

**Sant Gadge Baba Amravati University, Amravati**



**Semester-wise Course Structure, Course Code and Credit  
distribution and Syllabus for**

**Faculty of Science and Technology**

**Degree of Bachelor of Science with  
the Industrial Chemistry (Major) and \_\_\_\_\_  
(Minor) Discipline**

**As per NEP 2020, for Affiliated Colleges**

**Commencement year: 2024-25**

## Preamble:

The syllabus of Industrial Chemistry for First year has been redesigned for National Education policy under Choice based Credit System (CBCS) to be implemented from 2024-2025. In CBCS pattern semester system has been adopted for FY, SY and TY which includes Discipline Specific Core Course (DSC) at F. Y. level, Ability Enhancement Compulsory Course (AEC), Discipline Specific Elective Course (DSE) and Open Elective Course (OE), Skill Enhancement Course (SEC), Indian Knowledge Science (IKS), Vocational Skill course (VSC) etc.

It imbibes the guidelines of UGC, UGC LOCF, NEP-2020 and Government of Maharashtra for all its Under Graduate programmes. The Board of Study in Chemistry of the SGB Amravati University prepared the syllabus for the first year undergraduate of Industrial Chemistry. The new curriculum of B. Sc. (Industrial Chemistry) and B. Sc. (Honors with Research) Industrial Chemistry offer courses in the areas of Industrial Chemistry, Material Chemistry, Polymer Chemistry, Unit Operations, Mass Transfer Operations, Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Green Chemistry, Unit Processes etc. All the courses are having defined objectives and learning outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of chemistry and interdisciplinary areas. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. The courses also offer ample skills to pursue research as career in the field of chemistry and allied areas.

## Programme Attributes of a Industrial Chemistry Graduate

Attributes of Industrial chemistry graduate under the outcome-based teaching-learning framework may encompass the following:

- **Core competency:** The Industrial chemistry graduates are expected to know the fundamental concepts of chemistry and applied Chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Industrial Chemistry graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.
- **Critical thinking:** Industrial Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.
- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problem-solving philosophical approaches that are pertinent across the disciplines.

- **Analytical reasoning:** Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other *a priori* reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enrol and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

### Qualification Descriptors

The qualification descriptors for a Bachelor's degree in Industrial Chemistry may include following:

- i. Systematic and fundamental understanding of Industrial Chemistry as a discipline.
- ii. Skill and related developments for acquiring specialization in the subject.
- iii. Identifying Industrial Chemistry related problems, analysis and application of data using appropriate methodologies.
- iv. Applying subject knowledge and skill to solve complex problems with defined solutions.
- v. Finding opportunity to apply subject-related skill for acquiring jobs and self-employment.
- vi. Understanding new frontiers of knowledge in Industrial Chemistry for professional development.
- vii. Applying subject knowledge for solving societal problems related to application of Industrial Chemistry in day to day life.
- viii. Applying subject knowledge for sustainable environment friendly green initiatives.
- ix. Applying subject knowledge for new research and technology.

(Source: Learning Outcomes based Curriculum Framework (LOCF) for (B.Sc. with Industrial Chemistry) Undergraduate Programme 2020 [https://www.ugc.gov.in/pdfnews/0614691\\_LOCF-chemistry.pdf](https://www.ugc.gov.in/pdfnews/0614691_LOCF-chemistry.pdf) )

### Program Outcomes for B.Sc.

#### POs:

At the time of graduation, Students would be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological change.

### **Program Specific Outcomes for B.Sc. (Industrial Chemistry)**

#### **PSOs:**

Upon completion of the programme successfully, the learners would be able to-

1. Understand the scope, methodology and application of Industrial Chemistry.
2. Apply theoretical and practical concepts of instruments that are commonly used-in most of the chemistry field.
3. Plan and conduct scientific experiments and record the results of such experiments.
4. Get acquainted with safety of chemicals, transfer, and measurements of chemicals, preparation of solutions, and using physical properties to identify compounds and chemical reactions.
5. Describe how Industrial Chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine, and health

## **Employability Potential of the Programme:**

A degree in Industrial Chemistry is an intelligent choice for future employability and earning potential for learners. Degree program with Industrial Chemistry offers the necessary knowledge, develop skills and nurture creativity to achieve success in virtually any field that's even distantly related in some way to chemistry. A degree in Industrial Chemistry is recognized as a symbol of quality and commitment by employers both inside and outside the chemical industries. Industrial Chemistry provides jobs in cutting-edge technologies within science and research as well as in many fields of distant relations. Industrial Chemistry graduates apply their skills within the areas of environmental sciences, medical fields, scientific equipment sales, science communication, teaching or academic research, a few to mention. Thus, a degree in Industrial Chemistry widens numerous prospects and opportunities for a wide variety of careers in many different fields like science, research, business and health care, etc. Industrial Chemistry inculcates excellent analytical and mathematical skills, which lead to enhanced problem-solving abilities and critical thinking. This improves the likelihoods to secure job in other fields too. Some important skills and abilities honed by Industrial Chemistry learners include:

- Cutting-edge scientific and numerical skills
- Curiosity to understand and solve
- Attention to collect and analyse details
- Patience and determination
- Research and development skills
- Analytical skills
- Use of ICT enabled techniques
- Written and oral communications skills

The thriving and widely recognized branches of Industrial Chemistry like Material Chemistry, Unit Processes, Unit Operations, Mass Transfer Operations, Analytical Chemistry, Green Chemistry, etc. not only expand critical thinking and the ability to understand other scientific and engineering concepts more easily, but also open new horizons to pursue career in different fields. Material Chemistry offers research and development of materials, modify and study materials like Cement, Ceramics, Refractories, Glass for wider use. They also accomplish various scientific studies to identify or find applications for compounds for society. Many industries like Cement, glass, polymer prefer to employ chemists. Unit Processes and mass transfer operations has a greater potential in the fields pharmaceutical, dyes, petroleum Sugar, beverage Industry, etc. It focusses on solving the fundamental problems associated with designing of the Industrial Equipment's and problems related to energy balance. Analytical chemists find their role for toxicology examinations, quality control and assessment, analysis of pharmaceuticals, investigations for forensic analysis, development of equipment, etc. Analytical chemists work for a particular private or government laboratory or organization, and also develop particular specialties like food technology, forensics or toxicology, to name a few. Green chemistry enhances critical ability and inculcates problem solving skills among the learners regarding sustainable development. All industries rely heavily on physical parameters for manufacturing and quality assurance of products.

Apart from the technical and specific skills, a Industrial Chemistry graduate also acquires fundamental professional skills throughout the degree program to pursue careers not directly related to the field. These skills include:

- Effective listening and communication skills
- Presentation and interaction skills
- Data collection, analysis and reporting skills
- Modern ICT enabled skills
- Aptitude to work proficiently independently or in a team

Future scope for B.Sc. Industrial Chemistry graduates:

- Prestigious institutions like IIT, NIT, IISER, IISc, BARC, TIFR, a few to mention, offer higher studies such M.Sc. and Ph.D.
- Likewise, foreign Universities also accept Industrial Chemistry graduates for higher studies.
- Industrial Chemistry student can become small or medium scale entrepreneur (own industry).
- Union and State Public service commissions like UPSC, MPSC, Bank Probationary officers, other competitive examinations, etc. offer a multitude of jobs and positions like Drug Inspector, Lab chemist, forensic analyst, etc. for chemistry graduates.
- Students can take teaching jobs at Kendriya Vidyalaya, Navodaya Vidyalaya, High Schools after completing B.Ed. or respective eligibility criteria.
- Laboratory technician in various Public Sector Units like ONGC, IOCL, NTPC, BARC, and Private sector industries.
- Students can become Content Developer for IT industries.
- Students can become Chemical Engineer/Plant Inspector/Quality Control Chemists/ Food Inspector at Food Co-operation of India, Food Safety and Standards etc
- Laboratory technicians to look after sophisticated instruments like IR, Mass Spectrometer, UV-Visible Spectrophotometer, GC, GC-MS, HPLC etc. in research laboratory of academic institutions as well as private sector companies.
- Research Scientist/ Operations Manager/ Chemists / Quality Manager / Research Manager at various industries like Pharmaceuticals, Textile, Cement, Fine Chemicals, Plastic, Drugs, Paint, Dyes, Agricultural sector, etc.
- Employee at Security Printing and Minting co-operation of India
- Employee at Office of Controller general of Patent design and trade work.

