SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMKUR-3.

(Autonomous Institution affiliated to VTU, Belgaum)

Department: **CHEMISTRY** Subject: **ENGINEERING CHEMISTRY**

I/II Semester B.E. Common for all branches

Syllabus from the Academic year 2018-19 onwards

Subject code: **1 RCHE**

Lecture Hours/Week	: 4	Sessional Marks	: 50
		End semester exam. marks	: 100
Total Hours	: 48	Credits	: 4

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

1. Determine the electrode potential of newly constructed electrodes, calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples. Also, estimate the amount of metal(s) in effluents.
2. Develop new materials for construction of batteries/fuel cells to improve their performance.

   Protect the metals/alloys from undergoing corrosion by adopting suitable corrosion control methods.
3. Identify the change of phases on change in variables such as pressure, temperature and composition and correlate the changes to micro structure and thereby properties and mechanical applications.

   Apply the knowledge of colorimetry, potentiometry and conductometry in chemical analysis and carryout estimation of metals and other pollutants in industrial effluents samples.
4. Develop new polymers/polymer composites which find applications in the field of engineering.
5. Will be able to gain awareness of water quality, parameters which determine the water quality and their determination.

MODULE - I
ELECTRODE POTENTIAL, CELLS AND APPLICATIONS

Introduction to electrode potential, Single electrode potential - Definition, origin, sign conventions, Derivation of Nernst equation for single electrode potential. Effect of temperature and concentration on single electrode potential. Standard electrode potential (Definition). Electrochemical cells- Classification - Electrolytic cells and galvanic cells. Construction of a galvanic cell (Ex. Daniel cell). E.M.F of a cell – Definition, notation and conventions, Measurement of single electrode potential using Poggendorf's method. Concentration cells – Definition, construction. Concentration cells with and without transference. Derivation of an equation for E.M.F of concentration cells. Electrodes – Types - Reference electrodes – calomel electrode, Ag-AgCl electrode. Numerical problems on E, E^o, EMF of cells and concentration cells. Glass electrode (Ion-selective electrode) - Determination of pH using glass electrode.

10 Hours

MODULE – II

BATTERY TECHNOLOGY

Batteries – Basic concepts, components of a battery, operation of a battery. Advantages of using nanomaterials as electrode materials, different types of electrolytes. Classification of batteries – Primary, secondary and reserve batteries. Battery characteristics. Classical batteries – construction, working and applications of lead-acid and Ni-Cd battery, Zinc-Ag_2O battery. Modern batteries- construction, working and applications of Zn-air, nickel-metal hydride and lithium batteries- criteria for the selection of lithium for battery, difference between lithium-MnO_2 battery and lithium ion battery. Introduction to eco-friendly batteries. **05 Hours**

CORROSION SCIENCE

Metallic corrosion - Definition, corrosion interrelated problems. Electrochemical theory of corrosion. Common types of corrosion - Differential metal corrosion, differential aeration corrosion (waterline corrosion, pitting corrosion) and stress corrosion. Factors affecting the rate of corrosion. Hydrogen overvoltage and Tafel equation. Numerical problems on corrosion rate. Corrosion control methods – anodizing, phosphating, galvanizing, tinning, corrosion inhibitors. Cathodic and anodic protection**.** Use of nano materials for corrosion control**.** **05 hours**

MODULE **- III**

PHASE EQUILIBRIA

The phase rule – Statement, meaning of the terms involved in the phase rule, with examples. Application of phase rule to one component system – Water system. Two component system - Pb-Ag system, Eutectic point. Desilverization of lead. **4 hours**

INSTRUMENTAL METHODS OF ANALYSIS

Introduction- Types of analysis- Qualitative, quantitative, instrumental methods. Advantages of instrumental methods of analysis over physical and chemical methods. Electro optical methods- Colorimetry **–** Principle, Lambert's law, Beer's law, Derivation of Beer-Lambert's law, instrumentation and applications. Numerical problems. Electrochemical methods - Potentiometry – Principle, advantages and applications. Types of potentiometric titrations – Neutralization (acid-base), redox and precipitation titrations, Conductometry - Principle, advantages and applications. Applications of conductometric titrations- strong acid against a strong base, strong acid against a weak base, weak acid against a strong base, weak acid against a weak base, mixture of acids (strong acid+ weak acid) against a strong base, precipitation titration. **5 hours**

