**VISION**

To impart the fundamental knowledge in chemistry, enabling the student understands, synergise, apply and evaluate through critical thinking and learning experiences which can serve as a beacon for excelling in engineering.

**MISSION**

* Providing a creative and supportive platform for student centered and faculty mentored learning.
* Designing the course to provide hands on experience that suitable compensates the classroom learning.
* Inculcating independent and collaborative learning, where students can comprehensively applies skills in the context of their program.
* Thriving to update infrastructure compatible to the requirements of an Engineer
* Constantly encouraging faculty in pursuing higher qualification and promote research in their areas of interest, participating in professional body activities.
* Continuously updating teaching skills, pedagogical tools and exposure to the contemporary industrial practices.

**FACULTY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No** | **Name of the Staff** | **Educational Qualifications** | **Designation** | **Area of Specialization** |
| 1 | Dr. T V N Partha Sarathi | M.Sc., M. Phil., Ph.D | Professor & HOD | Inorganic and Analytical Chemistry |
| 2 | Dr. Abdul Rajack | M.Sc., Ph.D | Sr. Assistant Professor | Organic Chemistry |
| 3 | Mr. G. Ram Kumar | M.Sc., (Ph.D), PGDCAQM, PGDBM | Assistant Professor | Analytical Chemistry |
| 4 | Dr. G V S R Pavan Kumar | M.Sc., Ph.D | Assistant Professor | Analytical Chemistry |

**Non- teaching**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Name of the Staff** | **Designation** |
| 1 |  | Demonstrator |
| 2 | Smt. V. Krishnaveni | Lab Technician & ANM |
| 3 | Mr. S. Satyanarayana | Lab Assistant |

The department is housing four laboratories, where two are exclusively for regular laboratory course work of B.Tech courses and the remaining two are for carrying the research in advanced topics, funded research and aiming the services of social concern. The four laboratories in the department are as follows

* ENGINEERING CHEMISTRY LAB-I
* ENGINEERING CHEMISTRY LAB-II
* CENTRAL RESEARCH FACILITY (DEPARTMENT OF CHEMISTRY)
* WATER QUALITY TESTING LAB (WQTL)

**SYLLABUS**

**Engineering Chemistry (Common to all)**

**UNIT 1: WATER TECHNOLOGY**

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles **-** scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

**UNIT 2: POLYMERS**

Introduction to polymers, functionality of monomers, addition and condensation polymerization, copolymerization, stereospecific polymerization with specific examples. Thermoplastics and Thermo-sets – their differences.

Elastomers – applications with specific examples- Preparation, properties and uses of PVC, Bakelite, Teflon and Nylon-6, 6, Buna-S and Thiokol rubber- Fibre reinforced plastics – carbon fibre, glass fibre and aramids.

**UNIT 3: ELECTROCHEMISTRY AND APPLICATIONS**

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells –dry cell- Secondary cells – lead acid, nickel-cadmium and lithium ion batteries- working of the batteries including cell reactions- Fuel cells, hydrogen-oxygen, and methanol fuel cells – working of the cells.

Corrosion: Introduction to corrosion, mechanism of dry and wet corrosion, Pilling Bedworth ratios and uses, Types of corrosion – Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion, Factors affecting the rate of corrosion – metal based factors and environmental based factors, protection techniques – metal coatings – galvanization and tinning, cathodic protection, inhibitors – cathodic and anodic, organic coatings – paints – constituents and their functions.

**UNIT-4: CHEMISTRY OF ADVANCED MATERIALS**

**NANOMATERIALS:** introduction- synthesis of Nano material by sol gel method- CVD- engineering applications of Nano materials

**CEMENT**: Introduction to ordinary Portland cement- manufacturing of OPC- setting and hardening of cement- decay of cement.

**FUELS**: Introduction- classification- liquid fuels- cracking- knocking- octane number and cetane number; Lubricants- definition- mechanism and properties of lubricants

**UNIT 5: INSTRUMENTAL METHODS AND APPLICATIONS**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert’s law. Principle, instrumentation (Block diagram and working), applications of UV, IR and NMR spectroscopic methods. Chromatography- introduction- Ion exchange chromatography- applications

**COURSE OUTCOMES:**

**CO1:** The student will be able to differentiate between hard and soft water, boiler troubles, understand the methods of softening of water for industries. He/ She will be able to explain the principles of desalination and can estimate the hardness present in the water and validate its result with BIS and WHO standards.

