| Module | Chapter | Detailed Content | Syllabus Detailing | Learning Objectives |
|-------------|---------|--|--|---|
| Module 1 | Water | Impurities in water, Hardness of water, Potable water standards as per BIS w.r.t. pH, ii)) Alkalinity, iii) TDS, iv) Hardness; Determination of hardness of water by EDTA method and problems. Softening of water by hot, cold lime soda method and problems. Zeolite process and problems. Ion exchange process and problems. | Purpose: To make students to understandwhat causes hardness in water andtypes of hardness. They should be able to understand how hardness of water is estimated by by EDTA methodDiscuss the types of water softening method viz, Hot and cold lime soda method, Zeolite method and Ion exchange method. Scope – 1. Academic Aspects- To study the types of hardness and impurities causing hardness in water. Technology Aspect- To identify the specific type of method for softening of water and think how the method is suitable.3. Application Aspect- Apply the knowledge of softening of water, sewage treatment process to solve real world problem related to respective industry where water is used widely. | define the various types of hardness of water.(R) reciprocate the principle and theory of EDTA technique(U) calculate the hardness of water by EDTA technique(AN) study the principle and theory of Lime soda method. (U) define and apply the principle and theory of Zeolite method. (AP) understand the principle and theory of Ion exchangemethod(U) |

D. Syllabus Detailing and Learning objectives of Applied Chemistry I

| | | | Students Evaluation – | |
|--------|-----------|---|--|-----------------------------|
| | | | 1. Students can be asked to | |
| | | | distinguish between temporary and | |
| | | | permanent hardness. | |
| | | | 2. Students can be asked to explain | |
| | | | EDTA method used for hardness | |
| | | | determination. | |
| | | | 3. Students can be asked to explain | |
| | | | ion exchange method. | |
| | | | 4. Students can be asked to give | |
| | | | mechanism softening of water by | |
| | | | zeolite method. | |
| Module | Water | Part A: Water | Purpose- Tounderstand the need of | 1. To list the |
| 2 | | Drinking water or Municipal | treatment of water. To know how | characteristics of drinking |
| | + Polymer | water,Treatments removal of | the water can be treated by adding | water and the various |
| | | microorganisms, by adding Bleaching | Bleaching powder, Chlorination | disinfection |
| | | powder, Chlorination (no breakpoint | (no breakpoint chlorination), | techniques.(R) |
| | | chlorination). Disinfection by ozone. | Disinfection by ozone, | |
| | | Electrodialysis and Reverse osmosis, | Electrodialysis and Reverse | 2. compare the terms BOD |
| | | ultra filtration. BOD, COD(def,& | osmosis, ultra filtration. | and COD (U) |
| | | significance), sewage treatments | Scope – | |
| | | activated sludge process, numerical | Academic Aspects- To get aware | 3. understand the |
| | | problems related to COD. | about different methods of water | principle and theory |
| | | Part B: Polymers | treatment. | ofsewage treatment |
| | | Introduction to polymers, | 2. Technology Aspect- Methods like | method.(U) |
| | | Classifications. Types of | Reverse osmosis, Ultrafiltration, | |
| | | polymerization Thermoplastic and | Electro dialysis for water treatment. | 4. define monomer, |
| | | Thermosetting plastic Ingredients of | 3. Application Aspect- Sewage | polymer and |
| | | the plastic (Compounding of plastic) | treatment, activated sludge process | polymerization (R) |
| | | Tabuiantian of plastic hy Compression | tabrication of plastic by various | |
| | | radrication of plastic by Compression, | moulding method like compression | 5.list classes of polymers |
| | | Injection , Transfer, Extrusion molding | method, extrusion, injection and | and different types of |
| | | | transter moulding. | |

| | | | Students Evaluation – 1. Students can be asked to explain reverse osmosis, electro dialysis, and ultrafiltration. 2. Students can be asked distinguish to thermoplastic and thermosetting ploymers. 3. Students can be asked to explain various moulding techniques. | polymerization processes(R) 6. distinguish between thermosetting and thermoplastic Polymer (U) . |
|-------------|---------|---|---|---|
| Module 3 | Polymer | Polymer Preparation, properties and uses of Phenol formaldehyde, PMMA, Kevlar. Effect of heat on the polymers (Glass transition temperatures), Viscoelasticity. Conducting polymers, Engineering Plastics. Polymers in medicine and surgery. Rubbers: Natural rubber (latex), Drawbacks of natural rubber, Vulcanization of rubber, Preparation, properties and uses of BunaS, Silicone and Polyurethane rubber. | Purpose – To understand the vast application of polymers in medicine and surgery. To understand the preparation of PMMA, KEVLAR and phenol formaldehyde resins. Understand the mechanism of vulcanization and there need. Scope – 1. Academic Aspects- Student will study the preparation and properties of PMMA, Kevalr and Phenol formaldehyde. 2. Technology Aspect- Types of catalytic cracking used for obtaining petrol from heavy oil. Fuel cells are used to convert chemical energy in to electrical energy. 3. Application Aspect- Use of vulcanized rubber and silicone rubber in various | understand the formation of polymers. (U) study the effect of heat on polymers and their properties.(U) describe the importance of polymers in daily life.(AP) apply the knowledge of conducting polymer for the application in various field. AP) understand the process of vulcanization. (U) Discuss the application of |