**Sant Gadge Baba Amravati University, Amravati**  
**FACULTY: Science and Technology**  
**Teaching and Learning Scheme: for the Degree of Bachelor of Science (Industrial Chemistry)**  
**(Three Years- Six Semesters Bachelor's Degree Programme)**

**FIRST YEAR: SEMESTER – I**

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Work load (Hrs/ Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)  / Outdoor / Field	a	Major/ Minor	Theory1	120200	Mole Concept and Material Balance	2	2	6
			Lab/ Practical-1	120201	Industrial Chemistry Lab 1	2	4	
	b	Minor/ Major	Theory1			2	2	6
			Lab 1			2	4	
	c	Generic / Open Elective	Theory1	120202	Cleaning Products I	2	2	4
			Theory2	120203	Herbal Cosmetics I	2	2	
	d	VSC	-	-	-	-	-	4
		SEC	Lab/ Practical -2	120204	Lab 2 (Chemistry Lab Operations and Safety Measures)	2	4	
	e	AEC - English	Theory			1	1	6
		AEC – MIL	Theory			1	1	
		IKS- Generic	Theory				2	
		VEC	Theory			2	2	
	f	CC	Outdoor			2	4	4
			<b>TOTAL</b>				<b>22</b>	<b>26</b>

**FIRST YEAR: SEMESTER – II**

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical) / Outdoor / Field	<b>a</b>	Major/ Minor	Theory 2	120205	Fuels and Energy Balance	2	2	<b>6</b>
			Lab/ Practical- 3	120206	Industrial Chemistry Lab 3	2	4	
	<b>b</b>	Minor/ Major	Theory 2			2	2	6
			Lab 2			2	4	
	<b>c</b>	<b>Generic / Open Elective</b>	<b>Theory 3</b>	<b>120207</b>	<b>Cleaning Products II</b>	<b>2</b>	<b>2</b>	<b>4</b>
			<b>Theory4</b>	<b>120208</b>	<b>Herbal Cosmetics II</b>	<b>2</b>	<b>2</b>	
	<b>d</b>	<b>VSC</b>	<b>Lab/ Practical -4</b>	<b>120209</b>	Lab 4 Stoichiometry	<b>2</b>	<b>4</b>	<b>8</b>
		<b>SEC</b>	<b>Lab/ Practical -5</b>	<b>120210</b>	Lab 5 Formulation of Cleaning Products	<b>2</b>	<b>4</b>	
	<b>e</b>	AEC - English	Theory			1	1	<b>6</b>
		AEC – MIL	Theory			1	1	
		IKS- Generic	Theory			-	-	
		VEC	Theory			2	2	
	<b>f</b>	<b>CC</b>	<b>Outdoor</b>			<b>2</b>	<b>4</b>	<b>4</b>
			<b>TOTAL</b>			<b>22</b>	<b>32</b>	<b>32</b>



**Course Category: Major/Minor (Theory) - 1**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	120200	Mole Concept and Material Balance	2	30	2 Hrs	30+20 = 50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the various systems of Units.</li> <li>To Understand the stoichiometric equations and its applications.</li> <li>To understand and able to established the material balance equation.</li> </ol>			
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the interconversions of units.</li> <li>Able to established individual and overall material balance equations.</li> <li>Able to calculate composition of various mixtures by different methods.</li> <li>Able to established material balance equations.</li> </ol>			
Unit System	Content	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
<b>Unit I</b>	<b>Dimensions and Units:</b> Fundamental and derived quantities, base units, derived units and multiple units Systems of Units: FPS, CGS, MKS and SI. Interconversions of units. Problems based on interconversions of units.	8 Hours	8 Marks	<b>1. Interactive Lectures:</b> Use multimedia presentations, interactive slides, and animations to illustrate complex concepts.  <b>2. Hands-On Models:</b> Use digital modeling software for virtual three-dimensional visualization.  <b>3. Problem-Solving Sessions:</b> Organize regular problem-solving sessions where students can apply theoretical knowledge to solve problems.  <b>4. Flip-Class:</b> Assign readings or video lectures as homework and use class time for interactive discussions and problem-solving.
<b>Unit II</b>	<b>A] Mole Concept:</b> Mole, Atomic weight, Molecular weight, Equivalent weight, Methods of expressing compositions of i) solid mixtures, ii) liquid solutions, iii) gaseous mixtures Problems based on these	7 Hours	7 Marks	
<b>Unit III</b>	<b>Material Balance without Chemical Reactions:</b> Distillation, Crystallization, Evaporation, Extraction, Filtration with flow sheet diagram. Problems based on above unit operations.	8 Hours	8 Marks	
<b>Unit IV</b>	<b>Material Balance with Chemical Reactions:</b> Stoichiometric equation, Stoichiometric coefficient, Conversion, Yield, Selectivity, Limiting and excess reactants, Problems based on material balance without chemical reactions.	7 Hours	7 Marks	

<p><b>References:</b></p>	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>1. Unit Operations- I &amp; II by K.A. Gavhane, Nirali Prakashan.</li> <li>2. Introduction to Process Calculations (Stoichiometry) by K.A. Gavhane, Nirali Prakashan.</li> <li>3. A Text Book of Physical Chemistry by P.L.Soni, Sultan Chand &amp; Sons.</li> <li>4. A Text Book of Engineering Chemistry by S. S. Dara, S. Chand and Co.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>5. Stoichiometry by B. I. Bhatt and S. M.Vora, Tata McGraw-Hill Pub. Co.</li> <li>6. Chemical Process Principles, Part- I by O. A. Hougen, K. M. Watson, R.A. Ragatz, CBS Publishers.</li> <li>7. Non-conventional Energy Sources by G.D.Rai, Khanna Publishers.</li> <li>8. Principles of Physical Chemistry by B.R. Puri, M.S. Patahnia and L.R. Sharma, Vishal Publishing Co.</li> <li>9. Engineering Heat Transfer by Gupta and R. Prakash, Nem Chand and Bros.</li> </ol> <p><b>Web Resources</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://pdhonline.com/courses/m239/m239content.pdf">https://pdhonline.com/courses/m239/m239content.pdf</a></li> <li>2. <a href="https://archive.nptel.ac.in/courses/103/105/103105209/">https://archive.nptel.ac.in/courses/103/105/103105209/</a></li> <li>3. <a href="https://onlinecourses.nptel.ac.in/noc20_bt07/preview">https://onlinecourses.nptel.ac.in/noc20_bt07/preview</a></li> </ol>
<p><b>Model Questions:</b></p>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. Define Base Units.</li> <li>2. What are derived units? Give two examples.</li> <li>3. Problems based on Interconversions of Units.</li> <li>4. Prove that sum of all the mole fractions is unity.</li> <li>5. Discuss weight fraction.</li> <li>6. Discuss Mole percent.</li> <li>7. Give an account of Mole Fraction.</li> <li>8. Give the SI unit of:            a) Density            b) Pressure</li> </ol> <p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Give the SI Units of    a) Power            b) Energy            c) Enthalpy            d) Pressure</li> <li>2. Discuss Distillation Operation and give the material balance equation.</li> <li>3. Discuss Evaporation operation and give the individual and overall material balance equation with block diagram.</li> <li>4. Explain limiting component and excess component with suitable example.</li> <li>5. Discuss Extraction operation and give the individual and overall material balance equation with block diagram.</li> <li>6. Discuss evaporation operation with material balance equations and block diagram.</li> <li>7. Discuss stoichiometric equation and stoichiometric coefficient with suitable example.</li> <li>8. Explain the term    a) Yield    and            b) Selectivity</li> <li>9. Problems.</li> </ol>

