I Year I Semester	L	T	P	C
Code: 17CH101	3	1	0	3

ENGINEERING CHEMISTRY
(Civil Engineering and Mechanical Engineering)

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Learning Objectives:

1. Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
2. The basics for the construction of galvanic cells as well as some of the sensors used in instrumentsare introduced. Also if corrosion is to be controlled, one has to understand the mechanism ofcorrosion which itself is explained by electrochemical theory.
3. With the increase in demand, a wide variety of materials are coming up; some of them have excellentengineering properties and a few of these materials are introduced.
4. Understanding of crystal structures will help to understand the conductivity, semiconductors and superconductors. Magnetic properties are also studied.
5. With the increase in demand for power and also with depleting sources of fossil fuels, the demand for alternative sources of fuels is increasing. Some of the prospective fuel sources are introduced.

UNIT I: HIGH POLYMERS AND PLASTICS

Polymerisation: Introduction - stereoregular polymers – Thermoplastics and Thermosetting plastics – Compounding and fabrication (3 techniques) - Preparation, properties and applications of polyethene, PVC, Bakelite Teflon and polycarbonates Elastomers – Natural rubber-compounding and vulcanization – Synthetic rubbers: Buna S, Buna N, Thiokol and polyurethanes – Fiber reinforced plastics – conducting polymers – biodegradable polymers.

UNIT II: FUEL TECHNOLOGY

Fuels:- Introduction – Classification – Calorific value - HCV and LCV – Dulong's formula – Bomb calorimeter – Numerical problems – Coal - Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum- Refining – Cracking – Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents – Gaseous fuels – Natural gas. LPG and CNG – Combustion – Calculation of air for the combustion of a fuel – Flue gas analysis – Orsat apparatus – Numerical problems on combustion

UNIT III: ELECTROCHEMICAL CELLS AND CORROSION

Galvanic cells - Reversible and irreversible cells – Single electrode potential – Electro chemical series and uses of this series- Standard electrodes (Hydrogen and Calomel electrodes) - ConcentrationCells – Batteries: Dry Cell - Ni-Cd cells

Corrosion:- Definition – electrochemical theory of corrosion and it's mechanism – Types of electrochemical corrosion - Galvanic corrosion, concentration cell corrosion, differential aeration corrosion, waterline corrosion and pitting corrosion - Galvanic series – Factors
Influencing rate of corrosion - Protection from corrosion – Cathodic protection - Protective coatings: anodic and catholic coatings – Methods of application on metals (Galvanizing, Tinning, Electroplating)

UNIT IV: CHEMISTRY OF ADVANCED MATERIALS

Nano materials:- Introduction – sol-gel method & chemical reduction method of preparation –
Carbon nano tubes (CNTs) and fullerenes: Types, preparation, properties and applications
Liquid crystals:- Introduction – Types – Applications.
Superconductors:- Type-I & Type-2 superconductors, properties &applications
Green synthesis:- Principles – 3 or 4 methods of synthesis with examples

UNIT V: WATER TECHNOLOGY

Hard water:- Reasons for hardness – units of hardness - water for steam generation - Boiler troubles
– Priming and Foaming, scale formation, boiler corrosion, caustic embrittlement - Softening of Hard water : Lime – Soda process, Zeolite process and numerical problems based on these processes and Ion Exchange process - Water for drinking purposes-Purification – Sterilization and disinfection : Chlorination, Break point chlorination and other methods – Reverse Osmosis and Electro Dialysis.

UNIT VI: CHEMISTRY OF ENGINEERING MATERIALS AND FUEL CELLS

Refractories: - Definition, characteristics, classification, properties, failure of refractories
Lubricants: - Definition, function, Theory and mechanism of lubricants, properties (Definition andimportance)
Cement: - Constituents, manufacturing, hardening and setting, deterioration of cement
Fuel cells: - Hydrogen Oxygen fuel cells – Methanol Oxygen fuel cells

Outcome: The advantages and limitations of plastic materials and their use in design would be understood. Fuels which are used commonly and their economics, advantages and limitations are discussed. Reasons for corrosion and some methods of corrosion control would be understood. The students would be now aware of materials like nano materials and fullerenes and their uses. Similarly concept of superconductors is understood. The importance of green synthesis is well understood and how they are different from conventional methods is also explained. The impurities present in raw water, problems associated with them and how to avoid them are understood. The advantages and limitations of plastic materials and their use in design would be understood. The commonly used industrial materials are introduced.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, UniversityPress, IIM