DRAFT

National Education Policy-2020

Common Minimum Syllabus for Uttarakhand State Universities and Colleges

Four Year Undergraduate Programme-FYUP/Honours Programme/Master in Science

PROPOSED STRUCTURE FOR FYUP/MASTER'S

SKILL ENHANCEMENT COURSES SYLLABUS

DEPARTMENT OF CHEMISTRY

SYLLABUS PREPARATION COMMITTEE

S.N.	NAME	DESIGNATION	DEPARTMENT	AFFILIATION
1.	Dr. Chitra Pande	Professor	Chemistry	Kumaun University, Nainital
2.	Dr. Nand Gopal Sahoo	Professor	Chemistry	Kumaun University Nainital
3.	Dr. Geeta Tewari	Professor	Chemistry	Kumaun University Nainital
4.	Dr. Shah Raj Ali	Professor	Chemistry	Kumaun University Nainital
5.	Dr. Suhail Javed	Associate Professor	Chemistry	Kumaun University Nainital
6.	Dr. Mahesh C. Arya	Assistant Professor	Chemistry	Kumaun University Nainital
7.	Dr. Manoj Dhuni	Assistant Professor	Chemistry	Kumaun University Nainital
8.	Dr. Penny Joshi	Assistant Professor	Chemistry	Kumaun University Nainital
9.	Dr. Lalit Mohan	Assistant Professor (Contract)	Chemistry	Kumaun University Nainital
10.	Dr. Girish C. Kharkwal	Assistant Professor (Guest)	Chemistry	Kumaun University Nainital
11.	Dr. Deepshikha Joshi	Assistant Professor (Guest)	Chemistry	Kumaun University Nainital
12.	Miss. Anchal Aneja	Assistant Professor (Guest)	Chemistry	Kumaun University Nainital
13	Dr. Akanksha Rani	Assistant Professor (Guest)	Chemistry	Kumaun University Nainital
14.	Dr. Bhawana Pant	Assistant Professor (Guest)	Chemistry	Kumaun University Nainital

SYLLABUS REVIEW COMMITTEE

S.N.	NAME	DESIGNATION	DEPARTMENT	AFFILIATION
1.	Dr. Robina Aman	Professor	Chemistry	S. S. J. University, Almora
2.	Dr. Neeta Joshi	Professor	Chemistry	Sri Dev Suman Uttarakhand University, Garhwal
3.	Dr. Beena Negi	Assistant Professor	Chemistry	Gargi College, University of Delhi, Delhi

Contents

Semester-I .....
SEC 1-Course Title: Applied Aspects of Chemistry I: Introduction to Chemistry Laboratory .....

Semester-II.....
SEC 2- Course Title: Applied Aspects of Chemistry II: Laboratory Techniques……...

Semester-III
SEC 3-Course Title: Applied Aspects of Chemistry III: Cosmetics and Perfume…….

Semester-IV .....
SEC 4-Course Title: Applied Aspects of Chemistry IV: Soaps and detergents formulation …….

Semester-V.....
SEC 5-Course Title: Applied Aspects of Chemistry V: UV and FTIR Spectroscopy …….

Semester-VI .....
SEC 6-Course Title: Applied Aspects of Chemistry VI: HPLC and GC Techniques……...…

List of Papers (SEC) with Semester Wise Titles for 'Chemistry'					
Year	**Semester**	**Course**	**Paper Title**	**Theory/Practical**	**Credits**
Undergraduate Certificate in Chemistry					
FIRST YEAR	I	SEC 1	Applied Aspects of Chemistry I: Introduction to Chemistry Laboratory	Theory	2
	II	SEC 2	Applied Aspects of Chemistry II: Laboratory Techniques	Theory	2
Undergraduate Diploma in Chemistry					
SECOND YEAR	III	SEC 3	Applied Aspects of Chemistry III: Cosmetics and Perfume	Theory	2
	IV	SEC 4	Applied Aspects of Chemistry IV: Soaps and Detergents	Theory	2
Bachelor of Chemistry					
THIRD YEAR	V	SEC 5	Applied Aspects of Chemistry V: UV and FTIR Spectroscopy	Theory	2
	VI	SEC 6	Applied Aspects of Chemistry VI: HPLC and GC Techniques	Theory	2

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry I: Introduction to Chemistry Laboratory

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Applied Aspects of Chemistry I: Introduction to Chemistry Laboratory	2	1	-	1	Passed Class XII	Nil

LEARNING OBECTIVES

- To acquire the knowledge about general safety rules and cautions while working in chemistry laboratory.
- To acquire the knowledge about the general apparatus and glasswares used in chemistry laboratory.

