

COURSE STRUCTURE

Course Code	UCH1001A			
Course Category	<i>Basic Sciences</i>			
Course Title	Chemistry			
Teaching Scheme and Credits	L	T	Laboratory	Credits
Weekly load hrs	3	-	2	2+0+1=3
Pre-requisites: HSC (Chemistry)				
Course Objectives: <ol style="list-style-type: none"> 1. To impart knowledge of basic concepts of chemistry such as water analysis and water purification technology, corrosion, fuels, polymers, green chemistry and UV- Visible spectroscopy. 2. To introduce chemistry of materials used for engineering applications. 3. To inculcate creativity, problem solving skills using principles of chemistry. 				
Course Outcomes: After completion of this course students will be able to <ol style="list-style-type: none"> 1) Illustrate water quality parameters and technology for its improvement and understand applications of phase rule to water system. (CL – II) 2) Analyze corrosion related problems and its prevention method.(CL-IV) 3) Understand the analytical methods to access quality, properties, applications and combustion behavior of fossil fuels, gain knowledge of fuel cells.. (CL II). 4) Understand chemical structure, properties, polymerization techniques of polymers and their applications as engineering materials.(CL-II) 5) Demonstrate need of green chemistry and types and applications of new generation fuels 6) Illustrate the principle and applications of UV- visible spectroscopy. (CL-II) 				
Course Contents: Chemistry in Day- Today Life: Overview of role of Chemistry in our daily life. Water Technology and Phase Rule: Importance of potable water, Specifications for drinking water. Water analysis – hardness, alkalinity, chloride and dissolved oxygen, Ill effects of hard water in boilers, Boiler feed water treatments- Zeolite and Ion exchange ,numericals, Desalination techniques, reverse osmosis and electro-dialysis. Phase rule -one component system- Water, Applications and limitations of Phase rule. Corrosion Science: Types of corrosion- Dry corrosion- mechanism, Pilling-Bedworth rule, Wet corrosion - mechanism, factors influencing corrosion, Methods of corrosion control- Cathodic protection, and anodic, protective coatings- metallic coatings and nonmetallic coatings Fuels and Combustion: Classification of chemical fuels, calorific value, Bomb Calorimeter, Solid fuel - Coal - proximate and ultimate analysis. Liquid fuels - Petroleum - composition and refining. Petrol, Diesel and Jet fuels and their quality parameters. Combustion: chemical reactions, calculations of air required, Fuel Cells – Definition, Advantages and limitations, H ₂ -O ₂ Fuel cell.				

Polymer Chemistry: Polymers in day-to-day life, functionality of monomers, polymerization mechanism, thermoplastic and thermosetting polymers, T_m and T_g . Techniques of polymerization. Compounding of plastics. Specialty polymers- Conjugated Polymers, Stimuli-Responsive Polymers, Biodegradable polymers, Recycling of polymers.

Green Chemistry: Green Chemistry - Definition, goals, twelve principles, need and industrial applications. Traditional and green pathways of synthesis of polyurethane and green hydrogenation methods.

UV- Visible spectroscopy – Principle, instrumentation and applications.

Laboratory Work

Course outcomes:

After completion of Laboratory work students will be able to;

1. Understand and access quality of water and fuels,
2. Synthesize polymers and understand methods to access their physical properties.
3. Understand mechanism and environmental effect on corrosion.
4. Demonstrate practical competence to successfully participate in research and development of innovative technology programs.

List of Experiments:*(any 10 experiments)*

1. To Determine calorific value of fuel using Bomb calorimeter..
2. To estimate total hardness of water by EDTA method.
3. To determine alkalinity of given water sample.
4. Estimation of moisture and ash content in a given sample of coal.
5. Demonstration of effect of environmental conditions on metal corrosion.
6. To determine the electro chemical equivalent (ECE) of copper.
7. To prepare Nylons and to draw them in the form of thread.
8. To determine iron concentration in a given sample of water using colorimeter.
9. To study the adsorption of metal ions on plant based adsorbents using UV-visible spectrophotometer.
10. To determine the molecular weight of a polymer by using Ostwald's Viscometer.
11. Identification of components present in natural resources by using UV-visible spectrophotometer
12. Estimation of dissolved oxygen in the given samples of water by Winkler's method.

Learning Resources:

Reference Books:

1. Dara S. S., Umare S. A., "Textbook of Engineering Chemistry", 12th ed, S. Chand and Company Ltd., 1986.
2. Billmeyer F. W., "Textbook of polymer science", 3rd ed, John Wiley and Sons., 1984.

Supplementary Reading:

1. Wiley, Engineering Chemistry, 2nd ed, Wiley India Pvt.Ltd., 2014.
2. Jain and Jain, "Engineering Chemistry", 16 th ed, Dhanpat Rai and Co. (Pvt.) Ltd., Delhi, 2015.

Web Resources:**Weblinks:**

1. Corrosion : <http://nptel.ac.in/courses/113108051/>
2. Fuel and Combustion : <http://nptel.ac.in/courses/103105110/4>
3. Polymer : <http://nptel.ac.in/courses/104105039/>
4. Polymer : <http://nptel.ac.in/courses/104103071/40>
5. Green Chemistry : <http://nptel.ac.in/courses/103102015/>
6. Phase Rule: <http://nptel.ac.in/courses/103101004/5>
7. Water Technology: <http://nptel.ac.in/courses/105104102/>
8. UV-Visible Spectroscopy: <http://nptel.ac.in/courses/102103044/4>

MOOCs: *Online courses for self-learning*

1. Polymer : <https://www.coursera.org/learn/material-behavior>
2. UV-Visible Spectroscopy: <https://www.mooc-list.com/tags/spectroscopy>
3. Water Technology: <https://www.mooc-list.com/tags/water-treatment>

Pedagogy:

- Co-teaching
- Power point presentations
- Videos
- Demonstrations
- Systematic use of group work and project based learning

Assessment Scheme:

Class Continuous Assessment (CCA): (50 marks)

Assignment s	Test	Presentation s	Case study/Grou p activity	MCQ	Oral	Attendanc e and Initiative
15 Marks 30%	15 Marks 30 %	Nil	15 Marks 30 %	Nil	Nil	5 Marks 10%

Laboratory Continuous Assessment (LCA): (50 marks)

Regularity and punctuality	Understanding the objective	Understanding of procedure	Experiment Skills	Ethics
10 Marks 20%	10 Marks 20%	10 Marks 20%	10 Marks 20%	10 Marks 20%

Term End Examination : (50 marks)

Syllabus:

Module No.	Contents	Workload in Hrs		
		Theory	Lab	Assess
1	Chemistry in Day- Today Life: Overview of role of Chemistry in our daily life.	1	-	
2	Water Technology and Phase Rule: Importance of potable water, Specifications for drinking water. Water analysis – hardness, alkalinity, chloride and dissolved oxygen, Ill effects of hard water in boilers, Boiler feed water treatments- Zeolite and Ion exchange ,numericals, Desalination techniques, reverse osmosis and electro-dialysis. Phase rule -one component system- Water, Applications and limitations of Phase rule.	7	4	
3	Corrosion Science: Types of corrosion- Dry corrosion- mechanism, Pilling-Bedworth rule, Wet corrosion - mechanism, factors influencing corrosion, Methods of corrosion control- Cathodic protection and anodic, protective coatings- metallic coatings and nonmetallic coatings	5	2	
4	Fuels and Combustion: Classification of chemical fuels, calorific value, Bomb Calorimeter, Solid fuel - Coal - proximate and ultimate analysis. Liquid fuels - Petroleum - composition and refining. . Liquid fuels - Petroleum - composition and refining. Petrol, Diesel and Jet fuels and their quality parameters. Combustion: chemical reactions, calculations of air required, Fuel Cells – Definition, Advantages and limitations, H ₂ -O ₂ Fuel cell.	7	2	
5	Polymer Chemistry: Polymers in day-to-day life, functionality of monomers, polymerization mechanism, thermoplastic and thermosetting polymers, Tm and Tg. Techniques of polymerization. Compounding of plastics. Specialty polymers- Conjugated Polymers, Stimuli-Responsive Polymers, Biodegradable polymers, Recycling of polymers.	6	2	
6	Green Chemistry: Green Chemistry - Definition, goals, twelve principles, need and industrial applications. Traditional and green pathways of synthesis of polyurethane and green hydrogenation methods .	2	0	
7	UV- Visible spectroscopy – Principle, instrumentation and applications.	2	2	

Subject Coordinator

Dr.Kiran Kokate

HOS, Chemistry

Dr.Shubhalaxmi Joshi

Associate Dean, Faculty of Science