Applied Chemistry Syllabus for FYBTECH

Course Code CH-19001

Teaching Scheme: **Evaluation Scheme:**

Lectures: 3hrs / week **T1-20M, T2-20M**

Practical: 2hrs/week **End-SemExam:60M**

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Course Education Objectives (CEO)

1. To impart the understanding of fundamental principles, analytical methods and the technological aspects of modern chemistry.
2. To build the ability to analyze engineering problems based on the knowledge of chemistry
3. To develop problem-solving ability
4. To keep students abreast with the latest developments and applications of modern materials
5. To gain hands-on experience through laboratory sessions

Course Outcomes(CO)

1. Appreciate material properties and their engineering applications
2. Analyze and select the most appropriate engineering material
3. Perform experiments to establish suitability of various chemicals, materials and techniques
4. Develop problem solving ability to justify choice of chemicals and materials
5. Acknowledge the current developments in the field of nanotechnology, energy storage systems and green chemistry for sustainable development

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Unit 1: (A) Material Chemistry (B) Corrosion and corrosion control (9 Hrs)

Introduction to the basics of chemistry, Relevance of Chemistry to different Engineering specializations, Classification & Properties of Materials: Metals and alloys, ceramics and glasses, refractories, Cement, polymers, composites, Nanomaterials: definition, types, properties and applications, Electrochemistry of

corrosion, Mechanism of dry corrosion, Mechanism of wet corrosion, Factors affecting corrosion, Testing of corrosion: Weight-loss and weight-gain method, Microscopic exam, Methods of corrosion prevention, Cathodic protection- Sacrificial anode, Cathodic protection- Impressed current, Anodic protection, Protective coatings- examples of Metallic coatings, Examples of non-metallic coatings- paints

Unit 2: Polymer Chemistry (7Hrs)

Introduction- Classification of polymers- based on origin, based on polymer type, polymerisation mechanism, based on popular forms-fibres, films, etc, based on performance-commodity, speciality, engineering, Polymer Terminologies, Commercially important polymers with synthesis and applications- plastics, fibres, Commercially important polymers with synthesis and applications- adhesives, elastomers, Conducting polymers- Intrinsic and extrinsic conducting polymers, doping, factors responsible for conduction, synthesis of a conducting polymer, Properties of polymers- Solubility, Molecular Weight, Crystallinity, Properties of polymers- glass transition temperature, Role of additives in polymers.

Unit 3: Instrumental Methods of Chemical Analysis (7Hrs)

Qualitative and Quantitative analysis, Accuracy, Precision, Reliability of Analytical data, Confidence limit, Conventional methods of Analysis: Titrimetric, gravimetric; Principle, one example of estimation, Advantages of Instrumental Methods of Modern analytical techniques: an overview, electro-analytical, chromatography, thermo-analytical, Spectroscopy, XRD, TEM, SEM, Nephlometry, Turbidimetry, Spectroscopy: Principle, EM radiation, Beer-Lambert's law, Deviations of Beer-Lambert's law, Various types of shifts, Electronic transitions, Ultraviolet-Visible Spectroscopy- instrumentation, working & applications, Infrared Spectroscopy- instrumentation, working & applications, Use of spectroscopy as an analytical tool

Unit4: Energy Storage systems (7Hrs)

Introduction and overview, Basic principles and electrochemistry, Batteries- characteristics, Li- ion batteries, Fuel cells- Principle of Fuel Cell, Components of a fuel cell. Various types of fuel cells, AFC, PEMFC and their applications, Methanol

based fuel cell and its applications, Hydrogen production, Hydrogen storage system

Unit 5: Water Chemistry (6Hrs)

Specifications for water, Impurities in water (Suspended, Biological & Dissolved), Water quality parameters, Analysis of water: Alkalinity- methods & numerical, Hardness & Chloride content- methods & numerical, DO, BOD, COD, conductivity, Treatment of drinking water - membrane filtration & Reverse Osmosis, Treatment of wastewater

Unit 6: Green Chemistry (6Hrs)

12 principles of green chemistry, Synthesis of chemicals by green chemistry routes, 3Rs- Reduce, Reuse and Recycle, Disposal of plastics, Biodegradable polymers- need, constituents required, Biodegradable polymers- factors, properties & applications

Text Books

1. A textbook of Engineering Chemistry: Jain and Jain, Dhanpatrai Publication.
2. A textbook of Engineering Chemistry: S. S. Dara, S. Chand Publication 2010 edn.
3. A textbook of Engineering Chemistry: Shashi Chawla, Dhanpatrai Publication.

List of Recommended Books

1. Polymer Science: V.R.Gowariker, New Age International Publication
2. Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens.
3. Fuel Cells- Shripad Revankar, Pradeep Majumdar
4. Fuel Cell Fundamentals-Ryan O'Hayre, Suk-Won Cha,John wiley & Sons
5. Recent trends in Fuel Cell Science and Technology-Suddhasatwa Basu,Anamaya Publishers,New Delhi
6. Instrumental Methods of Chemical analysis, Willard Dean, Merrittee, Tata MacGrow Hill Limited

LIST OF EXPERIMENTS

Teaching Scheme: **Evaluation Scheme:**

Practical: 2hrs/week **Total Marks: 100 M**

CCE: 70M, ESE: 30M

1. Preparation and Standardization of Analytical Reagents
2. Determination of chloride content of water by Mohr's method
3. Determination of temporary and permanent hardness of water sample by EDTA method.
4. Determination of total alkalinity of the water sample.
5. Estimation of copper from brass by iodometry
6. Preparation of a chemical compound using green chemistry pathway
7. pH-metric titration of Acid/Base
8. Colorimetric determination of a concentration of a given inorganic sample.
9. Preparation of a polymer
10. Determination of the molecular weight of a polymer using Ostwald's viscometer.
11. Preparation of a nanomaterial