**CO2:** The student will be able to explain various types of polymers, and preparation, properties and engineering applications of thermoplastic, thermosetting plastics, rubbers and FRP’s.

**CO3:** The student will acquire the fundamental knowledge of Electrochemistry/ electrochemical reactions to understand the principles of batteries, fuel cell and corrosion.

**CO4:** The student gains knowledge in various engineering materials such as nanomaterials, cement. Student will also be able to explain the methods of cracking, knocking and selection of suitable liquid fuels.

**CO5:** The student will be able to understand electromagnetic spectrum and explain the working principles of IR, UV, NMR and chromatographic techniques.

*Text books:*

1. Teh Fu Yen Chemistry for Engineers Imperial college press, London
2. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
3. S.S. Dara ,Text Book of Engineering Chemistry, S. Chand Technical Series
4. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
5. K. Sesha Maheswaramma and MridulaChugh Engineering Chemistry Pearson Publications

*Reference books:*

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. H.Kaur, Instrumental Methods of chemical analysis, Pragathi Prakashan, 2012.
3. M. R. Senapati Advanced Engineering Chemistry Laxmi Publications Pvt Ltd
4. Kamaraj. P & Arthanareeswari. M “*Applied Chemistry”, 9th Edition*, Sudhandhira Publications, 2012.

**CO/PO Mapping**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Title: | | | | Engineering Chemistry (Common to all Branches) | | | | | | | | | | |
| Course Code: | | | | A3CYT101 | | | | | | | | | | |
| Course Designed by | | | | Dept. of Chemistry | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 2 | 1 |  | 1 |  |  |  |  | 1 |  |  |  |
| CO2 | 3 | 2 | 3 | 1 |  | 1 | 1 |  |  | 1 |  |  |  |  |
| CO3 | 3 | 2 | 2 |  |  | 1 | 1 |  |  |  |  |  |  |  |
| CO4 | 3 | 1 |  | 1 | 2 |  |  |  |  |  |  |  |  |  |
| CO5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | 1 |  |  |

|  |  |
| --- | --- |
| **Course designed by** | **Department of chemistry** |
| Approval | Approved by: Meeting of Board of Studies held on 2.08.2021 |
| Ratified by: 6th Meeting of Academic Council, 18-09-2021 |

**Engineering Chemistry – Laboratory (Common to all)**

**List of Experiments:**

1. Determination of HCl using sodium carbonate
2. Determination of Hardness of a groundwater sample.
3. pH metric titration of strong acid vs. strong base
4. Condcutometric titration of Strong acid VS Strong base
5. Condcutometric titration of Weak acid VS strong base
6. Potentiometric titration of Fe(II) with potassium dichromate
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of a polymer
9. Determination of viscosity of polymer solution using survismeter
10. Determination of percentage of Iron in Cement sample by colorimetry
11. Estimation of Calcium oxide in port land Cement
12. Preparation of Nanomaterials (ex: Fe/ Zn/ Ferrite)
13. Adsorption of acetic acid by charcoal
14. Determination of acid value and saponification value of a given lubricant

**Course Outcomes:**

**CO1:** The student will be able to determine total hardness, strength of acid in a lead acid battery, calcium in Portland cement using volumetric analysis

**CO2:** The student will be able to explain condcutometric, potentiometric, pH metric titrations and colorimetric determination.

**CO3:** The student will be able to explain the synthesis of a polymer, nanomaterials

**CO/PO Mapping**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Title: | | | | Engineering Chemistry (Common to all) | | | | | | | | | | |
| Course Code: | | | | A3CYL101 | | | | | | | | | | |
| Course Designed by | | | |  | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 |  | 1 |  |  | 1 |  |  |  | 1 | 1 | 2 |  |  |
| CO2 | 3 |  | 1 |  |  | 1 |  |  |  | 1 | 1 | 1 |  |  |
| CO3 | 3 |  | 1 |  |  |  |  |  |  | 1 | 1 | 1 |  |  |