MODULE – IV

POLYMER SCIENCE

Definition, classification – Based on occurrence, method of preparation, structure (linear, branched and crosslinked), effect of heat on polymer. Polymerization - Definition, types – addition and condensation with examples. Techniques of polymerization - bulk, solution, suspension and emulsion polymerization. Mechanism of polymerization - free radical mechanism (ethylene as an example). Weight average and number average molecular weight - Definition, numerical problems. Glass transition temperature (Tg) – Definition - factors affecting Tg and significance of Tg. Resins and Plastics – Compounding of resins. Synthesis, properties and applications of Teflon (PTFE), PMMA, polyurethanes, Polyethylene terphthalate (PET) and phenol-formaldehyde. Elastomers - Deficiencies of natural rubber. Synthesis and applications of butyl rubber, Buna-S and Acrylonitrile butadiene styrene **(**ABS). Adhesives – Synthesis and applications of epoxy resins. Polymer

composites – Definition and advantages. Synthesis and applications of Polyaramides (Kevlar). Bio-degradable plastics.

Conducting polymers - Definition, mechanism of conduction in polyacetylene. Polymer nanocomposites- definition, properties, synthesis and applications. **10 Hours**

MODULE – V

WATER TECHNOLOGY

Introduction- Impurities present in water. Chemical analysis of water: Determination of (i) Total hardness using EDTA (ii) Alkanility (iii) Chloride by Mohrs method (iv) Nitrate using Phenoldisulphonic acid (v) Dissolved oxygen by Winkler method (vi) Chemical oxygen demand and Biological oxygen demand. Numerical problems on hardness of water and COD. Water softening by Reverse osmosis (RO) - Principle and process. Membranes for RO. **09 Hours**

TEXT BOOKS

1. Engineering Chemistry - A text book of Chemistry for Engineers, Suba Ramesh and others. Wiley India, First Edition. 2011.

REFERENCE BOOKS

(Electrode potential, cells and applications)

1. Elements of Physical Chemistry, Samuel Glasstone and David Lewis, The Macmillan Press Limited, Reprint: 1976.
2. Physical Chemistry, Walter J Moore, Longmans Green and Co. Ltd., 1966.

(Battery technology)

3. Industrial electro chemistry, Derek Pletcher and Frank C. Walsh, Blackie academic and professional, 1993.
4. Chemical and electro chemical energy systems, R. Narayan, B. Viswanathan, University Press (India) Ltd., 1998.

(Corrosion science)

5. Corrosion Engineering, M.G. Fontana, McGraw Hill Publications, New York, 1987.
6. Industrial electro chemistry, Derek Pletcher and Frank C. Walsh, Blackie academic and proessional,1993.

(Phase equilibria)

7. A Text book for engineers, Wiley India Pvt. Ltd., First edition 2011.

(Instrumental methods of analysis)

8. Instrumental analysis, Douglas A Skoog, F.James Holler and Stanley R. Crouch, Cengage learning India Pvt. Ltd., 2010.

9. Instrumental Methods of Analysis. H. H. Willard, L.L. Merritt and J.A. Dean and F. A. Settle, CBS Publishers, 7th Edition, 1988.

(Polymer science)

10. Text Book of Polymer Science, F.W. Billmeyer, Wiley Inter science publications , 1994.

11. Polymer science, V.R. Gowriker, N. V. Viswanathan, Jayadev Sreeshar, New age International (P) Ltd., 1996.

12. Nanocomposite science and technology – P.M. Ajayan, L.S. Schadler, P.V. Braun, Wiley, New York

(**Water Technology**)

13. A text book of Environmental Chemisty and pollution and pollution control.- . S. S. Dara, D.D. Mishra, S Chand, 2012.

14. Chemistry for Engineering Students- B.S.Jai Prakash, R.Venugopal, Shivakumaraiah, Pushpa Iyengar.

---**---