



CHEM 1001	Chemistry	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12 th level Chemistry				
Co-requisites	--				

Course Objectives

Objectives of the course are:

1. To make students familiar with the fundamental concepts of chemistry.
2. To make the students understand the various basic chemical reactions, related calculations and reasoning.
3. To prepare the students for studying advanced subjects with required knowledge of chemistry.

Course Outcomes

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

- CO1. To know the basic concepts of chemistry w.r.t thermochemical reactions, reaction dynamics, water chemistry, electrolysis, electrochemical reactions, polymers and Nanochemistry.
- CO2. To explain the parameters and techniques to improve the quality of water.
- CO3. To apply the concepts of chemistry in reaction dynamics, corrosion related problems and selecting suitable fuel for various domestic/industrial applications
- CO4. To analyze the results of various analytical/chemical procedures

Catalogue Description

Chemistry is present everywhere around us. It is existing in everything we see, feel or imagine. It is one of the very fundamental basics behind every structure, building, bridge, refinery and industry. In this course, focus will be on firming the basic knowledge of students about chemistry. Students will learn how to use the concepts correctly through prescribed syllabus. They will be taught various types of fuels. Different processes used to improve the quality of fuels in refineries will be discussed. Combustion calculations related to oxygen or air required will help them to get an effective fuel:O₂ ratio to result in proper and complete combustion. Water chemistry will make the students understand various parameters of water quality and the treatments to improve it. Chemical dynamics will help them to understand the mechanism of reaction. This knowledge will make them able to control the factors to move the reaction in desired direction. Corrosion is based on electrochemical cells. For any engineer, it is quite mandatory to have an understanding to select the suitable metal and also the methods to protect it from decaying. They will also be discussed about various types of polymers and nanomaterials so that they can correlate their properties to their various application areas. Course delivery will be made by classroom teaching, Blackboard, presentations, videos and tutorial classes.

Course Content

UNIT 1: FUELS & THERMOCHEMISTRY

10 LECTURE HOURS

Prerequisite: Enthalpy of formation, Enthalpy of neutralization and Enthalpy of combustion, Hess's law of constant heat summation and its application, bond energy

Contents: Fuels - Introduction, Classification, Important properties of a good fuels, Calorific value, Determination of calorific value by Bomb calorimeter, Analysis of coal- proximate, Ultimate analysis, Combustion and its calculations, Distillation of crude oil, composition of petroleum, Important reactions for petroleum industries (isomerization, dimerization, aromatization, cracking), Octane number, cetane number, renewable energy sources: biodiesel, biogas, bioethanol. Hydrocarbons chemistry: Basic concepts for preparation strategy, chemical properties and reactivity of aliphatic (alkanes, alkenes, alkynes, cycloalkanes) and aromatic hydrocarbons.

UNIT 2: REACTION DYNAMICS

9 LECTURE HOURS

Prerequisite: Rate of reaction and rate constant, factors affecting rate of a reaction, order and molecularity of a reaction, Rate expression for zero and first order

Contents: Pseudo first order reaction, Second (2A & A+B) and third (3A) order reaction, Methods of determining order of a reaction: Hit and trial method, half-life period method, graphical method, Von't Hoff method (ratio variation method), differential method and Ostwald isolation method. Concept of energy barrier and activation energy, Collision theory, Kinetics of complex reactions- reversible, parallel, consecutive and chain reaction, Steady state approximation, Lindemann theory. Equilibrium and equilibrium constant, K_p , K_c , K_x . Homogeneous and heterogeneous equilibrium, Le-chatelier principle.

UNIT 3: ELECTROCHEMISTRY AND CORROSION

6 LECTURE HOURS

Prerequisite: Galvanic cell, Single electrode potential

Contents: Nernst equation, Nernst Equation based concept and complex problem in electrochemistry, ECS and its applications. Conductance and its types, Variation of conductance with dilution, Kohlrausch law, conductometric titrations, application of electrochemistry in corrosion. Corrosion: Introduction, dry theory, Wet theory, acid theory, types, Factors, prevention.

UNIT 4: WATER CHEMISTRY

6 LECTURE HOURS

Contents: Introduction, hardness of water, measurement of hardness, alkalinity, water softening- lime-soda process, zeolite process, ion exchange process.

UNIT 5: POLYMERS

6 LECTURE HOURS

Contents: Classification, Types of polymerization techniques: Bulk, solution, suspension and emulsion, mechanism of polymerization (cationic, anionic and free radical), vulcanization, average molecular weight

of polymers, conducting polymers, plastic used in daily life applications viz. making of tyres, ropes, electrical fittings, contact lenses, credit cards, air tight containers, cookwares, cold drink bottles.

UNIT 6: NANOMATERIALS

3 LECTURE HOURS

Contents: Introduction, Methods of preparation: precipitation, co-precipitation, sol-gel, hydrothermal, microemulsion. Introduction to various characterization techniques viz. XRD, SEM, TEM, BET, UV-VIS for nanomaterials. Properties: optical and surface properties. Application of nanomaterials.

Text Books

1. Engineering Chemistry by Renu Bapna. Publisher: New Delhi: MacMillan, 2010, ISBN:0230330762.
2. Text book of Engineering Chemistry by Shashi Chawla, Publisher: Delhi: Dhanpat Rai, 2014. ISBN 13: 123456755036.
3. Engineering Chemistry by P. Krishnamoorthy. Publisher: New Delhi: McGraw Hill, 2012, Edition: 1. ISBN: 9780071328753.

Reference Books

1. Encyclopedic dictionary of organic chemistry, By Milton, Jules K., Publisher: New Delhi Pentagon Press 2004 Description: 208p., ISBN: 818274167--X; 9788182741676.
2. Crude oil chemistry, By: Simanzhenkov, Vasily, Book Publisher: New York: Marcel Dekker, 2003 Description: 409p. ISBN: 082474098.
3. Atkins' physical chemistry, By: Atkins, Peter, Paula, Julio De, Book Publisher: New Delhi Oxford University Press 2014, Edition: 10th. ISBN: 9780198728726; 0198728727.
4. Essentials of Physical Chemistry by Bahl & Tuli, Publisher: S.Chand & Co., ISBN 13: 978-8121929783.
5. Organic Chemistry for engineers, By: Mallick, Abhijit, Book Publisher: New Delhi: Viva Books, 2012, ISBN: 9788130920580.

Modes of Evaluation: Quiz/Assignment/ Common Class Tests/ Tutorial classes/ Written Examination Scheme:

Components	MSE I	IA (30)		ESE
		CCTs	Tutorials/Assignment/ etc.	
Weightage (%)	20	15	15	50

Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)

PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CO2	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CO3	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
CO4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average	2.8	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0

1. WEAK

2. MODERATE

3. STRONG