**MCQs**

1. Length is an example of ---- quantity.  
a) Basic      b) derived      c) Multiple      d) None of these
2. Which of the following is an example of derived quantity?  
a) Length      b) Area      c) Mass      d) Time
3. Which of the following is a basic quantity?  
a) Pressure      b) Enthalpy      c) Mass      d) Density
4. Gram equivalent of solute dissolved in one liter of solvent is called.  
a) Molality      b) Molarity      c) Normality      d) None of these
5. The component which decides the product is called as  
a) Limiting reactant      b) Excess Reactant      c) Product      d) None of these
6. The component of which the requirement is in excess to that of theoretical requirement is called  
a. Limiting reactant      b) Excess Reactant      c) Product      d) None of these
7. Gram moles of solute dissolved in one liter of solvent is called  
a) Normality      b) Molality      c) Molarity      d) None of these
8. One mole of compound is equivalent to its  
a) Atomic weight      b) equivalent weight      c) molecular weight      d) None of these
9. The unit operation which is used to separate two or more than two liquid components from each other by thermal energy is called as  
a. Extraction      b) evaporation      c) crystallization      d) distillation

## Course Category: Major Lab-1

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	120201	Industrial Chemistry Lab 1	2	60	4 Hrs	25+25= 50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the various systems of Units.</li> <li>To Understand the stoichiometric equations and its applications.</li> <li>To understand the various standardization methods.</li> </ol>	
<b>Course Outcomes:</b>	<p>After completion of the course student should</p> <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the interconversions of units.</li> <li>Able to practical knowledge in professional life.</li> <li>Able to perform distillation operation.</li> <li>Able to established mass relation equation.</li> </ol>	
<b>Unit System</b>	<b>Content</b>	<b>Incorporation of Pedagogies</b>
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Problems based on mass relation</li> <li>Numerical problems on units and conversions.</li> <li>Preparation of standard solution of Oxalic acid.</li> <li>Preparation of standard solution of copper sulphate</li> <li>Standardization of sodium hydroxide solution.</li> <li>Standardization of sodium thiosulphate solution</li> <li>Determination of molecular weight of given sample by Rast's method.</li> <li>Problems on material balance.</li> <li>Separation of two miscible liquids by simple distillation.</li> <li>Standardization of <math>\text{KMnO}_4</math> Solution.</li> </ol>	<p><b>Lab Reports:</b> Students prepare detailed lab reports on their findings.</p> <p><b>Discussion Sessions:</b> Group discussions.</p> <p><b>Group Projects:</b> Assign group projects on stoichiometric methods.</p> <p><b>Class Debates:</b> Discuss the findings amongst the students.</p>
<b>References:</b>	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>Practical Chemistry, by Ambrish Agarwal, Shivalal Agrawal and Co.</li> <li>Laboratory Manual Chemistry by NCERT</li> <li>GCE Chemistry Practical Handbook Department of Science Faculty of Science and Technology National Institute of Education.</li> <li>Text Book: Practical General Chemistry by Dr. Ahmad Al-Owais &amp; Dr. Abdulaziz Al-Wassil.</li> <li>Laboratory Manual for Engineering Chemistry Practical.</li> <li>Engineering Chemistry Laboratory Manual, Maharaj Vijayaram Gajapathi Raj College of Engineering.</li> <li>Understanding 0 level Chemistry Practical</li> <li>A Textbook on Experiments and Calculations in Engineering Chemistry By S.S Dara. S Chand Ltd.</li> <li>Practical Lab Manual of Pharmaceutical Organic Chemistry – I by Dr. Shivendra Kumar Dwivedi, IP Innovative Publication Pvt. Ltd.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li>Standardization of Solution: <a href="https://www.youtube.com/watch?v=R1FM4cyIMNM">https://www.youtube.com/watch?v=R1FM4cyIMNM</a></li> <li><a href="https://www.youtube.com/watch?v=Md67iTTBij0">https://www.youtube.com/watch?v=Md67iTTBij0</a></li> </ol>	
<b>Model Questions:</b>	NA	

**Distribution of Marks and the scheme of Practical Examination is as follows:**

**Section 1: Internal Assessment**

• Active participation in activities	10 Marks
• Continuous Assessment Tests (CAT) (At least three tests) *	10 Marks
• Submission of duly certified practical record	05 Marks
<b>Total</b>	<b>25 Marks</b>

\*Note: Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations

**Section 2: External Assessment**

• Exercise 1	10 Marks
• Exercise 2	10 Marks
• Viva-Voce (external)	05 Marks
<b>Total</b>	<b>25 Marks</b>

**Course Category: Generic/Open Elective-1**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	120202	Cleaning Products I	2	30	2 Hrs	30+20=50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the Various cleaning products.</li> <li>To Understand the action of cleaning agents.</li> <li>To identify various cleaning products as per the applications.</li> </ol>			
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the preparation of cleaning products.</li> <li>Able to prepare household cleaning products.</li> <li>Able to start small scale business.</li> <li>Able to understand the science behind cleansing action.</li> </ol>			
<b>Unit System</b>	<b>Content</b>	<b>Work Load Allotted</b>	<b>Weightage of Marks Allotted</b>	<b>Incorporation of Pedagogies</b>
<b>Unit I</b>	Cleaning agents: Introduction, History, Action of cleaning agents, Safe ingredients for homemade Cleaners, uses of cleaning products, classification of cleaning agents. Storage of cleaning agents.	8 Hours	8 Marks	<b>1.Interactive Lectures:</b> Use multimedia presentations, interactive slides, and animations to illustrate complex concepts.  <b>2. Hands-On Models:</b> Use digital modeling software for virtual three-dimensional visualization.  <b>3.Problem-Solving Sessions:</b> Organize regular problem-solving sessions  <b>4.Flip-Class:</b> Assign readings or video lectures as homework and use class time for interactive discussions.
<b>Unit II</b>	Natural and Synthetic cleaning agents, chemistry of cleaning action. Chemical compositions of cleaning agents. Preparation, raw material, uses and properties of Floor Polishes and air freshener. Their uses and action.	7 Hours	7 Marks	
<b>Unit III</b>	Home Made Cleaners: Introduction, Preparation, raw material, uses and properties of Drain Cleaners, Floor Cleaners and Lime and Mineral deposit remover.	8 Hours	8 Marks	
<b>Unit IV</b>	Preparation, raw material, uses and properties of Metal cleaner and Metal Polishes, Rust Remover, Tub and Tile Cleaner.	7 Hours	7 Marks	

