

**The Engineering Chemistry Laboratory** is well located with an airy and spacious hall of floor area 340 sq.meter including a store room for safe keeping of explosive & corrosive chemicals in view of the Laboratory safety. Each working table in the laboratory is well furnished with reagent racks & well connected with water supply & Burners. The experiments prescribed by K L University have been carefully planned in cycles so that individual student can conduct single experiments independently and multiplicity of gadgets is avoided ensuring maximum resource utilization. The Demonstrator to students ratio in the labs is maintained at 1:15 and the lab groups are planned at 60 each. The students conduct their Lab. Assignments under the vigilant guidance and support of four faculty members, three Laboratory Assistant & one laboratory attendant.

**The Chemistry Laboratory is well equipped with various instruments other than the usual glasswares & chemicals as per KLU syllabus, which includes:**

- Digital Spectrophotometer
- Conductivity meter
- Colorimeter
- Water Bath (24 holes)
- Water distillation Unit
- Digital pH meter
- Analytical Balance

**As per syllabus prescribed by K L University, the laboratory is conducting with the following Experiments**

<b>1</b>	<b>Determination of strength of NaOH</b>
<b>2</b>	<b>Estimation of Total Hardness of water by EDTA method</b>
<b>3</b>	<b>Estimation of alkalinity of water</b>
<b>4</b>	<b>Determination of acidity of water sample</b>
<b>5</b>	<b>Estimation of Dissolved Oxygen in water</b>

<b>6</b>	<b>Determination of free CO<sub>2</sub> in water sample</b>
<b>7</b>	<b>Determination of total residual chlorine in water</b>
<b>8</b>	<b>Determination of p<sup>H</sup></b>
<b>9</b>	<b>Determination of Cu by complexometry</b>
<b>10</b>	<b>Determination of Calcium in milk powder</b>
<b>11</b>	<b>Preparation of Urea Formaldehyde resin</b>
<b>12</b>	<b>Preparation of Phenol Formaldehyde resin</b>
<b>13</b>	<b>Preparation of Nylon 6:6</b>
<b>14</b>	<b>Spectrophotometry</b>

At the end of the engineering chemistry lab every student has to perform one **project based Lab**. The department is also committed to sustain the scientific enquiry of the students and research that is socially beneficial.

## Project Based Labs

**With real-world problems it is possible to highlight the interdisciplinary nature of chemistry and the relevance of chemistry to the lives of students.**

The goals of the project based lab were threefold: (1) to increase students' interest in science early in their academic careers, particularly engineering students; (2) to raise students' awareness of the connections between chemistry and real-life issues; and (3) to engender a more sophisticated view of science among engineering students. To achieve these goals, we created a module-based laboratory curriculum in which the students spend 13 to 15 weeks learning chemistry in the context of a specific real-world problem. Three modules have been developed covering all the topics of Engineering Chemistry course. We specifically chose to test these modules in the first year Engineering Chemistry course because we wanted to influence students early in their careers in implementing this project based approach. Every group (max 5 students) has to select one project from each

module. Each module consists of a set of projects exploring the same concepts of various aspects.

### **List of Modules for project based labs**

<b>Module1</b>	<ol style="list-style-type: none"><li>1. How much NaHCO<sub>3</sub> is in one effervescent tablet?</li><li>2. Does tooth paste protect your teeth?</li><li>3. What are the concentrations of phosphate ions in soft drinks?</li><li>4. Magic behind the working of Antacid tablet</li><li>5. What is the mass of CaCO<sub>3</sub> in Egg Shells?</li><li>6. Resolving the mystery of aspirin action</li><li>7. Vinegar and its significance in our kitchen.</li><li>8. Water is Life</li><li>9. Importance of buffering to agriculture</li><li>10. Do you know the parameters of cooking oil?</li><li>11. Is Ascorbic acid good for you?</li><li>12. Does your soap protect your beauty?</li></ol>
<b>Module2</b>	<ol style="list-style-type: none"><li>1. Facts and Fallacies of Milk</li><li>2. Have you checked Ca/Mg ratio in your soil samples?</li><li>3. Tap into Quality</li><li>4. Explore the content of copper in articles</li><li>5. Identifying perfect site to build power plant.</li></ol>
<b>Module3</b>	<ol style="list-style-type: none"><li>1. Metal corrosion as a natural clock</li><li>2. Sailing on the "C": A Vitamin Titration with a Twist</li><li>3. Little chlorine content in city's drinking water</li><li>4. Chlorine bleach shelf life</li><li>5. Getting to grips with soil organic matter</li><li>6. Untangling the iodine value riddle</li><li>7. The chemistry of water: would you drink water</li></ol>

### **Module 1**

1. How much sodium bicarbonate is in one effervescent tablet?

Imagine that you work as a chemist in a vitamin C factory. Your boss wants you to do a little industrial spying to find out the amount of sodium bicarbonate used by Effervescent tablet. Your job is to design and carry out an investigation to determine the percent by mass of sodium bicarbonate in Effervescent tablets.