| | | | Student Evaluation - 1.Students can be asked to derive numerical aperture 2. Students can be asked to find refractive index of core and cladding 3. Students can be asked to explain the types of an optical fibre. | Buna S (R) |
|-------------|------------|--|--|--|
| Module 4 | Lubricants | Lubricants Introduction, Definition, Mechanism of Lubrication, Classification of lubricants, Solid lubricants (graphite & Molybdenum disulphide), Semisolid lubricants (greases Na base, Li base, Ca base, Axle greases.), Liquid lubricants, Additives in blended oils. Important properties of lubricants, definition and significance of - Viscosity ,Viscosity index, Flash and Fire points, Cloud and Pour points, Oiliness, Emulsification, Acid value and problems, Saponification value and problems. | Purpose – This chapter emphasizes on the different types of lubricants and their applications in various types of machinery. Scope – 1. Academic Aspects- Students will learn different type's mechanism of lubrication. 2. Technology Aspect- Use of graphite in various food processing industry. Need of semisolid lubricants and blended oils in various industries as lubricants. 3. Application Aspect- Use of thick film mechanism in sewing machine, Use of thin film mechanism in rail axle boxes. Student Evaluation - 1. Students can be asked to define propertiessuch as Acid value, Saponification value, cloud point, pour point, flash point fire point. 2. Students can be asked to explain mechanism of hydrodynamic lubrication. | understand the relationship between friction and wear (U) understand the various mechanisms of lubrication.(U) explain the different types of lubricants(R) analyze the various properties of lubricants(AN) apply the lubrication mechanism as per the operating condition(R) apply the knowledge of lubricants for selecting a particular lubricant for lubrication. (AP) |

| | | | 3.Students can be asked explain the structure of graphite, molybdenum disulphide and how it acts as lubricants. | |
|---|------------|---|--|---|
| 5 | Phase Rule | Phase Rule Gibb's Phase Rule, Term involved with examples, One Component System (Water), Reduced Phase Rule, Two Component system (PbAg), Applications and Limitations of Phase Rule. | Purpose – To learn the Gibbs phase rule and terms involved in it. Scope – Academic Aspects- Students will learn the term Phase, Component and degree of freedom. Technology Aspect- Phase rule can be used for manufacturing of alloys Application Aspect- Application of one component system to water and two component system to Ag-Pg system. Student Evaluation – Students can be asked to explain the term phase, component and system. Students can be asked to explain dibbs phase rule and reduced phase rule. Students can be asked to give limitations of phase rule. | understand Gibb's phase rule and terms involved in it and its significance.(U) learn Phase diagram and its application for one and two component systems (U). understand one component system of water(U) draw phase diagram for two component system. (AP) calculate degree of freedom by using mathematical expression of phase rule(AN) list the limitation and advantages of phase rule(R) |

| Module | Important | | Purpose – | 1.study the terms: |
|--------|-------------|------------------------------------|---|-----------------------------|
| 6 | Engineering | Important Engineering Materials | This chapter discusses the functions | Cement, Concrete, RCC |
| | Materials | Cement: Manufacture of Portland | of various ingredients used in | and their importance.(R) |
| | | Cement, Chemical Composition and | manufacturing of cement. It also | _ |
| | | Constitution of Portland Cement, | makes aware about different known | 2. learn different steps in |
| | | Setting and Hardening of Portland | examples of various cements. It Put | manufacturing of |
| | | Cement, Concrete RCC and Decay. | focus in the area of nanomaterials. | Portland cement.(U) |
| | | Nanomaterials, Preparation (Laser | Scope – | |
| | | and CVD method), properties and | 1. Academic Aspects- | 3. understand the |
| | | uses of CNTS, Fullerene properties | Students will explore different types | mechanism of setting and |
| | | and uses. | of cement. How properties of | hardening of Portland |
| | | | cement get changed after varying the | cement.(U) |
| | | | ratio of different ingredients. | |
| | | | 2. Technology Aspect- | 4. explain the difference |
| | | | Formation of carbon nanotubes by | between concrete & |
| | | | CVD and laser ablation method. | RCC.(R) |
| | | | 3. Application Aspect- | |
| | | | Use of cements in various types of | 5. state preparation, |
| | | | construction. Use of carbon | properties & uses of |
| | | | nanotubes and fullerene. | CNTs(R) |
| | | | Student Evaluation – | |
| | | | 1. Students can be asked to give the | 6. learn the properties and |
| | | | functions of various ingredients used | uses of fullerene(U) |
| | | | manufacturing of cement. | |
| | | | 2. Students can be asked to list the | |
| | | | application of carbon nanotubes. | |
| | | | 3. Students can be asked to give the | |
| | | | applications, properties of fullerenes. | |