] Isolation of essential oil – Extraction from cinnamon bark by water distillation.
3] Isolation of Essential Oils from Lemongrass and Eucalyptus leaves
4] Preparation of Essential Oils from rose flowers and ginger roots
5] Extraction of Essential Oils by Enfleurage Method
6] Extraction of Essential Oils Using Volatile Solvent Method

Code - DSC 1-12

Instrumental Methods of Analysis-II

Learning Objectives

1. To understand advanced spectroscopic and analytical techniques such as IR, AAS, NMR, and mass spectrometry.
2. To develop knowledge of advanced chromatographic methods including HPLC, GC, and HPTLC.
3. To enable structural elucidation and interpretation of spectral data for organic compounds.
4. To introduce modern analytical techniques and their applications in cosmetic analysis and quality control.

Learning Outcomes

1. Explain principles and instrumentation of advanced spectroscopic and chromatographic techniques.
2. Interpret IR, NMR, and mass spectra for structural identification of compounds.
3. Apply advanced chromatographic techniques for separation and analysis of complex mixtures.
4. Utilize modern analytical methods (GC-MS, LC-MS) for impurity profiling and quality control in cosmetic formulations.

Unit 1: Advanced IR and Atomic Absorption Spectroscopy (12L/20M)

Double beam IR spectrophotometer and working, FTIR: principle and advantages, Detailed interpretation of IR spectra (aromatic compounds, conjugated systems), Structural elucidation using IR and NIR Spectra.

Atomic Absorption Spectroscopy (AAS): Principle and theory, Instrumentation (hollow cathode lamp, atomizer, flame/furnace), Interferences and their removal, Applications in trace metal analysis (cosmetics, water samples)

Unit 2: Advanced Chromatographic Techniques (12L/20M)

High Performance Thin Layer Chromatography (HPTLC): principle and advantages

High Performance Liquid Chromatography (HPLC): Principle, instrumentation, column types, detectors, Normal phase vs reverse phase

Gas Chromatography (GC): Principle, instrumentation, carrier gas, detectors, Method development basics and validation parameters (accuracy, precision, LOD, LOQ)

Unit 3: Advanced Characterization Techniques (12L/20M)

Nuclear Magnetic Resonance spectroscopy: Basic principle, Instrumentation, working, chemical shift, shielding/deshielding, Applications. Interpretation of simple 1H NMR spectra.

Mass spectrometry: Principle, ionization methods, fragmentation patterns, Gel filtration chromatography: principle and applications, Light scattering methods: Nephelometry and Turbidimetry, Case studies related to cosmetic product analysis

Unit 4: Modern Analytical Techniques (09L/15M)

GC-MS: principle, Instrumentation, Working and applications

LC-MS: principle, Instrumentation, Working and applications

Advantages and Applications in impurity profiling and formulation analysis, Introduction to quality control and regulatory relevance in cosmetics

Reference Books:

1. Instrumental Methods of Chemical Analysis by H. Kaur
2. Introduction to Spectroscopy by D. L. Pavia
3. Badger & Banchero: Introduction to chemical Engineering.
4. Coulson and Richardson's & Vol. I & II: Chemical Engineering.

Code - DSC 1-12

Instrumental Methods of Analysis-II (Practicals)

(60H/50M)

1) Structural identification of some simple organic molecules using IR spectra.
2) Structural identification of some simple organic molecules using NMR spectra.
3) To analyze mass spectra and identify molecular ion peak and fragmentation pattern.
4) To separate individual components from mixture using column chromatography.
5) Demonstration of HPLC analysis.
6) To analyze chromatograms obtained from HPLC and identify components in a mixture.
7) Comparison of TLC and HPLC for Mixture Analysis.

Code: DSE 1-3

Principles of Cosmecutics-II

Learning Objectives:

Upon completion of this course the students will be familiar with:

1. State the physicochemical properties like particle size, distribution phenomenon and rheology.
2. They will know physicochemical concepts to be considered during formulation of Colloidal Dispersion.
3. Studentswillbefamiliarwithevaluationmethodandassessmentofdistributionphenomenon, Colloidal Dispersion, micromeritics and Rheology.

Learning Outcomes:

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course, are described:

1. Explain the role of distribution phenomenon and Rheology.
2. Understand the physical properties of colloidal dispersion.
3. Understand of physicochemical properties of drugs including particle size.

Unit:1: (07L/12M)

Distribution phenomenon: Distribution of solute between immiscible liquids, ionic dissociation and molecular association influencing partitioning, Applications of distribution phenomenon.

Unit:2 (08L/13M)

Colloidal Dispersion: Properties of colloids – Optical, kinetic and electrical and their applicability in determining molecular weight of polymer, stability of colloidal systems mechanism of peptization.