<p><b>References:</b></p>	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Home Made Cleaners by Denise G. Dias Johnson Co. Extension Agent, FCS</li> <li>2. Home Made Cleaning Products by Waste Virginia University.</li> <li>3. DIY Natural Cleaning by Kristin Marr.</li> <li>4. Green Tok: The Ultimate Guide to Natural &amp; Reduced Waste Cleaning.</li> <li>5. Cleaning Science Uttarakhand Open University.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Advanced Cleaning Product Formulations Volume 5 by Ernest W Flick</li> <li>2. Homemade Household Cleaners Amanda Griffin and Randall A. Cantrell.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li>1. Cleaning Product Formulation: <a href="https://www.ihmnotes.in/assets/Docs/Sem-1/AO/Ch-4,%20CLEANING%20AGENTS.pdf">https://www.ihmnotes.in/assets/Docs/Sem-1/AO/Ch-4,%20CLEANING%20AGENTS.pdf</a></li> <li>2. Cleaning Product Formulation: <a href="https://www.turi.org/content/download/7355/134087/file/Vida%20Verde%20recipe%20booklet%20-%20English%20-%20202016.pdf">https://www.turi.org/content/download/7355/134087/file/Vida%20Verde%20recipe%20booklet%20-%20English%20-%20202016.pdf</a></li> </ol>
<p><b>Model Questions:</b></p>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. Define Cleaning Agent.</li> <li>2. Give the uses of cleaning products.</li> <li>3. Give the chemical composition of cleaning agent.</li> <li>4. Give the various uses of Floor Polishes.</li> <li>5. Give the reagents used for preparation of air freshener.</li> <li>6. What are the properties of good floor cleaner?</li> <li>7. Give the raw materials used for the preparation of drain cleaner.</li> <li>8. What are the uses of metal polishes?</li> <li>9. Give the raw materials used in rust remover.</li> </ol> <p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Discuss the history of cleaning products.</li> <li>2. How will you classify cleaning agents? Discuss in detail.</li> <li>3. Explain the method of preparation of Floor Polish.</li> <li>4. Explain the method of preparation of Mineral deposit remover.</li> <li>5. Discuss the characteristics of mineral deposit remover.</li> <li>6. Explain the preparation method of air freshener.</li> <li>7. What are the characteristics of metal cleaner?</li> </ol> <p><b>MCQs</b></p> <ol style="list-style-type: none"> <li>1. Cleaning agents removes       <ol style="list-style-type: none"> <li>a. Stain</li> <li>b. Dust</li> <li>c. Dirt</li> <li>d. All of these</li> </ol> </li> <li>2. Which of the following are major reagents of homemade cleaner?       <ol style="list-style-type: none"> <li>a. Baking Soda</li> <li>b. Enzyme</li> <li>c. Bleaching Powder</li> <li>d. Petrochemical Solvent</li> </ol> </li> <li>3. Disinfectants, detergents, sanitizers are the examples of       <ol style="list-style-type: none"> <li>a. Cosmetics</li> <li>b. Metal polishes</li> <li>c. Air Freshener</li> <li>d. Cleaning agents.</li> </ol> </li> <li>4. The emulsion of water with waxes is called as       <ol style="list-style-type: none"> <li>a. Drain cleaner</li> <li>b. Hair shampoo</li> <li>c. Floor and furniture polish</li> <li>d. None of these</li> </ol> </li> <li>5. Lavender, sandalwood, cinnamons are used in       <ol style="list-style-type: none"> <li>a. Shoe polish</li> <li>b. Drain cleaner</li> <li>c. Air freshener</li> <li>d. Metal polish</li> </ol> </li> <li>6. Mineral deposits are removed by       <ol style="list-style-type: none"> <li>a. Acid</li> <li>b. Waxes</li> <li>c. Oil</li> <li>d. None of these</li> </ol> </li> <li>7. White Vinegar is used to remove       <ol style="list-style-type: none"> <li>a. Dust</li> <li>b. Dirt</li> <li>c. Stain</li> <li>d. All of these</li> </ol> </li> <li>8. The major reagents used in metal polishing are       <ol style="list-style-type: none"> <li>a. White Vinegar</li> <li>b. Baking soda</li> <li>c. Lemon</li> <li>d. All of these</li> </ol> </li> </ol>

**Course Category: Generic/Open Elective - 2**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	120203	Herbal Cosmetics I	2	30	2 Hrs	30+20=50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Students should understand the benefits of Herbal Cosmetics.</li> <li>2. Students should aware about Global Cosmetic Market</li> <li>3. Should aware about herbal cosmetic market potential in India.</li> <li>4. Should aware bout the basics of herbal cosmetics.</li> </ol>			
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>1. Able to formulate various herbal cosmetic on commercial basis.</li> <li>2. Able to overcome the problems arise during formulation.</li> <li>3. Able to analyzed the formulated product.</li> <li>4. Able to apply basic knowledge to incorporate innovative ideas in formulation.</li> </ol>			
<b>Unit System</b>	<b>Content</b>	<b>Work Load Allotted</b>	<b>Weightage of Marks Allotted</b>	<b>Incorporation of Pedagogies</b>
<b>Unit I</b>	Herbal Cosmetics in ancient India: Introduction, Raja Serfoji's contribution in formulation of lip balm, skin scrub, cure for dandruff, kayakalpa, face pack, cure for pimple. Global Perspective of Plant-Based Cosmetic Industry: Introduction, Specialty Plant Materials for Herbal Cosmetic Production like Essential oil, dye and colourants, oils Fat and waxes. Indian scenario of cosmetic Industry.	8 Hours	8 Marks	<b>1.Interactive Lectures:</b> Use multimedia presentations, interactive slides, and animations to illustrate complex concepts. <b>2. Hands-On Models:</b> Use digital modeling software for virtual three-dimensional visualization. <b>3.Problem-Solving Sessions:</b> Organize regular problem-solving sessions <b>4.Flip-Class:</b> Assign readings or video lectures as homework and use class time for interactive discussions
<b>Unit II</b>	<b>Formulation of Herbal Cold Creams:</b> Benefits of Herbal Cold Cream, Functions, desire properties. Formulation method, raw materials, vanishing cream, Evaluation of herbal cream with respect to pH, organoleptic properties, homogeneity, spreadability, dye test, appearance, washability, irritancy test.	7 Hours	7 Marks	
<b>Unit III</b>	<b>Formulation of Herbal Aloe vera Gel:</b> Benefits of Herbal Aloe vera Gel, Functions, desire properties. Formulation Method, raw materials, Evaluation with respect to pH, Homogeneity, Smoothness, Appearance.	8 Hours	8 Marks	
<b>Unit IV</b>	<b>Formulation of Herbal Sunscreen Lotions:</b> Benefits of Herbal sun Screen lotion, Functions, desire properties. Formulation, raw materials Composition of Sunscreen lotion, Evaluation of formulated sunscreen lotion with respect to physicochemical studies, safety evaluation, irritation test, efficacy analysis.	7 Hours	7 Marks	



<b>References:</b>	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Textbook of herbal cosmetics by Vaibhav Tripathi, Dinanath Jhade, Niraj Sharma, Rageeb Usman,S. Vikas &amp; Co. Publishers.</li> <li>2. Textbook of herbal cosmetics by M. Vimaladevi, CBS Publishers &amp; Distributors.</li> <li>3. Herbal Cosmetics Handbook By Himadri Panda, Asia Pacific Business Press.</li> <li>4. Herbal Plants used in Cosmetics and Cosmeceuticals and their advantages over the Synthetic Counterparts By Charu Gupta and Dhan Prakash.</li> <li>5. Text book of Cosmetic Formulations, by Sarah Adinda Puteri.</li> <li>6. Textbook of Cosmetic Formulations By Sharna Gadhiya and Dhanawat.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li>1. Formulation of Cosmetics: <a href="https://www.slideshare.net/pharmmathu/formulation-and-evaluation-of-cosmetic-products">https://www.slideshare.net/pharmmathu/formulation-and-evaluation-of-cosmetic-products</a></li> </ol>
<b>Model Questions:</b>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. What is Cosmetic?</li> <li>2. Give the Specialty Plant Materials used for Herbal Cosmetic Production.</li> <li>3. List down the benefits of Herbal Cold Cream.</li> <li>4. Discuss the organoleptic properties of Herbal cold cream.</li> <li>5. What is dye test for herbal cold cream?</li> <li>6. Give the Benefits of Herbal Aloe vera Gel.</li> <li>7. Give an account of Homogeneity test for Aloe vera Gel.</li> <li>8. Discuss the advantages of Herbal Sunscreen Lotion.</li> </ol> <p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Give an account of Herbal Cosmetics in ancient India.</li> <li>2. Discuss the Raja Serfoji's contribution in formulation of Herbal Cosmetics.</li> <li>3. Explain the formulation method of Herbal Cold Cream.</li> <li>4. Discuss the Properties of Herbal Cold Cream.</li> <li>5. Explain the formulation method of Herbal Aloe vera Gel.</li> <li>6. Discuss advantages of Herbal Sunscreen lotion over synthetic one.</li> <li>7. Discuss methods of evaluation of formulated Sun screen lotion.</li> <li>8. Discuss various raw materials used in herbal sun screen lotion.</li> </ol> <p><b>MCQs</b></p> <ol style="list-style-type: none"> <li>1. Raja Serfoji is known for his contribution in       <ol style="list-style-type: none"> <li>a. Herbal Medicine</li> <li>b. Herbal Cosmetics</li> <li>c. Allopathic drugs</li> <li>d. Both a and b</li> </ol> </li> <li>2. Which of the following is a part of Herbal Cosmetics?       <ol style="list-style-type: none"> <li>a. Crude oil</li> <li>b. Petroleum</li> <li>c. Mineral oil</li> <li>d. Essential oil</li> </ol> </li> <li>3. The pH value of the Cosmetic Product should be       <ol style="list-style-type: none"> <li>a. 1-2</li> <li>b. 4.5-7</li> <li>c. 8-10</li> <li>d. 10- 12</li> </ol> </li> <li>4. Cold cream is used to maintain       <ol style="list-style-type: none"> <li>a. Moisture balance of skin</li> <li>b. Moisture balance of hair</li> <li>c. Dryness</li> <li>d. None of these</li> </ol> </li> <li>5. Which of the following test are used for formulated cold cream?       <ol style="list-style-type: none"> <li>a. pH</li> <li>b. Viscosity</li> <li>c. Spreadability</li> <li>d. All of These</li> </ol> </li> <li>6. Aloe vera Gel when applied on skin is helps to       <ol style="list-style-type: none"> <li>a. Fights skin-ageing</li> <li>b. Soothe sunburn</li> <li>c. Moisturize the skin</li> <li>d. All of the above</li> </ol> </li> <li>7. Sun Screen lotion is used to protect Skin from       <ol style="list-style-type: none"> <li>a. UV Rays</li> <li>b. Dust</li> <li>c. Cold</li> <li>d. None of these</li> </ol> </li> </ol>