Concept: Volumetric analysis- Acid-base Titration

2. Does your tooth paste protect your teeth?

Imagine that you have been hired by the Consumer Council to investigate whether toothpaste can really slow down the rate of reaction between teeth and acids. It is your job to plan and carry out experiments to compare at least three different brands of toothpaste. You may use chicken eggshells to substitute for human teeth.

Concept: Volumetric analysis- Acid-base Titration

3. What are the concentrations of phosphate ions in soft drinks?

Imagine that you work as a chemist in a cola drink company. You want to determine the concentrations of  $\text{H}_3\text{PO}_4$  molecules and  $\text{H}_2\text{PO}_4^-$  ions in a sample of commercial solution of phosphoric acid by titration. Unfortunately, your pH meter has been damaged. So, you want to use acid-base indicators instead.

Concept: Volumetric analysis- Acid-base Titration

4. Magic behind the working of Antacid tablet.

Imagine that you were in 17th century and your relative is severely suffering from acidity. What remedy would you suggest and how it works.

Concept: Volumetric analysis- Acid-base Titration

5. What is the mass of  $\text{CaCO}_3$  in egg shells?

Imagine that you are working in the commercial egg industry. To help your boss monitor the eggshell quality, you need to determine the percentage by mass of calcium carbonate in hen eggshells. Your task is to plan and carry out TWO methods that will allow you to measure the amount of calcium carbonate in eggshells accurately. Of the two methods you designed, discuss which you think is better and the criteria you used for selecting the better method.

Concept: Volumetric analysis- Acid-base Titration

6. Resolving the mystery of Aspirin action

Imagine that you are working in the pharmaceutical company. To help your boss monitor the purity, you need to determine the amount of aspirin in the tablets. Your task is to plan to find out the proper method and assess the amount of aspirin.

Concept: Volumetric analysis- Acid-base Titration.

7. Vinegar and its significance in our kitchen.

In kitchen we are using vinegar as one of ingredient in all cooking items. But we don't know acetic acid content in the vinegar sample. Quality of vinegar is depending on the content of acetic acid. As a chemist you suggest proper method and assess the amount of vinegar.

Concept: Volumetric analysis- Acid-base Titration

#### 8. Water is Life.

Imagine that you are working in the Municipal Corporation, Vijayawada as chemist. As per the directions of higher authorities, you are directed to analyse the water samples in different areas in Vijayawada to assess the quality of water especially alkalinity, acidity and CO<sub>2</sub>. Your task is to plan to collect water samples and estimate the above contents by applying good methods.

Concept: Volumetric analysis- Acid-base Titration

#### 9. Importance of buffering to Agriculture

Imagine that you are working as a Soil-chemist at AP-agriculture board. As per the directions of higher authorities, you are directed to analyse the soil samples in different agricultural fields in Vijayawada to assess the quality of soil especially alkalinity, acidity. Your task is to plan to collect soil samples and estimate the above parameters by applying good methods.

Concept: Volumetric analysis- Acid-base Titration

#### 10. Do you know the parameters of cooking oil?

Imagine that you are working as a chemist in Indian Oil Company at Kakinada. Your job is to assess the quality of oil samples in terms of saponification and acid value. So collect different oil samples, suggest proper method and assess the above parameters.

Concept: Volumetric analysis- Acid-base Titration

#### 11. Is Ascorbic acid good for you?

We are eating fruits for maintaining our health. Ascorbic acid one of the content of the fruits which contains many health benefits and its limited concentration is useful for our health. But we do not know the concentration of ascorbic acid fruits. So our task is to suggest any two methods for the determination of ascorbic acid.

Concept: Volumetric analysis- Acid-base Titration

#### 12. Does your soap protect your beauty?

Imagine that you have been hired by the Consumer Council to investigate whether soap can really keep your skin fresh and healthy. It is your job to plan and carry

out experiments to compare at least three different brands of soaps and assess the grade.