**STANDARD BOOKS:**

1. Text of Quantitative Chemical analysis, A I Vogel, 6th Edition, Cengage Learning.
2. Quantitative Chemical Analysis, Day and Underwood, Prentice Hall Publications
3. Dr. Jyotsna Cherukuis(2012)Laboratory Manual of Engineering Chemistry-II, VGS Techno Series
4. K. Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication

|  |  |
| --- | --- |
| **Course designed by** | Department of chemistry |
| **Approval** | Approved by: Meeting of Board of Studies held on 2.08.2021 |
| Ratified by: 6th Meeting of Academic Council, 18-09-2021 |

**ENGINEERING CHEMISTRY (Theory)**

**LESSON PLAN**

|  |  |  |
| --- | --- | --- |
| **UNIT NO.** | **TOPICS TO BE COVERED** | **NO. OF PERIODS REQUIRED** |
| **I** | **WATER TECHNOLOGY:** Introduction –Soft Water and hardness of water | 1 |
| Estimation of hardness by EDTA Method problems related to calculation of total hardness of water | 1 |
| Boiler feed water Boiler troubles | 1 |
| Scales and Sludge’s , Boiler Corrosion, | 1 |
| Caustic embrittlement, Priming and Foaming | 1 |
| Softening of water – Lime – Soda Method, Zeolite Method – | 2 |
| Bureau of Indian Standards(BIS) and World health organization(WHO) standards | 1 |
| Icon exchange process - Reverse osmosis – Electro Dialysis | 1 |
| **II** | **POLYMERS** :Introduction to polymers, functionality of monomers, addition and condensation polymerization | 1 |
| Copolymerization, stereospecific polymerization with specific examples. | 2 |
| Plastics – Thermoplastics and thermo setting plastics – Compounding of plastics | 1 |
| Moulding techniques of Plastics – compression, injection, transfer and extrusion moulding, | 1 |
| Preparation and properties of Polyethylene, PVC, Bakelite and Teflon. | 1 |
| Elastomers – Natural Rubber and Vulcanization | 1 |
| Synthetic rubbers – Preparations, properties and uses of Buna – S, Buna – N, Thiokol. | 1 |
| Fibre reinforced plastics – carbon fibre, glass fibre and aramids.  **<** | 1 |
| **III A** | **ELECTROCHEMISTRY:** Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations | 2 |
| Primary cells –dry cell- Secondary cells – Dry cell, Alkaline battery , nickel-cadmium working of the batteries including cell reactions | 1 |
| Batteries - Lead acid battery, , Nickel Cadmium Battery. lithium ion batteries | 1 |
| Fuel cells, hydrogen-oxygen, and methanol fuel cells | 1 |
| **III B** | **CORROSION:** Introduction to corrosion, mechanism of dry and wet corrosion, Pilling Bedworth ratios and uses | 2 |
| Types of corrosion – Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion | 1 |
| Factors affecting the rate of corrosion – metal based factors and environmental based factors | 1 |
| Protection techniques – metal coatings cathodic protection, inhibitors – cathodic and anodic, | 1 |
| Surface coatings - Types - Methods of application on metals (Hot dipping, Galvanizing, tinning) | 1 |
| Organic coatings – paints – constituents and their functions | 1 |
| **IV** | **NANOMATERIALS:** Introduction- synthesis of Nano material by sol gel method- CVD- engineering applications of Nano materials | 2 |
| **FUELS**: Introduction- classification- liquid fuels- cracking- knocking | 1 |
| Catalytical cracking- knocking- octane number and cetane number; | 2 |
| **CEMENT**: Introduction to ordinary Portland cement- manufacturing of OPC- setting and hardening of cement- decay of cement | 2 |
| **Lubricants**- definition- mechanism and properties of lubricants | 1 |
| **V** | ,,  **INSTRUMENTAL METHODS AND APPLICATION:** Electromagnetic spectrum. Absorption of radiation: Beer-Lambert’s law. | 3 |
| Principle, instrumentation (Block diagram and working), | 3 |
| Applications of UV, IR and NMR spectroscopic methods. | 2 |
| Chromatography- introduction- Ion exchange chromatography- applications | 2 |
|  | Total | 48 |

**ENGINEERING CHEMISTRY LAB**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Name of the experiment** | **No. of periods required** |
| 1 | Introduction to Chemistry laboratory and Orientation  , | 03 |
| 2 | Introduction for basic Glass ware, Laboratory Safety, GLP | 03 |
| 3 | **Minimum of 10 experiments to be carried out by each student** | 30 |
| 4 | Internal Examination | 03 |
| 5 | Project based learning | 06 |
| 6 | **Total** | 45 |