Unit:3 (07L/12M)

Rheology: Types of flow behavior, thixotropy and thixotropic co-efficient measurement of various rheological properties, factors influencing rheology of dispersed systems.

Unit:4 (08L/13M)

Micromeritics: Particle size, size distribution, shape and surface area and their determination in heterogeneous systems. Porosity density and packaging arrangements in flow properties and their influence on processing of solid preparations.

Books Recommended:

1. Martin, Swarbrick. Commerate & cuhn Physical Pharmacy.
2. Burger &Lee, Physical and Technical Pharmacy.
3. Rawlins: Bentley's Text Book of Pharmaceutics.
4. Shilton and Ridgway: Physical Pharmaceutics.
5. Remington's Pharmaceutical Practices.

Code: DSE 1-3
Principles of Cosmecutics-II Practical

(30H/25M)

1. Evaluation of suspension stability
2. To find out the partition coefficient & distribution of drug between two phases.
3. To determine molecular weight by viscosity measurement method
4. To verify the Hofmerster series for the flocculation of colloids.
5. Determination of globule size of emulsion-effect of internal phase.
6. To study Kraft point and Cloud point
7. Determination of Angle of repose and study the flow properties of powders.
8. To study the bulk density and porosity of powders.

Code: DSE 1-4
Physical Chemistry-II

Learning Objectives

- To understand phase equilibria and apply phase rule to one and two component systems.
- To study properties of solutions and use colligative properties for molecular weight determination.
- To explain chemical equilibrium and kinetics of reactions including rate laws and reaction mechanisms.
- To develop understanding of pH, buffer systems and acid–base behavior in chemical systems.

Learning Outcomes

- Students will be able to apply phase rule to analyze phase diagrams of one component systems.
- Students will be able to determine molecular weight using colligative properties and explain solution behavior.
- Students will be able to evaluate reaction rates, order and mechanisms using principles of chemical kinetics and equilibrium.
- Students will be able to calculate pH, understand buffer action and explain acid–base indicator theories.

Unit I: Phase Equilibria and Phase Rule (07L/12M)

Phase rule, terms involved in phase rule, applications to one component system, water system, sulphur system, introduction to two component systems.

Unit II: Solutions and Colligative Properties (07L/12M)

Raoult's law and its applications, molecular weight determination by vapour pressure method, boiling point elevation, freezing point depression.

Unit III: Chemical Equilibrium and Kinetics (08L/13M)

Law of mass action, Le-Chatelier's principle, homogeneous gaseous equilibria, homogeneous equilibria in liquid systems, introduction to chemical kinetics, molecularity, order and rate of reaction, kinetics of first and second order reactions, characteristics and methods of determination.

Unit IV: pH, Buffers and Acid–Base Theory (08L/13M)

pH and hydrogen ion concentration, pH calculations for weak acids and weak bases, buffer solutions and types, mechanism of buffer action of acidic and basic buffers, theories of acid-base indicators.

Books recommended:

1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry
4. Vogel- Quantitative Inorganic Analysis.
5. Physical Chemistry by Bahl & Tuli.

Code: DSE 1-4
Physical Chemistry-II Practical

(30H/25M)

1. Study the phenol – water two phase system and determine the critical temperature of the system.
2. Determination of the molecular weight of a non-volatile compound by the Rast's Camphor method.
3. To study of partition of iodine between Carbon Tetrachloride and water and to determine the partition coefficients of iodine between the two solvents.
4. Study the first order kinetics of the hydrolysis of Methyl Acetate in an acid medium.
5. Study the second order kinetics of the reaction of $K_2S_2O_8$ with KI.
6. Study of Buffer solutions and to determine the pH of buffer solution using a comparator

Vocational and Skill Enhancement Course

Code: VSC4

Physical Pharmaceutics Practicals-II

(60H/50M)

1. To determine viscosity of liquid using Ostwald's viscometer at room temperature.
2. To determine Particle size distribution of powder by sieve method.
3. Particle size distribution of powder by microscopy.
4. To prepare & study colloidal solution of silver.
5. To determine concentration of given polymer (PVA – cold H_2O soluble) from the viscosity measurement
6. Effect of particle size on angle of repose.
7. Effect of glidant on angle of repose.
8. To study the effect of Protective action of hydrophilic colloid on the precipitation of a hydrophobic colloid.
9. To determine the true density of a given powder by solvent displacement method.

FP2/CEP2/ OJT1

Field Project-III /Project (RP-III)/ Co-curricular Courses (CC)/ Internship /Apprenticeship /Community Engagement