## Course Category: Skill Enhancement Course (SEC)-1

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	120204	SEC Lab 3 Chemistry Lab Operations and Safety Measures	2	60	--	50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To cultivate efficient working skills among the students to work in a chemistry laboratory.</li> <li>To create a trained workforce which can responsibly learn imbibe and explore verticals on structured knowledge safely.</li> <li>To make students aware of different chemicals and their properties being used in the chemistry laboratory.</li> <li>To make aware about hazards in the laboratory.</li> </ol>	
<b>Course Outcomes:</b>	<p>After completion of the course student should able to</p> <ol style="list-style-type: none"> <li>Design and implement safe working practices in chemistry laboratory.</li> <li>Safely handle different glass apparatus.</li> <li>Handle the chemicals and equipment safely and properly.</li> <li>Design working protocols related to various methods and instruments in chemistry laboratory.</li> </ol>	
<b>Unit System</b>	<b>Content</b>	<b>Incorporation of Pedagogies</b>
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Design an illustrative chart exhibiting creativity at transaction of Do's and Don'ts instructions for working in a chemistry laboratory.</li> <li>Carry out Classification and labeling of the given set of chemicals based upon Globally Harmonized System.</li> <li>Carry out preparation of the indicative MSDS (Material Safety Data Sheet) of given set of chemicals as per Standard MSDS format.</li> <li>Design an illustrative chart exhibiting creativity at transaction of Common Safety Symbols along with its description. Associate appropriate safety symbol with each of the given set of chemicals.</li> <li>Identify and enlist the Incompatible Chemicals from a given set of chemicals available in the laboratory.</li> <li>Carry out a brief review of common pathways by which working Chemicals can enter the Body.</li> <li>Classify the Hazard based on storage, handling, and disposal of chemicals.</li> <li>Identification and describe handling protocols for Substances with Greater Hazardous Nature.</li> <li>Carry out detailed investigations on procedural protocols for safe Disposal of Chemicals.</li> <li>Carry out study on recommended Safety and Emergency Equipment essential for the safe practices in a Chemistry Laboratory.</li> <li>Study the guidelines in the Event of a Chemical Accident or Spill.</li> <li>Write detailed description on Fire Safety in the laboratory.</li> </ol>	<p><b>Lab Reports:</b> Students prepare detailed lab reports on their findings.</p> <p><b>Discussion Sessions:</b> Group discussions.</p> <p><b>Group Projects:</b> Assign group projects on labeling and categorization of chemicals.</p> <p><b>Class Debates:</b> Discuss the findings amongst the students.</p>
<b>References:</b>	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>Handbook for Laboratory Safety By Benjamin R. Sveinbjornsson and Sveinbjorn Gizurarson</li> <li>CRC Handbook of Laboratory Safety By A. Keith Furr.</li> <li>Laboratory Safety Handbook prepared by Fens Laboratory Safety Team.</li> <li>Laboratory Safety by Richard Lumb Lisa Shephard Ivan Bastian Mark Fitz-Gerald</li> <li>Laboratory Safety for Chemistry Students by Robert H Hill and David C Finster.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li><a href="https://ucblueash.edu/content/dam/refresh/blueash-62/documents/academics/academic-departments/chemistry/LabSafetyRules.pdf">https://ucblueash.edu/content/dam/refresh/blueash-62/documents/academics/academic-departments/chemistry/LabSafetyRules.pdf</a></li> <li><a href="https://www.youtube.com/watch?v=VXB1HWnjQBA">https://www.youtube.com/watch?v=VXB1HWnjQBA</a></li> </ol>	
<b>Model Questions:</b>	NA	

**Distribution of Marks and the scheme of (SEC) Practical Examination is as follows:**

**Internal Assessment**

• Active participation in activities	15 Marks
• Continuous Assessment Tests (CAT) (At least three tests) *	20 Marks
• Submission of duly certified practical record	10 Marks
• Internal examiner viva-voce	05 Marks
<b>Total</b>	<b>50 Marks</b>

\*Note: Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations

**Course Category: Major/Minor (Theory) - 2**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120205	Fuels and Energy Balance	2	30	2 Hrs	30+20=50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the energy balance.</li> <li>To understand the conventional and non-conventional energy sources.</li> <li>To understand the sources of fuels</li> <li>To understand the types of fuels.</li> </ol>			
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to calculate the calorific value of fuel.</li> <li>Able to differentiate between conventional and non-conventional energy sources.</li> <li>Able to analyzed the coal by proximate and ultimate methods.</li> <li>Able to understand the process of mining of fuels.</li> </ol>			
Unit System	Content	Work Load Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
<b>Unit I</b>	Energy Balance: Heat capacity, Cp, Cv, Molar heat capacity, Heat of reaction, formation, combustion, neutralization, Heat of solution, Hess's law of constant heat summation. Latent heat, latent heat of fusion, latent heat of vaporization, latent heat of sublimation. Problems based on heat of combustion, heat of Reaction and Heat of Formation.	8 Hours	8 Marks	<ol style="list-style-type: none"> <li>Interactive Lectures: Use multimedia presentations, interactive slides, and animations to illustrate complex concepts.</li> <li>Hands-On Models: Use digital modeling software for virtual three-dimensional visualization.</li> <li>Problem-Solving Sessions: Organize regular problem-solving sessions where students can apply theoretical knowledge to solve energy balance problems.</li> <li>Flip-Class: Assign readings or video lectures as homework and use class time for interactive discussions and problem-solving</li> </ol>
<b>Unit II</b>	Energy: General idea about conventional energy sources, and non-conventional Energy Sources–Solar energy, Space heating and water heating by solar energy, Production of electricity by solar energy, driving of vehicle by solar energy. Tidal power, Wind energy, Biomass energy, Geothermal Energy.	7 Hours	7 Marks	
<b>Unit III</b>	Solid fuels: Introduction, Classification of fuel on the basis of Occurrence, on the basis of physical state with examples. Coal: Types of coal, Coal formation, Coal analysis (proximate and ultimate), Destructive distillation of coal, Coal tar distillation, uses of coal tar products, Manufacturing of coal gas and water gas	8 Hours	8 Marks	
<b>Unit IV</b>	Liquid fuels: Introduction, Petroleum-Origin and classification, Fractional distillation of crude oil, Cracking, Mining of petroleum, natural gases, Uses of petroleum.	7 Hours	7 Marks	

