

## **BAS102 / BAS202: ENGINEERING CHEMISTRY**

### **Course Objectives:**

1. To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemistry of advanced Materials like Liquid crystals, Nanomaterials, Graphite & fullerenes and Green Chemistry.
2. To enable the students to understand and apply the detailed concepts of spectroscopic techniques and stereochemistry to identify the compounds, element etc.
3. To enable the students to understand and apply the concepts related to Electrochemistry, Batteries, Corrosion and Chemistry of Engineering Materials like cement.
4. To enable the students to understand and apply detailed concepts of water source, water impurities, hardness of water and boiler troubles used in industry as well as analysis of coal & determination of calorific values.
5. To enable the students to understand detailed concepts related to polymers, Polymerization, Polymer Blends and Polymer Composites.

Content	Contact Hours
<b>Unit-1:</b>	<b>8</b>
<b>Atomic and Molecular Structure:</b> Molecular orbital's of diatomic molecules, Bond Order, Magnetic characters and numerical problems.  <b>Chemistry of Advanced Materials:</b> <b>Liquid Crystals:</b> Introduction, Types and Applications of liquid crystals, Industrially important materials used as liquid crystals. <b>Graphite and Fullerene;</b> Introduction, Structure and applications. <b>Nanomaterials;</b> Introduction, Preparation, characteristics of nanomaterials and applications of nanomaterials, Carbon Nano Tubes (CNT), <b>Green Chemistry:</b> Introduction, 12 principles and importance of green Synthesis, Green Chemicals, Synthesis of typical organic compounds by conventional and Green route (Adipic acid and Paracetamol), Environmental impact of Green chemistry on society.	
<b>Unit-2:</b>	<b>8</b>
<b>Spectroscopic Techniques and Applications:</b> Elementary idea and simple applications of UV, IR and NMR, Numerical problems.  <b>Stereochemistry:</b> Optical isomerism in compounds without chiral carbon, Geometrical isomerism, Chiral Drugs.	
<b>Unit-3:</b>	<b>8</b>
<b>Electrochemistry and Batteries:</b> Basic concepts of electrochemistry.  <b>Batteries;</b> Classification and applications of Primary Cells (Dry Cell) and Secondary Cells (Lead Acid battery).  <b>Corrosion:</b> Introduction to corrosion, Types of corrosion, Cause of corrosion, Corrosion prevention and control, Corrosion issues in specific industries (Power generation, Chemical processing industry, Oil & gas industry and Pulp & paper industries).	
<b>Chemistry of Engineering Materials:</b>  <b>Cement;</b> Constituents, manufacturing, hardening and setting, deterioration of cement, Plaster of Paris (POP).	

<b>Unit-4:</b>	<b>8</b>
<b>Water Technology:</b> Sources and impurities of water, Hardness of water, Boiler troubles, Techniques for water softening (Lime-Soda, Zeolite, Ion Exchange and Reverse Osmosis process), Determination of Hardness and alkalinity, Numerical problems.	
<b>Fuels and Combustion:</b> Definition, Classification, Characteristics of a good fuel, Calorific Values, Gross & Net calorific value, Determination of calorific value by Bomb Calorimeter, Theoretical calculation of calorific value by Dulong's method, Ranking of Coal, Analysis of coal by Proximate and Ultimate analysis method, Numerical problems, Chemistry of Biogas production from organic waste materials and their environmental impact on society.	
<b>Unit-5:</b>	<b>8</b>
<b>Materials Chemistry:</b>	
<b>Polymers;</b> Classification, Polymerization processes, Thermosetting and Thermoplastic Polymers, Polymer Blends and Composites, Conducting and Biodegradable polymers, Preparation, properties, industrial applications of Teflon, Lucite, Bakelite, Kelvar, Dacron, Thiokol, Nylon, Buna-N and Buna-S and their environmental impact on society, Speciality polymers.	
<b>Organometallic Compounds:</b> General methods of preparation and applications of Organometallic compounds ( $\text{RMgX}$ and $\text{LiAlH}_4$ ).	

### Course Outcomes:

Upon completion of the course the student should be able to:

Units	Course Outcomes	Bloom's Level
CO-1	Get an understanding of the theoretical principles of chemistry of molecular structure, bonding and properties, Chemistry of advanced materials (liquid crystals, Nanomaterials, Graphite & Fullerene) as well as the Principles of Green Chemistry.	K3
CO-2	Apply the fundamental concepts of determination of structure with various spectral techniques and stereochemistry.	K4
CO-3	Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion and develop understanding of Chemistry of Engineering materials (Cement).	K3
CO-4	Develop understanding of the sources, impurities and hardness of water, apply the concepts of determination of calorific values and analyze the coal.	K3
CO-5	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials. Understanding the applications of specific polymers and Chemistry applicable in industrial process.	K3

### Reference Books:

1. Engineering Chemistry by Rath & Singh, 2<sup>nd</sup> Edition, Cengage Learning India Pvt Ltd Delhi.
2. Engineering Chemistry by SS Dara, S Chand & Co Ltd
3. Engineering Chemistry by Jain & Jain, S.Chand & Comp, New Delhi
4. Engineering Chemistry by K. Sesha Maheswaramma, Pearson
5. Engineering Chemistry by OG Palanna, Mc Graw Hill Education, New Delhi
6. Engineering Chemistry by Shashi Chawala, Dhanpat Rai Publishing Comp, New Delhi
7. University Chemistry by BH Mahan
8. University Chemistry by CNR Rao