Concept: Volumetric analysis- Acid-base Titration

## **Module 2**

### 1. Facts and fallacies of Milk

Government initiated a new program to bring awareness among the people about quality of food. In this connection Elementary School Milk Program (ESMP) was introduced to distribute milk to children. Unfortunately the program hindered by purchasing bad quality milk. Your task is to plan collect different milk samples and assess the contents of the calcium and magnesium in milk.

Concept: Volumetric analysis- Complexometric titration.

### 2. Have you checked the Ca/Mg in soil samples?

Imagine that you are working as a Soil-chemist at AP-agriculture board. As per the directions of higher authorities, you are directed to analyse the soil samples in different agricultural fields in Vijayawada to assess the quality of soil especially Ca/Mg ratio. Your task is to plan to collect soil samples and estimate the above parameters by applying good methods.

Concept: Volumetric analysis- Complexometric titration.

### 3. Tap into Quality

Imagine that you are working in the Municipal Corporation, Vijayawada as Civil Engineer. As per the directions of higher authorities, you are directed to analyse the water samples in different areas in Vijayawada to assess the quality of water especially Hardness of water samples. Your task is to plan to collect water samples and estimate the above contents by applying good methods.

Concept: Volumetric analysis- Complexometric titration.

### 4. Explore the content of copper in articles

Imagine that you are working as chemist in Steel Authority of India Limited (SAIL). SAIL is manufacturing various articles having meagre amount of copper to protect the material from corrosion. Your task is to assess the percentage of copper in articles.

Concept: Volumetric analysis- Complexometric titration.

### 5. Identify the perfect site to build the power plant

Imagine that you are working as Electrical Engineer in APSPDCL. As per the orders given by government you are appointed as chief engineer to select site to establish a new power plant. Your task is to identify the suitable site and other parameters to establish a new power plant.

Concept: Volumetric analysis- Complexometric titration.

### **Module 3**

1. Metal corrosion as a natural clock.

Imagine that you are working as Mechanical engineer in TATA Motors, Chennai. To develop Nano cars, TATA Company take some initiative steps to select good metal material for build it. In this connection you are appointed to check the quality of material in terms of corrosion.

Concept: Volumetric analysis- Redox titration.

2. Sailing on the “C”: A Vitamin Titration with a Twist

Imagine that you work as a chemist in a vitamin C factory. Your boss wants you to do a little industrial spying to find out the amount of Vitamin C in tablets. Your job is to design and carry out an investigation to determine the amount of Vitamin C in tablets.

Concept: Volumetric analysis- Redox titration.

3. Little chlorine content in city's drinking water

Imagine that you are working in the Municipal Corporation, Vijayawada as Civil Engineer. As per the directions of higher authorities, you are directed to analyse the water samples in different areas in Vijayawada to assess the quality of water especially amount of chlorine. Your task is to plan to collect water samples and estimate the above contents by applying good methods.

Concept: Volumetric analysis- Redox titration.

4. Chlorine bleach shelf life

Municipal Corporation, Vijayawada was decided to purchase a bulk amount of bleaching powder to control the seasonal diseases in the city. Before purchasing of material, the samples sent to you to assess the quality of bleaching powder in terms of chlorine. So as a Civil engineer your task is to suggest proper method for analysis of sample.

Concept: Volumetric analysis- Redox titration.

## 5. Getting to grips with soil organic matter

Imagine that you are working as a Soil-chemist at AP-agriculture board. As per the directions of higher authorities, you are directed to analyse the soil samples in different agricultural fields in Vijayawada to assess the quality of soil especially Soil Organic Matter. Your task is to plan to collect soil samples and estimate the above parameters by applying good methods.

Concept: Volumetric analysis- Redox titration.

## 6. Untangling the iodine value riddle

Imagine that you are working as a chemist in Indian Oil Company at Kakinada. Your job is to assess the quality of oil samples in terms of Iodine value. So collect different oil samples, suggest proper method and assess the above parameters.

Concept: Volumetric analysis- Redox titration.

## 7. The chemistry of water: would you drink water

Imagine that you are working in the Municipal Corporation, Vijayawada as Civil Engineer. As per the directions of higher authorities, you are directed to analyse the water samples in different areas in Vijayawada to assess the quality of water especially COD & DO. Your task is to plan to collect water samples and estimate the above contents by applying good methods.

Concept: Volumetric analysis- Redox titration.

Note: Apart from the above mentioned concept for each PBL the following concepts are also explored.

- Acid Base Neutralization
- P<sup>H</sup> Meter
- Conductivity Meter
- Spectrophotometer