<b>References:</b>	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Non-conventional Energy Sources by G.D.Rai, Khanna Publishers</li> <li>2. A Text Book of Physical Chemistry by P.L.Soni, Sultan Chand &amp; Sons.</li> <li>3. A Text Book of Engineering Chemistry by S. S. Dara, S. Chand and Co.</li> <li>4. Engineering Chemistry by H.K. Chopra, A. Parmar, Alpha Science International Ltd.</li> <li>5. Engineering Chemistry by Jain and Jain, Dhanpat Rai publishing Co.</li> <li>6. Non-Conventional Energy Sources by N.K. Bansal, Vikas Publishing House.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/103105110">https://nptel.ac.in/courses/103105110</a></li> <li>2. <a href="https://archive.nptel.ac.in/content/storage2/courses/103105110/m111.pdf">https://archive.nptel.ac.in/content/storage2/courses/103105110/m111.pdf</a></li> <li>3. <a href="http://www.ignou.ac.in/upload/unit-3.pdf">http://www.ignou.ac.in/upload/unit-3.pdf</a></li> </ol>
<b>Model Questions:</b>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. Discuss heat capacity with suitable example.</li> <li>2. Give an account of Latent Heat.</li> <li>3. Discuss various non-conventional energy sources.</li> <li>4. Give an account of tidal power.</li> <li>5. Give the uses of solar energy.</li> <li>6. Give the classification of fuel on the basis of occurrence with suitable examples.</li> <li>7. Give an account of types of coal.</li> <li>8. Give the classification of petroleum.</li> <li>9. Discuss the various uses of petroleum products.</li> </ol> <p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Prove that <math>C_p - C_v = R</math></li> <li>2. Give the relationship between <math>C_p</math> and <math>C_v</math>.</li> <li>3. What is Hess's law of constant summation? Discuss in detail.</li> <li>4. Give an account of water heating by solar energy.</li> <li>5. Explain the proximate analysis of coal.</li> <li>6. Explain the process of destructive distillation of coal tar.</li> <li>7. Explain the fractional distillation of crude oil.</li> <li>8. Give an account of mining of petroleum.</li> </ol>

**MCQs**

1. Amount of energy required to increase the temperature of one mole of system through  $1^{\circ}\text{K}$  is called as  
a) Molar heat capacity   b) Heat of Reaction   c) Latent Heat   d) None of these
2. When matter changes from one state to another the energy change is called as  
a) Latent heat   b) Heat of formation   c) Heat of Solution   d) Heat of Reaction
3. Which of the following is a source of non-conventional energy?  
a) Petrol   b) Diesel   c) Coal   d) Sun
4. Which of the following is a source of conventional energy?  
a) Sun   b) Wind   c) Coal   d) Geothermal
5. Which of the following is analyzed in Proximate analysis of coal?  
a) Nitrogen   b) Moisture   c) Total Carbon   d) Sulphur
6. Which of the following is analyzed in Ultimate analysis of coal?  
a) Moisture   b) ash   c) Nitrogen   d) None of these
7. Which of the following is a natural fuel?  
a) Petrol   b) Diesel oil   c) Wood   d) Naphtha
8. Which of the following product is obtained from fractional distillation of crude oil?  
a) Petrol   b) Naphtha   c) Diesel oil   d) All of these

### Course Category: Major Lab-3

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120206	Industrial Chemistry Lab 1	2	60	4 Hrs	25+25= 50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the various systems of Units.</li> <li>To Understand the stoichiometric equations and its applications.</li> <li>To understand the various standardization methods.</li> </ol>	
<b>Course Outcomes:</b>	<p>After completion of the course student should</p> <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the interconversions of units.</li> <li>Able to practical knowledge in professional life.</li> <li>Able to analyzed coal sample.</li> <li>Able to analyze liquid fuels.</li> </ol>	
<b>Unit System</b>	<b>Content</b>	<b>Incorporation of Pedagogies</b>
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Determination of viscosity of lubricant oil by Redwood viscometer.</li> <li>Determination of Aniline Point of Diesel.</li> <li>Determination of moisture content in the given coal sample.</li> <li>Determination of ash content in the given coal sample.</li> <li>Determination of flash point of given fuel sample.</li> <li>Determination of fire point of given fuel sample.</li> <li>To determine Viscosity of petroleum sample by Redwood method.</li> <li>Determination of cloud point of given petroleum sample.</li> <li>Determination of pour point of given petroleum sample.</li> <li>Determination of Melting point of wax.</li> </ol>	<p><b>Lab Reports:</b> Students prepare detailed lab reports on their findings.</p> <p><b>Discussion Sessions:</b> Group discussions.</p> <p><b>Group Projects:</b> Assign group projects on stoichiometric methods.</p> <p><b>Class Debates:</b> Discuss the findings amongst the students.</p>
<b>References:</b>	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>Practical Chemistry, by Amrish Agarwal, Shivalal Agrawal and Co.</li> <li>Laboratory Manual Chemistry by NCERT.</li> <li>GCE Chemistry Practical Handbook Department of Science Faculty of Science and Technology National Institute of Education.</li> <li>Text Book: Practical General Chemistry by Dr. Ahmad Al-Owais &amp; Dr. Abdulaziz Al-Wassil.</li> <li>Laboratory Manual for Engineering Chemistry Practical.</li> <li>Engineering Chemistry Laboratory Manual, Maharaj Vijayaram Gajapathi Raj College of Engineering.</li> <li>Understanding 0 level Chemistry Practical.</li> <li>A Textbook on Experiments and Calculations in Engineering Chemistry By S.S Dara. S Chand Ltd.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li><a href="https://www.youtube.com/watch?v=Yysmew-I1PI">https://www.youtube.com/watch?v=Yysmew-I1PI</a></li> <li><a href="https://www.youtube.com/watch?v=XtvSjXGqFVY">https://www.youtube.com/watch?v=XtvSjXGqFVY</a></li> </ol>	
<b>Model Questions:</b>	NA	

**Distribution of Marks and the scheme of Practical Examination is as follows:**

**Section 1: Internal Assessment**

• Active participation in activities	10 Marks
• Continuous Assessment Tests (CAT) (At least three tests) *	10 Marks
• Submission of duly certified practical record	05 Marks
<b>Total</b>	<b>25 Marks</b>

\*Note: Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations

**Section 2: External Assessment**

• Exercise 1	10 Marks
• Exercise 2	10 Marks
• Viva-Voce (external)	05 Marks
<b>Total</b>	<b>25 Marks</b>



