CH 101	CHEMISTRY	L-T-P-C
Semester/Year: First Year	Pre-Requisite - None	3-1-0-4

Course Objectives

The objective of the course to impart fundamental knowledge about some selected aspects of chemistry. The topics include material chemistry, physical chemistry, organic chemistry and inorganic chemistry. Some industry relevant topics are also covered under which basic concepts are taught.

Syllabus:

Unit I: Water and its Treatment

Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance

Unit II: Chemical Kinetics

Zero order and pseodo unimolecular reactions; determination of the order of reaction, rate laws, kinetics of complex reactions- parallel, consecutive and reversible reactions steady state concept; Arrhenius equation, energy of activation and its experimental determination; simple collision theorymechanism of bimolecular reaction, chain reaction, activated complex theory of reaction rate, ionic reactions

Unit III: Petroleum and fuels

Cracking of hydrocarbons, knocking; cetane number and octane number; synthetic petrol and petrochemicals; sources and classification of coals; carbonization of coal; analysis of coal; determination of calorific value of coal by Bomb calorimeter; bio-fuels

Unit IV: Polymers and plastics

Classification of polymers; methods of preparation of polymers; bio-polymers; degradation of polymers; commercially important thermosetting and thermoplastics polymers, recycling of plastics, conductivity and chemical resistance of polymers

Unit V: Surface Chemistry

Adsorption; Different forms of adsorptions; energetics of adsorptions; application of adsorptions; adsorption isotherms- Langmuir, Freundlich and BET isotherms; colloids; surfactants; micelles; enzyme catalysis; catalysis in industrial processes

Unit VI: Corrosion and its control

Introduction; mechanism of corrosion; factors affecting corrosion; passivity; protection against corrosion- cathodic protection, protection by materials selection; design and use of protective coatings

Unit VII: Chemistry of nanomaterials

Introduction; different methods of synthesis of nanomaterials- top down and bottom up; different analytical techniques for characterization of nanomaterials; application of nanomaterials in chemistry

Books:

1. Engineering Chemistry by Jain and Jain (Dhanpat Rai)
2. Engineering Chemistry by S Chawla (Dhanpat Rai)
3. Physical Chemistry by S Glasstone (McMillan India)
4. Environmental Chemistry by A K Dey (New Age international)
5. Chemistry of Nanomaterials by C N R Rao et al (Wiley-VCH)

Course Outcomes (CO)

CO-1: Students will understand the basic concepts of reaction dynamics and will be able to apply the knowledge in related fields.

CO-2: Students will acquire knowledge about water and its treatment and familiarize themselves with the basic concepts of nanomaterials.

CO-3: Students will understand the basic concepts of corrosion, factors affecting it and available methods for controlling corrosion and apply the knowledge in fighting against corrosion.

CO-4: Students will understand the fundamentals of surface chemistry and will be able to apply in their future course of learning.

CO-5: Students will have the knowledge about different fuels and petroleum products and their common properties.

CO-6: Students will learn the classification, synthesis and applications of polymers.

NATIONAL INSTITUTE OF TECHNOLOGY SILCHAR
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CH 101 **CHEMISTRY** **L-T-P-C**
Semester/Year: First Year **Pre-Requisite - None** **3-1-0-4**

Lecture No	Lesson Plan
1	Sources and types of impurities in water; Hardness: Definition, Causes and its disadvantages, numerical problems of hardness of water
2	Boiler scale: Definition, Causes and its prevention; Caustic Embrittlement: Definition, Causes and its prevention
3	Boiler corrosion: Definition, Causes and its prevention, Treatment of water at domestic level: Zeolite process: Numerical problems on zeolite process
4	Lime soda process: Principles, Process, Limitation and numerical problems
5	Treatment of water at industrial level: Ion Exchange process: Principles, Process, and Limitation; Adsorption and Solvent extraction
6	Chemical oxygen demand, Biological oxygen demand: Definition, experimental procedure for their determination, limitations, their significance and numerical problems
7	Zero order and pseodo unimolecular reactions; determination of the order of reaction, rate laws
8-9	kinetics of complex reactions- parallel, consecutive and reversible reactions steady state concept
10	Arrhenius equation, energy of activation and its experimental determination
11-12	simple collision theory-mechanism of bimolecular reaction, chain reaction, activated complex theory of reaction rate, ionic reactions
13-15	Cracking of hydrocarbon, knocking, cetane number and octane number, Synthetic petrol, petrochemical and bio-fuels.
16-17	Sources and Classification of Coal, Carbonization of coal, analysis of coal
18	Determination of Calorific value of coal by Bomb Calorimeter
19	Introduction to polymers and plastics, Functionality of polymers, Classification of polymers (on the basis of their method of synthesis, structure, on the basis of source, their behavior when heated to processing temperature)
20	Amorphous and crystalline polymers, Determination of Molecular weights of polymers, Bio-polymers, Degradation of polymers
21	Structural difference between thermoplastics and thermosetting polymers, Different methods for doing polymerization
22	Commercially important thermoplastics and thermosetting plastics (Polyethylene (LDPE & HDPE), Polyvinyl chloride).
23	Commercially important thermoplastics and thermosetting plastics (Polystyrene, Polytetrafluoroethylene). Recycling of plastics
24	Conducting polymers (conjugated and doped conducting polymers) and their conducting mechanism, chemical resistance of polymers.
25-27	Different forms of adsorptions; energetics of adsorptions; application of adsorptions; adsorption isotherms- Langmuir, Freundlich and BET isotherms
28-29	colloids; surfactants; micelles; enzyme catalysis
30	catalysis in industrial processes
31	Introduction to corrosion
32-33	Types and mechanism of corrosion
34-35	Factors affecting corrosion

36	Methods to control corrosion
37-38	Introduction; different methods of synthesis of nanomaterials- top down and bottom up
39	Role of surfactant or capping agent in morphology of nanoparticles
40	Various dimensions of nanoparticles
41-42	different analytical techniques for characterization of nanomaterials

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DEPARTMENT OF CHEMISTRY

CH 111	**CHEMISTRY LABPRATORY**	**L-T-P-C**
Semester/Year: First Year	**Pre-Requisite - None**	**0-0-3-2**

Course Objectives

To teach good laboratory practice and skills to analyze and interpret the data from experiments with some insight into future career prospect in the fields related to Chemistry.

List of Experiments:

Experiment 1: To Determine the total hardness of pond water/ supplied water using Standard EDTA Solution

Experiment 2: Estimation of magnesium from supplied solution using standard EDTA

Experiment 3: Estimation of calcium from supplied solution using standard EDTA

Experiment 4: Determination of Dissolved oxygen (D.O) of lake water

Experiment 5: Determination of total alkalinity of supplied aqueous solution.

Experiment 6: To determine the strength of the $KMnO_4$ solution using standard oxalic acid solution

Experiment 7: To determine amount of Fe(II) present in the supplied solution using Standard $KMnO_4$ solution

Experiment 8: To determine amount of Fe(III) present in the supplied solution using Standard $K_2Cr_2O_7$

Experiment 9: Quantitative determination of Copper (II) using Standard HYPO ($Na_2S_2O_3$) Solution

Experiment 10: Estimation of calcium in milk powder using standard EDTA solution

Experiment 11. Detection of special elements in supplied organic compounds.

Experiment 12: Determination of functional groups in the supplied organic compounds

Experiment 13: Preparation of Copper (II) glycinato complex

Experiment 14: Determination of relative viscosity of the given organic compound by Ostwald Viscometer

Experiment 15: Determination of surface tension of the given organic compound by Stalagmometer

Books:

1. Advanced Practical Chemistry, S. C. Das
2. Laboratory manual

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DEPARTMENT OF CHEMISTRY

CH 111	**CHEMISTRY LABPRATORY**	**L-T-P-C**
Semester/Year: First Year	**Pre-Requisite - None**	**0-0-3-2**

Course Outcomes (CO)

After studying this module, the students shall be able to

CO-1: Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes etc. by performing experiments like determination of Total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, dissolved oxygen present in water.

CO-2: Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water

CO-3: Determine the physical properties of liquids by performing the experiments such as viscosity. They will also be able to determine the viscous nature of the lubricating oil. The generated knowledge can be used for industrial product development like detergent formulation.

CO-4: Determine the surface tension of liquids

CO-5: Synthesize coordination complexes of biologically important transition metal ions.

CO-6: To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.