LEARNING OUTCOMES

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

- Have a basic information about the general safety measures and cautions for working in chemistry laboratory.
- Have the knowledge about the glasswares and laboratory apparatus.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: INTRODUCTION: CHEMISTRY LABORATORY (20 HOURS)

- General introduction to chemistry lab, safety rules and precautions in chemistry laboratories, storage, ventilation, lighting.
- Fumes, cupboards, hazards, maintenance of laboratory, definition of equipment/apparatus, cleaning of laboratories, apparatus and preparation room.

UNIT II: LAB APPARATUS (25 HOURS)

(A) Glass apparatus:

- Beaker, test tube, boiling tube, conical flask, filtration flask, round bottom flask, flat bottom flask, funnel, separating funnel, watch glass.
- Measuring cylinder, Petridish, desiccator, measuring cylinder, glass rod, and glass tube.

(B) Volumetric and Heating apparatus:

Volumetric flask, burette, analytical balance, electronic balance, Bunsen burner, water bath, hot air oven, heating mantle.

(C) Miscellaneous apparatus:

-Buchner funnel, burner, test tube stand, tong, burette stand, clamp, china dish, wire gauze, cork, vacuum pumps, crucibles, clay pipette, pestle and mortar, spatulas, thermo meter.

- pH meter, Kipp's apparatus.

ESSENTIAL READINGS/RECOMMENDED READINGS

- R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education.
- Willard, H. Hobert, L. L. Merritt, J. Dean, F. A. Settoe, "Instrumental Methods of Analysis", CBS Publishers & Distributors.
- D. Gary Christian, "Analytical Chemistry", John Wiley & Sons.
- Harris and C. Daniel, "Quantitative Chemical Analysis", W. H. Freeman.
- S. M. Khopkar, "Basic Concepts of Analytical Chemistry", New Age International.
- D. A. Skoog, D. M. W. Holler, "Fundamentals of Analytical Chemistry", Cengage Learning

USEFUL WEB LINKS

http://chemcollective.org/vlabs
https://www.vlab.co.in/broad-area-chemical-sciences

PROBABLE JOB ASPECTS IN INDUSTRIES

- Lab Technician
- Lab Assistant

Semester-II
Undergraduate Certificate (in the Field of Multidisciplinary Study)

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry II: Laboratory Techniques

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Applied Aspects of Chemistry I: Laboratory Techniques	2	1	-	1	Passed Applied Aspects of Chemistry-I	Nil

LEARNING OBECTIVES

- To have a knowledge of reagents used in the chemistry laboratory.
- To acquire the knowledge of preparing the standard solutions.

LEARNING OUTCOMES

- After studying this course, the students will become familiar with the types of reagents used in chemistry laboratory.
- The students will become competent in preparing the primary and secondary standard solutions.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: LABORATORY REAGENTS AND SOLVENTS (22 HOURS)

- Classification of reagents according to their action: (i) acids (ii) bases (iii) salts (iv) complexing agents (v) oxidizing and reducing agents (vi) precipitating agents (vii) Chelating agents, each type to be explained with at least one suitable example. Fumes, cupboards, hazards, maintenance of laboratory, definition of equipment/apparatus, cleaning of laboratories, apparatus and preparation room.

UNIT II: PRIMARY AND SECONDARY STANDARDS (23 HOURS)

- Definition, characteristics, uses examples for different types of reactions. Each type is to be explained with at least one example.
- Solvents: Solute, Solvent & Solution, classification of solvents (i) Protic and aprotic (ii) Acidic, basic amphiprotic and neutral (iii) Aqueous and non-aqueous (iv) Polar and non polar. Each type is to be explained with at least one example.

ESSENTIAL READINGS/RECOMMENDED READINGS

- Ajay Kr. Gupta, "Handbook on Soaps, Detergents & Acid Slurry", Asia Pacific Business Press Inc.
- P.K. Chattopadhyay, "Modern Technology of Soaps, Detergents & Toiletries", Asia Pacific Business Press Inc.

- H. Panda, "Herbal Soaps & Detergents Handbook", Asia Pacific Business Press Inc.

USEFUL WEB LINKS

https://onlinecourses.swayam2.ac.in/cec23_cy04/preview

PROBABLE JOB ASPECTS IN INDUSTRIES

- Lab Technician
- Lab Assistant

Semester-III
Undergraduate Diploma (in the Field of Multidisciplinary Study)

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry III: Cosmetics and Perfumes

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Applied Aspects of Chemistry III: Cosmetics and Perfumes	**2**	**1**	**-**	**1**	**Passed Applied Aspects of Chemistry-II**	**Nil**

LEARNING OBJECTIVES

- To acquire the knowledge of essential oils extracted from aromatic plants.
- To provide hands-on training on thin layer chromatography and detection of essential oil samples.
- To gain the knowledge and hands-on formulations of skin care products.

LEARNING OUTCOMES

- After studying this course, the students will be able to understand the methods of extraction of essential oils.
- This course will enhance the knowledge of the students about the chemical compositions and sources of essential oils with reference to Uttarakhand.
- The course will also enlighten the students about the Government schemes in the relevant field.
- The course will produce employable students who can be taken readily in the cosmetics and essential oil industries.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: EXTRACTION OF ESSENTIAL OILS (25 HOURS)

- Methods of extractions: steam distillation, hydro-distillation, solvent extraction, Details of assembly for each method and limitations of the methods.
- Chromatographic techniques: Thin Layer Chromatography (TLC)- Preparation of TLC plates, Sampling and detection methods of essential oil samples.
- Use of essential oils in cosmetics, food and beverage industries, day-care products, aromatherapy and health care.

UNIT II: SKINCARE PRODUCTS (20 HOURS)

- Introduction and classification of skincare products.
- Chemical and herbal products: Creams: Introduction, Types of creams- Foundation cream, vanishing cream, hand cream, body cream, night cream, massage cream. Ingredients and methods of preparation of face cream, cold cream, sun tan creams.
- Powder: Introduction, ingredients and methods of preparation of face powder and body powder.
- Colourants: Introduction and ingredients of lipsticks, rouges, Sun tan products: Palliative, simulative. Quality control.

ESSENTIAL READINGS/RECOMMENDED READINGS

- Earnest Guenther, "The Essential Oils", D. Van Nostrand Company.
- Paul Z. Bedoukian, "Perfumery and Flavouring Synthetics", Chemical Publishing Co., Inc.
- Billot, Mareel, F. V. Wells, "Perfumery Technology", D. Van Nostrand Company.
- H. Panda, "Perfumes and Flavours Technology Handbook", Asia Pacific Business Press Inc.

USEFUL WEB LINKS

https://iisdt.in/product/diploma-in-aroma-therapy/
https://perfumeclasses.com/wp-
https://www.tutorialsduniya.com/notes/chemistry-of-cosmetics-perfumes-notes
https://www.tutorialsduniya.com/notes/chemistry-of-cosmetics-perfumes-notes

PROBABLE JOB ASPECTS IN INDUSTRIES

- Technicians in cosmetic and perfume industry.
- Junior Chemist
- Marketing officer

Semester-IV
Undergraduate Diploma (in the Field of Multidisciplinary Study)

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry IV: Soaps and Detergents

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Prerequisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Applied Aspects of Chemistry IV: Soaps and Detergents	2	1	-	1	Passed Applied Aspects of Chemistry -III	Nil

LEARNING OBJECTIVES

- To learn about general methods of synthesis of herbal soaps.
- To understand the formulations of detergents.
-

LEARNING OUTCOMES

- After studying this course, the students will be capable to formulate both general and herbal soaps.
- The students will able to prepare various detergents both general and herbal.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: FORMULATION OF SOAPS (25 HOURS)

- Introduction, raw materials and its selection, principles of soap making methods**.** Ingredients and methods of preparation of face soap, toilet soap and bathing soap.
- Chemistry and properties imparted by the ingredients.

UNIT II: FORMULATION OF DETERGENTS (20 HOURS)

- Types and properties of detergents, classification (anionic, cationic, nonionic), components of detergents (surfactants, additives, builders) biodegradability.
- Synthetic detergents: Introduction, chemical characteristics of synthetic detergents, general method to making synthetic detergents
- Ingredients and methods of preparation of dish-wash bar. Chemistry and properties imparted by the ingredients.

ESSENTIAL READINGS/RECOMMENDED READINGS

- S. K. Singh, "Handbook on Cosmetics", Asia Pacific Business Press Inc.
- S. Nanda, A. Nanda, R. K. Khar, "Cosmetic Technology", CBS Publishers & Distributors.

- Barel, M. Paye, H. I. Maibach, "Handbook of Cosmetics Science and Technology", CRC Press.
- M. S. Balsem, S. D. Genshon, M. M. Rieger, E. Sagarin, S. J. Strianase, "Cosmetics", Chemical Publishing Co., Inc.
- F. Williams, W. H. Schmitt, "Chemistry and Technology of the Cosmetics and Toiletries Industry", Springer.
- R. G. Harry, "Harry's Cosmeticology", Chemical Publishing Co., Inc.
- N. Board, "Handbook on Herbal Products (Medicines, Cosmetics, Toiletries, Perfumes)", Asia Pacific Business Press Inc.

USEFUL WEB LINKS

https://www.slideshare.net/anujames9066/skin-care-product-ppt

https://www.slideshare.net/joanvijetha/skin-care-cosmetics

https://pharmacy.hebmu.edu.cn/trywhx/resources/43/2019624163611.pdf

PROBABLE JOB ASPECTS IN INDUSTRIES

- Opportunities for self-employment and start-ups.
- Chemists in soap and detergent industries.

Semester-V
Bachelor of (in the Field of Multidisciplinary Study)

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry V: UV and FTIR Spectroscopy

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THECOURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Applied Aspects of Chemistry V: UV and FTIR Spectroscopy	**2**	**1**	**-**	**1**	**Passed Applied Aspects of Chemistry-IV**	**Nil**

LEARNING OBJECTIVES

- To learn about the working principle and instrumental handling of UV and FTIR spectroscopy.
- To introduce learners these techniques in structure elucidation.

LEARNING OUTCOMES

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

- Understand the theoretical as well as practical aspects of UV and IR spectroscopic techniques.
- To apply these spectroscopic techniques in structure elucidation.
- The course will produce a well-trained high-level manpower that can meet the demands of the modern and devolving society and complete globally with their peers in chemical sciences.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: ULTRAVIOLET (UV)-VISIBLE (VIS) SPECTROSCOPY (23 HOURS)

- Hardware and software knowledge of UV, instrument handling, sample testing. presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation, concept of chromophore and auxochrome.
- Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.
-

UNIT II: INFRA-RED (IR) SPECTROSCOPY (22 HOURS)

- Hardware and software knowledge of IR, Basic understanding of instrumentation, Demonstration experiment on IR.
- Measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

ESSENTIAL READINGS/RECOMMENDED READINGS

- D. Pavia, G. Lampman, G. Kriz, "Introduction to Spectroscopy", Thomson Learning, Boton.
- C. N. Banwell, E. M. Mccash, "Fundamentals of Molecular Spectroscopy"
- Y. R. Sharma, "Elementary Spectroscopy", S. Chand & Company Pvt. Ltd.
- P.S. Kalsi, Spectroscopy of Organic Compounds, New Age International Publishers.
- Robert M. Silverstein, Francis X. Webster, Kiemle, "Spectrometric Identification of Organic Compounds", Wiley.

USEFUL WEB LINKS

https://www.youtube.com/watch?v=v_R6dXyxRI4
https://www.youtube.com/watch?v=tz0BrCqPTV0
https://www.youtube.com/watch?v=EnB7aw7lGxg
https://www.youtube.com/watch?v=GGFKwxOZHt8

PROBABLE JOB ASPECTS IN INDUSTRIES

- Analyst in related R & D laboratories
- Technical Assistant in Quality Control Units

Semester-VI
Bachelor of (in the Field of Multidisciplinary Study)

SKILL ENHANCEMENT COURSE (SEC)
Applied Aspects of Chemistry VI: HPLC and GC Techniques

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title	Credits	Credit distribution of the Course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/Practice		
SEC: Skill Development Course: Analytical Techniques: HPLC and GC	2	1	-	1	Passed Applied Aspects of Chemistry -VI	Nil

LEARNING OBJECTIVES

- To gain knowledge on the techniques used in R & D labs.
- To learn samples testing using HPLC and GC techniques.

LEARNING OUTCOMES

Upon successful completion of this course, the students will be able to:
- Understand the chromatographic methods and their industrial applications.
- Gain a comprehensive understanding of various chromatographic techniques.
- Master the theory and practice of gas chromatography.
- Understand the features and instrumentation of high-performance liquid chromatography (HPLC) and its applications.

UNIT-WISE SYLLABUS (TOTAL: 45 HOURS)

UNIT I: HPLC- HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (25 HOURS)

- Introduction to HPLC, principle, normal and reversed phase HPLC
- Instrumentation, types of columns and solvents, types of detectors.
- Experimental handling of HPLC, sample preparation and analysis.
- Applications of HPLC as an analytical tool.

UNIT II: GAS CHROMATOGRAPHY (20 HOURS)

- Introduction of GC, principle.
- Instrumentation, types of columns and detectors (TCD, ECD, FID).
- Experimental handling of GC, sample preparation and analysis.
- Application of GC as an analytical tool.

ESSENTIAL READINGS/RECOMMENDED READINGS

- John R. Dean, “Extraction Techniques in Analytical Sciences”, Wiley.
- McNair, Harold M. James M. Miller, Nicholas Snow, “Basic Gas Chromatography”, Wiley.

USEFUL WEB LINKS

- https://lab-training.com/wp-content/uploads/2014/11/HPLC-E-Book.pdf
- https://www.youtube.com/watch?v=9KkcioAoO-Y
- https://nptel.ac.in/courses/103108100

PROBABLE JOB ASPECTS IN INDUSTRIES

- Analyst in related R & D laboratories
- Technical Assistant in Quality Control Units