### Course Category: Generic/Open Elective-3

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120207	Cleaning Products II	2	30	2 Hrs	30+20=50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the Various cleaning products.</li> <li>To Understand the action of cleaning agents.</li> <li>To identify various cleaning products as per its uses.</li> <li>To develop sense of Entrepreneurship development</li> </ol>						
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the preparation of cleaning products.</li> <li>Able to prepare household cleaning products.</li> <li>Able to start small scale business.</li> <li>Able to apply basic concepts and innovative ideas during formulations</li> </ol>						
<b>Unit System</b>	<b>Content</b>	<b>Work Load Allotted</b>	<b>Weightage of Marks Allotted</b>	<b>Incorporation of Pedagogies</b>			
<b>Unit I</b>	Cleaning agents: Introduction, History, Global and Indian Scenario. Market potential for cleaning products in India. Characteristics of Ideal Cleaning agent, Major raw materials having cleansing properties.	8 Hours	8 Marks	<b>1.Interactive Lectures:</b> Use multimedia presentations, interactive slides, and animations to illustrate complex concepts. <b>2. Hands-On Models:</b> Use digital modeling software for virtual three-dimensional visualization. <b>3.Problem-Solving Sessions:</b> Organize regular problem-solving sessions <b>4.Flip-Class:</b> Assign readings or video lectures as homework and use class time for interactive discussions.			
<b>Unit II</b>	Preparation, raw material, uses and properties of multipurpose cleaner, carpet shampoo, Toilet Cleaner, Handwash.	7 Hours	7 Marks				
<b>Unit III</b>	Preparation, raw material, uses and properties of Wax Remover, Furniture Polish, Hair Gel and Hair oil	8 Hours	8 Marks				
<b>Unit IV</b>	Preparation, raw material, uses and properties of Shoe Polish, Spot/stain Removers, Window and glass cleaner.	7 Hours	7 Marks				
<b>References:</b>	<b>Text Books:</b> <ol style="list-style-type: none"> <li>Home Made Cleaners by Denise G. Dias Johnson Co. Extension Agent, FCS</li> <li>Home Made Cleaning Products by Waste Virginia University.</li> <li>Homemade Household Cleaners by Amanda Griffin and Randall A. Cantrell.</li> <li>DIY Natural Cleaning by Kristin Marr.</li> <li>Green Tok: The Ultimate Guide to Natural &amp; Reduced Waste Cleaning</li> <li>Cleaning Science Uttarakhand Open University.</li> <li>Wax Polishes Manufacturing Hand Book by NPCS Board of Consultants and Engineer, Asia Pacific Business Press.</li> </ol> <b>Web Resources:</b> <ol style="list-style-type: none"> <li>Cleaners and Metal Polishes: <a href="https://www.slideshare.net/ei1234/formula-and-manufacture-of-polishes-floor-polish-oil-polish-metal-polish-furniture-polish-leather-polish-shoe-polish-automobile-polish-aluminum-polish-glass-polish">https://www.slideshare.net/ei1234/formula-and-manufacture-of-polishes-floor-polish-oil-polish-metal-polish-furniture-polish-leather-polish-shoe-polish-automobile-polish-aluminum-polish-glass-polish</a></li> </ol>						

<b>Model Questions:</b>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. Discuss market potential of cleaning agents in India.</li> <li>2. Discuss the characteristics of cleaning agents.</li> <li>3. Give the major raw materials used in cleaning products.</li> <li>4. Give the properties of carpet cleaner.</li> <li>5. Give the raw materials used in carpet shampoo.</li> <li>6. Give the properties of wax remover.</li> <li>7. Discuss the raw materials used in furniture polish.</li> <li>8. Give the properties of Multipurpose cleaner.</li> <li>9. Give the raw materials used in stain remover.</li> </ol>
	<p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Discuss the Global Trend about cleaning product.</li> <li>2. Explain the method of preparation of Handwash.</li> <li>3. How will you prepare multipurpose cleaner? Explain in detail.</li> <li>4. Discuss the properties and applications of wax remover.</li> <li>5. Explain the process of preparation of glass cleaner.</li> <li>6. Explain the method of formulation of stain remover.</li> <li>7. Discuss the raw material and characteristics of hair gel.</li> </ol>
	<p><b>MCQs</b></p> <ol style="list-style-type: none"> <li>1. Which of the following is having cleansing properties? a. Lemon      b. Baking Soda      c. Vinegar      d. All of these</li> <li>2. Ideal cleaning agent should be a. Costly      b. Toxic      c. Non-Toxic      d. low shelf life</li> <li>3. Sodium lauryl sulfate is mainly used to prepare a. Metal polish      b. Hand wash      c. Air Freshener      d. None of these</li> <li>4. Which of the following is used in Wooden furniture Polish? a. Turpentine      b. linseed oil      c. Citrus thinner      d. None of these</li> <li>5. Flaxseed and Chia seed extract is used to prepare a. Metal Polish      b. Floor Cleaner      c. Herbal Hair Gel      d. None of these</li> <li>6. Iso Propyl alcohol is used as a reagent in a. Wax remover      b. Tile Cleaner      c. Drain Cleaner      d. Mineral remover</li> <li>7. Isopropyl alcohol, Mon ethanolamine and Glycol are the main reagents used in preparation of a. Shoe Polish      b. Glass Cleaner      c. Air freshener      d. None of these</li> </ol>

**Course Category: Generic/Open Elective Theory-4**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120208	Herbal Cosmetics II	2	30	2 Hrs	30+20=50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Students should aware about the present scenario of herbal cosmetics.</li> <li>2. Students should aware about the market potential of the herbal and synthetic cosmetics</li> <li>3. Students should understand the benefits of herbal cosmetics.</li> <li>4. Should know the chemistry of Cosmetics.</li> </ol>			
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>1. Able to formulate various herbal cosmetics</li> <li>2. Able to start their own small-scale production.</li> <li>3. Able to differentiate synthetic and natural cosmetics.</li> <li>4. Able to identify business opportunities.</li> </ol>			
Unit System	Content	Work Load Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
<b>Unit I</b>	<b>Herbal Cosmetics:</b> Introduction, Product and its Applications, Industry outlook and trend, Market Potential and issues. Types of herbal cosmetics, Indian standards for Herbal Cosmetics.	8 Hours	8 Marks	<b>1.Interactive Lectures:</b> Use multimedia presentations, interactive slides, and animations to illustrate complex concepts.  <b>2. Hands-On Models:</b> Use digital modeling software for virtual three-dimensional visualization.  <b>3.Problem-Solving Sessions:</b> Organize regular problem-solving sessions  <b>4.Flip-Class:</b> Assign findings or video lectures as homework and use class time for interactive discussions.
<b>Unit II</b>	<b>Formulation of Face Wash:</b> Benefits of Herbal Face wash, Functions of face wash, desire properties. Formulation method, raw materials, Categories of therapeutic agents used in face wash, Additives used in Face Wash. Evaluation of Face Wash with respect to Colour, odour, consistency, spreadability, washability, foamability, grittiness.	7 Hours	7 Marks	
<b>Unit III</b>	<b>Formulation of Herbal Shampoo:</b> Benefits of Herbal Shampoo, Functions, desire properties. Formulation Method, raw materials, Evaluation with respect to pH, testing of wetting, foam stability, Dirt dispersion test, Conditioning performance evaluation	8 Hours	8 Marks	
<b>Unit IV</b>	<b>Formulation of Face Pack:</b> Benefits of Herbal Face Pack, Functions, desire properties. Formulation, raw materials Composition of Sunscreen lotion, Evaluation of formulated Face pack with respect to pH, Irritancy Test, Stability, Texture, smoothness.	7 Hours	7 Marks	

<p><b>References:</b></p>	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Textbook of herbal cosmetics by Vaibhav Tripathi, Dinanath Jhade, Niraj Sharma, Rageeb Usman,S. Vikas &amp; Co. Publishers.</li> <li>2. Textbook of herbal cosmetics by M. Vimaladevi, CBS Publishers &amp; Distributors.</li> <li>3. Herbal Cosmetics Handbook by Himadri Panda, Asia Pacific Business Press.</li> <li>4. Herbal Plants used in Cosmetics and Cosmeceuticals and their advantages over the Synthetic Counterparts by Charu Gupta and Dhan Prakash.</li> <li>5. Text book of Cosmetic Formulations, by Sarah Adinda Puteri.</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li>1. Formulation of Cosmetics: <a href="https://www.slideshare.net/pharmmuthu/formulation-and-evaluation-of-cosmetic-products">https://www.slideshare.net/pharmmuthu/formulation-and-evaluation-of-cosmetic-products</a></li> </ol>
<p><b>Model Questions:</b></p>	<p><b>Short Type</b></p> <ol style="list-style-type: none"> <li>1. Give the applications of Herbal Cosmetics.</li> <li>2. Give the various types of Herbal Cosmetics</li> <li>3. List down the benefits of Herbal Facewash.</li> <li>4. Discuss the desire properties of herbal face wash.</li> <li>5. How will you carry out evaluation of formulated face wash? Discuss any one test.</li> <li>6. Give the benefits of Herbal Shampoo over the synthetic one.</li> <li>7. What is foam stability test of shampoo?</li> <li>8. Give the composition of Herbal Face Pack.</li> <li>9. Discuss the desire properties of Face Pack.</li> </ol> <p><b>Long Type</b></p> <ol style="list-style-type: none"> <li>1. Give an idea about Industrial Trend of Herbal Cosmetics in India.</li> <li>2. Discuss various types of herbal Cosmetics.</li> <li>3. Explain the formulation method of Face Pack.</li> <li>4. Give an account of additives used in Face Pack.</li> <li>5. How Formulated Herbal Shampoo be evaluated? Discuss in Detail.</li> <li>6. Explain the formulation method of Herbal Shampoo.</li> <li>7. Discuss the various raw materials used for preparation of Face Pack.</li> <li>8. Discuss benefits of Herbal face pack over Synthetic one.</li> </ol>

### MCQs

1. Which of the following is used in preparation of herbal cosmetics?
  - a. Aloe Vera
  - b) Turmeric Powder
  - c) Rosewater
  - d) all of these
  
2. Herbal Face wash is used to
  - a. Remove dead skin
  - b. Keep skin fresh
  - c. Keep skin healthy
  - d. All of these
  
3. Good face wash should
  - a. Spread easily on skin
  - b. Have long drying period
  - c. Have rough texture
  - d. None of these
  
4. Which of the following is used as antioxidant in face wash?
  - a. Propylene Glycol
  - b. Fruits
  - c. Vegetable
  - d. Both b and c
  
5. Which of the following therapeutic agents used in face wash?
  - a. Antimicrobial
  - b. Anti-inflammatory
  - c. Anti-acne
  - d. all of these
  
6. Foaming agent used in Herbal Shampoo is
  - a. Reetha
  - b. Amla
  - c. Hibiscus
  - d. Bhringraj
  
7. Good Shampoo should have
  - a. Good foam stability
  - b. Less foam stability
  - c. Both
  - d. None of these
  
8. Good face pack should
  - a. Supply necessary nutrients to the skin
  - b. Penetrate deep down in skin
  - c. Reduces wrinkles
  - d. All of these

## Course Category: Vocational Skill Course VSC-1

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120209	Lab 4 Stoichiometry	2	60	-	50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the various standardization methods of reagents.</li> <li>To Understand the stoichiometric equations and its applications.</li> <li>To understand and able to standardized the solution.</li> </ol>	
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to apply basic knowledge for the standardization of solution.</li> <li>Able to prepare various standard solutions.</li> <li>Able to calibrate pipette and burette.</li> <li>Able to prepare solution of desire concentration.</li> </ol>	
<b>Unit System</b>	<b>Content</b>	<b>Incorporation of Pedagogies</b>
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Preparation of 1N solution NaOH.</li> <li>Preparation of 1N solution HCL.</li> <li>Preparation of 0.1N solution Oxalic Acid.</li> <li>Preparation of KMnO<sub>4</sub> 1N solution.</li> <li>Preparation of 0.1N solution Na<sub>2</sub>CO<sub>3</sub>.</li> <li>Standardization of 1N solution NaOH.</li> <li>Standardization of 1N solution HCL.</li> <li>Standardization of 0.1N solution Oxalic Acid.</li> <li>Standardization of KMnO<sub>4</sub> 1N solution.</li> <li>Standardization of 0.1N solution Na<sub>2</sub>CO<sub>3</sub>.</li> <li>Preparation of 1N NaOH solution to 0.1 N NaOH solution.</li> <li>Preparation of 1N Oxalic Acid solution to 0.1 N Oxalic Acid solution.</li> </ol>	<p><b>Lab Reports:</b> Students prepare detailed lab reports on their findings.</p> <p><b>Discussion Sessions:</b> Group discussions.</p> <p><b>Group Projects:</b> Assign group projects on stoichiometric methods.</p> <p><b>Class Debates:</b> Discuss the findings amongst the students.</p>
<b>References:</b>	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>Practical Chemistry by Ambrish Agarwal, Shivalal Agrawal and Co.</li> <li>Laboratory Manual Chemistry by NCERT</li> <li>GCE Chemistry Practical Handbook Department of Science Faculty of Science and Technology National Institute of Education.</li> <li>Text Book: Practical General Chemistry by Dr. Ahmad Al-Owais &amp; Dr. Abdulaziz Al-Wassil</li> </ol> <p><b>Web Resources:</b></p> <ol style="list-style-type: none"> <li><a href="https://www.chemicals.co.uk/blog/how-to-make-a-standard-solution">https://www.chemicals.co.uk/blog/how-to-make-a-standard-solution</a></li> <li><a href="https://www.youtube.com/watch?v=iPYyRNjXkgY">https://www.youtube.com/watch?v=iPYyRNjXkgY</a></li> </ol>	
<b>Model Questions:</b>	NA	

### Distribution of Marks and the scheme of (VSC) Practical Examination is as follows:

#### Internal Assessment

• Active participation in activities	15 Marks
• Continuous Assessment Tests (CAT) (At least three tests) *	20 Marks
• Submission of duly certified practical record	10 Marks
• Internal examiner viva-voce	05 Marks
<b>Total</b>	<b>50 Marks</b>

\*Note: Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations

**Course Category: Skill Enhancement Course (SEC-2) Lab 6**

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	120210	Lab 5 Formulation of Cleaning Products	2	60	--	50

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>To understand the applications of Cleaning Agents.</li> <li>To Understand the action of cleaning agents.</li> <li>To understand the methods of formulation of various cleaning agents.</li> <li>To develop sense of entrepreneurship.</li> </ol>	
<b>Course Outcomes:</b>	After completion of the course student should <ol style="list-style-type: none"> <li>Able to apply basic knowledge for formulation of cleaning agent.</li> <li>Able to identify various applications of Cleaners.</li> <li>Able to start small scale business.</li> <li>Able to apply innovative ideas in formulation.</li> </ol>	
<b>Unit System</b>	<b>Content</b>	<b>Incorporation of Pedagogies</b>
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Formulation of Air Freshener.</li> <li>Formulation of Floor Polish.</li> <li>Formulation of Rust Remover.</li> <li>Formulation of Tile Cleaner.</li> <li>Formulation of Mineral deposit remover.</li> <li>Formulation of Handwash.</li> <li>Formulation of Wax Remover.</li> <li>Formulation of Hair Gel.</li> <li>Formulation of Shoe Polish.</li> <li>Formulation of Stain Remover.</li> <li>Formulation of Glass Cleaner.</li> </ol>	<b>Lab Reports:</b> Students prepare detailed lab reports on their findings. <b>Discussion Sessions:</b> Group discussions. <b>Group Projects:</b> Assign group projects on formulation methods. <b>Class Debates:</b> Discuss the findings amongst the students.
<b>References:</b>	<b>Text books:</b> <ol style="list-style-type: none"> <li>Wax Polishes Manufacturing Hand Book by NPCS Board of Consultants and Engineer, Asia Pacific Business Press.</li> <li>Home Made Cleaners by Denise G. Dias Johnson Co. Extension Agent, FCS</li> <li>Home Made Cleaning Products by Waste Virginia University.</li> <li>Homemade Household Cleaners by Amanda Griffin and Randall A. Cantrell.</li> <li>DIY Natural Cleaning by Kristin Marr.</li> <li>Green Tok: The Ultimate Guide to Natural &amp; Reduced Waste Cleaning</li> <li>Cleaning Science Uttarakhand Open University.</li> </ol> <b>Web Resources:</b> <ol style="list-style-type: none"> <li><a href="https://www.youtube.com/watch?v=oC7BFcGRbAQ">https://www.youtube.com/watch?v=oC7BFcGRbAQ</a></li> <li><a href="https://www.youtube.com/watch?v=1FoE-P0T5Dw">https://www.youtube.com/watch?v=1FoE-P0T5Dw</a></li> </ol>	
<b>Model Questions:</b>	NA	

**Distribution of Marks and the scheme of (SEC) Practical Examination is as follows:**

**Internal Assessment**

The 50 marks fragmentation as follows:

• Active participation in activities	15 Marks
• Continuous Assessment Tests (CAT) (At least three tests) *	20 Marks
• Submission of duly certified practical record	10 Marks
• Internal examiner viva-voce	05 Marks
<b>Total</b>	<b>50 Marks</b>

\*Note: Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations.