St. Xavier’s College (Autonomous), Ahmedabad-09

Sem- I: Industrial Chemistry
Elective Paper: Conceptual Industrial Chemistry: IC 1401
Effective from Dec 2014
CORE Paper: Conceptual Industrial Chemistry (Theory)
Course Code: IC 1401
No. of Credits: 02
Learning Hours: 30 hrs

Course Overview & Course Objectives
The main objective of the course will be to build the basic foundation for studying chemistry. By the end of the paper, a student should be able to:

a. To learn about the difference in aliphatic and aromatic compounds, application of aromatic compounds in various field.
b. To learn about basic calculation of compounds, chemical reaction and some application.
c. To learn about Petroleum products formation, separation and different methods.
d. To learn about different Unit Operations and Renewable sources.

Thus, the knowledge from the course can help in the following:

a. Basic knowledge of chemistry is important for higher study in the subject.
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation in the field of Chemistry.
c. Various aspects of organic , inorganic and physical chemistry can help for the research specialization at higher study.

Course Content
Unit-1: Aromatic Hydrocarbons
[Prerequisites or topics for Self Study: classification of aliphatic compounds and their properties]
1. Classification, Chemical and physical properties, preparation of Aromatic hydrocarbons.
2. Application in industry – Pharmaceutical industries, drugs, dyes, Polymer industries.

Unit-2: Material Balance calculations
[Prerequisites or topics for Self Study: basic studies of states and matter and get information from the periodic table]
1. Basic chemical calculations: Atomic weight, molecular weight, equivalent Weight, mole and Composition of liquid mixtures and gaseous mixtures.
2. Introduction to Material balance with and without chemical reactions: Limiting reactant, Conversion yield, Recycling or bypass operation.
Unit-3: Petroleum Products

[Prerequisites or topics for Self Study: study of Unsaturated Aliphatic compounds name]
1. Petroleum products: Introduction and formation of petroleum products
2. Processing of petroleum products: Natural gas, fractionation of crude oil, Cracking, Reforming, Hydroforming, and Isomerization.

Unit-4: Unit Operations and Renewable Resources

[Prerequisites or topics for Self Study: Get information about separation and filtration]
1. Renewable sources: Definition, Types of renewable resources, Availability and use.
2. Cellulose and starch: properties and modifications

Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 1401: Conceptual Industrial Chemistry (Theory)

V. Paper: Industrial Chemistry (Practicals)
Course Code: IC 1402L
No. of Credits: 02
Session: 2 hrs

1. Determination of Normality of NaOH using standard solution of HCl
2. Determination of Normality of HCl using standard solution of NaOH.
3. Purification of compounds by recrystallization.
5. To determine the amount of TDS in water sample.
6. Preparation of Methyl Salicylate.
7. Preparation of petroleum jelly.
8. Purification by distillation.

Reference Books: IC 1402: Industrial Chemistry (Practicals)
1. “Quantitative Chemical Analysis” by Daniel C. Harris, 7th Ed.

Sem- II: Industrial Chemistry
Elective Paper: Selected Topics in Industrial Chemistry: IC 2401
Effective from Dec 2014
CORE Paper: Selected Topics in Industrial Chemistry: (Theory)
Course Code: IC 2401
No. of Credits: 02
Learning Hours: 30 hrs

Course Overview & Course Objectives
The main objective of the course will be to build the basic foundation for studying chemistry. By the end of the paper, a student should be able to:

a. To learn about Nomenclature of Basic Chemical Compounds which are useful in the plant with the information of some equipments.
b. To learn about pollution control of the industries and basic information about inorganic chemicals.

Thus, the knowledge from the course can help in the following:
a. Basic knowledge of industrial chemistry is important for higher study in the subject.
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation and also in the field of research in Chemistry.

Course Content
Unit-1: Basics concept of industrial material
[Prerequisites or topics for Self Study: Get information about basic chemicals and techniques]
1. Nomenclature of Basic Chemical Compounds
2. Heat Exchangers

Unit-2: Unit operation -1
Prerequisites or topics for Self Study: Get basic information about types of unit operation
1. Extraction
2. Fuels
3. Vacuum pumps

Unit-3: Application of industrial chemistry
Prerequisites or topics for Self Study: Study about the inorganic component from their properties
a. Pollution
b. Inorganic materials of industrial importance: Alumina, Silica, charcoal, diamond, Graphite, Lamp black etc.

Unit-4: Energy balance
Prerequisites or topics for Self Study: Basic study of system and types of systems, energy and their relation


Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 2401 : Selected Topics in Industrial Chemistry: (Theory)

Semester II
VI. Paper: Industrial Chemistry: (Practical)
Course Code: IC 2402L
No. of Credits: 02
Session: 2 hrs

1. Determination of mineral and Total Acidity of water Samples.
2. To verify the Beer – Lambert Law by Colorimeter.
3. To identify amino acid present in the given sample mixture using TLC.
4. TLC of paracetamol drug.
5. Preparation of Toothpaste.
6. Preparation of leather saving cream.
8. Preparation of Vicco Turmeric

**Reference books: IC 2402: Industrial Chemistry (Practical)**
1. “Quantitative Chemical Analysis” by Daniel C. Harris, 7th Ed.

**CORE Paper: Industrial Process Chemistry (Theory)**
**Course Code: IC 3401**
**No. of Credits: 02**
**Learning Hours: 30hrs**

**Course Overview & Course Objectives**
The main objective of the course will be to build the basic foundation for studying Industrial chemistry. By the end of the paper, a student should be able to:

a. To learn about the difference between unit operation and unit process and different types of unit process.
b. To learn about the synthesis of dyes and pigments in industry
c. To learn about the usage of dyes and pigments in industry.

Thus, the knowledge from the course can help in the following:

a. Basic knowledge of Industrial chemistry is important for higher study in the subject.
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation in the field of Chemistry.
c. Various aspects of Industrial Chemistry, organic, inorganic and physical chemistry can help for the research specialization at higher study.

**Course Content**

**Unit-1: Unit process I**
(8L) [14 Marks]
[Prerequisites or topics for Self Study:- Basic chemistry of types of unit process and term related to it.]
Nitration: Introduction, kinetics and mechanism, preparation of aromatic nitro compounds.
Sulfonation: Introduction, kinetics and mechanism, preparation of aromatic nitro compounds.

**Unit-2: Unit process II**
(7L) [14 Marks]
[Prerequisites or topics for Self Study:- Basic chemistry and terms related to halogen compound for unit process and various catalyst.]
Halogenation: Introduction, Kinetics and mechanism of halogenation, commercial manufactures like chloromethane, chloral and Monochloro acetic acid.
Hydrogenation: Introduction, Catalyst for hydrogenation, Hydrogenation of vegetable oils, Manufacture of Methanol by hydrogenation

Unit-3: Introduction of dyes (8L) [14 Marks]
[Prerequisites or topics for Self Study:- Basic chemistry and terms related to dyes and pigments and their characteristics]

Introduction about dyes and pigments, Classification of dyes on the basis of structure and method of application, chemistry mode of application to fibers and classification: Azodyes, Acid dyes, Basic dyes and Mordent dyes.

Unit-4: Synthetic dyes (7L) [14 Marks]
[Prerequisites or topics for Self Study:- Basic chemistry and terms related to dyes and pigments]

Synthesis of different dyes like Eriochrome Black T, Congo red, Methyl Orange, Mordent Yellow, and Anthraquinone dyes, Alizarin dyes, Reactive dye and disperse dyes in commercial ways.

Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 3401: Industrial Process Chemistry (Theory)


Semester III Industrial Chemistry
Effective from June 2015
I. Paper: Industrial Chemistry (Practical)
Course Code: IC 3402L
No. of Credits: 02
Sessions: Two X 3hrs

Course Content
2. To prepare 5-nitro salicylic acid from salicylic acid in maximum yields.
3. Preparation of anthraquinone from anthracene
4. Preparation of p-nitro acetanilide from acetanilide.
5. Preparation of methyl orange.
6. Preparation of Mordent yellow.
7. Preparation of disperse dye.
8. Preparation of diazoaminobenzene from aniline.

Teaching methodologies: Practical work, problem solving, and group discussion etc.

Reference books: IC 3402L: Industrial Chemistry (Practicals)

Semester IV Industrial Chemistry
Elective Paper: Applied Industrial Chemistry
Effective from June 2015
CORE Paper: Applied Industrial Chemistry (Theory)
Course Code: IC 4401
No. of Credits: 02
Learning Hours: 30 hrs

Course Overview & Course Objectives
The main objective of the course will be to build the basic foundation for studying Industrial chemistry. By the end of the paper, a student should be able to:
a. To learn about basic unit process and their mechanism.
b. To learn about a large group of engineering materials of increasing importance in industrial applications as polymer.
c. To learn about wide range of chemical and natural materials used in formulation of cosmetic Preparation.

Thus, the knowledge from the course can help in the following:

a. Basic knowledge of Industrial chemistry is important for higher study in the subject.
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation in the field of Chemistry.
c. Various aspects of Industrial Chemistry, organic, inorganic and physical chemistry can help for the research specialization at higher study.

Course Content

Unit-1: Unit Process III (8L) [14 Marks]
[Prerequisites or topics for Self Study: - Basic chemistry and terms related to alkyl group or aralkyl radical for unit process and about aminating agents]

b. Ammination by Ammonolysis
c. Hydrolysis

Unit-2: Polymer Science (7L) [14 Marks]
[Prerequisites or topics for Self Study: - Basic chemistry and terms related to polymers and types of polymers]
Introduction and Classification of Polymers, Nomenclature of Polymers, Mechanism of Free radical and ionic Polymerization, Polymer degradation, Properties and application of Synthetic polymers.

Unit-3: Cosmetic Chemistry (8L) [14 Marks]
[Prerequisites or topics for Self Study: - Basics of basic raw material for the production of hair and oral care products and some for perfumery material]
Introduction, Raw Materials for Cosmetic chemistry, Perfumery Products, Dental products, Regulation of Cosmetic Products, Quality and Environmental Issues by Cosmetics.

Unit-4: Entrepreneurship (7L) [14 Marks]
[Prerequisites or topics for Self Study:-Fundamentals of Entrepreneurship]
Creative skills, knowledge, strength or power, Investment, risk factor, economically and Financially sound, Marketing Skill.

Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books.
and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 4401: Industrial Process Chemistry (Theory)
1. “Polymer Science”, by V.R. Gowarikar, N.V. Viswanathan, and Jaydevshreedhar, New Age International Limited Publisher.
2. “Comprehensive Industrial Chemistry” by Dr. Prakash G. More, Pragati Prakashan, India.
8. “Study Material in Vocational Subject of Industrial Chemistry”, complie/edited by

Semester IV Industrial Chemistry
Effective from June 2015
I. Paper: Industrial Chemistry (Practical)
Course Code: IC 4402L
No. of Credits: 02
Sessions: Two X 3 hrs

Course Content
1. To prepare P-amino diazo-benzene in maximum yields.
2. Preparation of p-amino benzoic acid from p-nitro benzoic acid.
3. Preparation of m-nitro aniline from m-dinitrobenzene.
4. Preparation of p-nitro benzoic acid from p-nitro toluene
5. Preparation of phenylazo-β-napthol from aniline
6. Preparation of Nylon -6, 6.
7. Preparation of Lip Balm from olive oil.
8. Preparation of vaporizing Balm.

Teaching methodologies: Practical work, problem solving, and group discussion etc.
Reference books: IC 4402L: Industrial Chemistry (Practicals)
4. “Quantitative Chemical Analysis”, by Daniel C. Harris, 7th Ed.

(SEC- Industrial Chemistry) Semester V
(To be effective from June 2016)

CH 5501 Organic Chemistry
CH 5502 Inorganic Chemistry
CH 5503 Physical Chemistry
CH 5504 Analytical Spectroscopic Techniques
IC 5401 Subject Elective (Pharmaceutical chemistry)

CH 5505L Practical:
(I.) Inorganic Qualitative Analysis
&
Physical Chemistry (Kinetics, Solubility and Instruments)
(II.) Organic Preparation
&
Analytical Chemistry (Estimations and Chromatography)

Course Structure with respect to credit, hours and marks

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<th>Paper No.</th>
<th>Credit</th>
<th>Total Marks</th>
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Total Credit 25
N.B.: The practical batch should be maximum of 10 students with respect to the credit.

**Semester V Industrial Chemistry**

**Effective from June 2016**

**Subject Elective Paper SEC: Pharmaceutical chemistry (Theory)**

**Course Code: IC 5401**

**No. of Credits: 02**

**Learning Hours: 30 hrs**

**Course Overview & Course Objectives**

The main objective of the course will be to build the basic foundation for studying industrial chemistry. By the end of the paper, a student should be able to:

a. To learn fundamentals aspects of pharmacopeia and monograph of drugs.
b. To learn about classification of pharmaceutical drugs
c. To learn about Pharmaceutical dosage Forms.
d. To learn about drug discovery and design.

Thus, the knowledge from the course can help in the following:

a. Basic knowledge of these topics in Pharmaceutical chemistry which is important for practicals and industrial applications
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation and also in the field of research in Chemistry.

**Course Content**

**Unit-1: Pharmacopeia and monograph of drugs**

[14 marks]

[Prerequisites or topics for Self Study: - Basic terms related to pharmacopeia and monograph of drugs]

1. **Pharmaceuticals**: Historical background and development of pharmaceutical industry in India in brief.
3. **Monograph of drugs**: Paracetamol, Trimethoprim, Bisacodyl, Mebendazole, Sulphamethoxazole.
4. **Various types of Excipients**: Coating agent, coloring agent.

**Unit-2: Classification of pharmaceutical drugs:**

[14 marks]

Raw materials, Process of manufacture, effluent handling of the following Bulk drugs

[Prerequisites or topics for Self Study: - Basic terms related to classification of pharmaceutical drugs]
1. Hypnotic and sedatives drug: General; Early hypnotics; Barbiturate derivatives; Non barbiturate compounds
2. Antimicrobial drug: Mercurochrome, Isoniazid (INH), PAS
3. Cardiovascular drug: Introduction, cardiovascular agent-Methyl dopa
4. Vitamins: Introduction and biological activity of Vit-A, Vit- B₆, Vit-C

Unit-3: Pharmaceutical Dosage Forms [14 marks]
[Prerequisites or topics for Self Study:-Fundamental terms and definitions pharmaceutical dosage forms]
1. Pharmaceutical Formulation
2. Routes of administration: Introduction, Types & Usage.

Unit-4: Drug discovery and Design [14 marks]
[Prerequisites or topics for Self Study: - Basic terms related to Drug discovery and Design]
1. Drug discovery: Choosing diseases, choosing drug target
2. Drug design: Identification of the active part, Functional group Modification

Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 5401: Pharmaceutical chemistry (Theory)
2. Pharmaceutical Dosage form & Drug delivery system by Howard c. Ansel, Nicholas G. Popovich.
3. Medicinal chemistry by V.K.Ahluwalia
5. Medicinal Chemistry by Gurdeep Chatwal.

V. Paper SEC: Industrial Chemistry (Practicals)
Course Code: IC 5402 L
No. of Credits: 02
Sessions: Two X 3 hrs
Laboratory Session
1. To estimate purity of Sulphamethoxazole in tablet as powder by Mohr’s method.
2. To identify related substance present in Bisacodyl tablet by TLC.
3. To identify related substance present in sulfa drug tablet by TLC.
4. Prepare paracetamol drug from p-amino phenol.
5. To determine the sulphated Ash of paracetamol tablet.
6. To titrate given solution of Sulphamethoxazole drug against 0.1 N NaNO₂ by potentiometrically.
7. Determine the % of Vitamin- C in given sample.

References Book: Industrial Chemistry (Practicals)

Proposed Syllabus under Autonomous system for Semester V and VI
B Sc Industrial Chemistry
(2016-2019)
August 10, 2015
(SEC- Industrial Chemistry) Semester VI
(To be effective from June 2016)

CH 6501 Organic Chemistry
CH 6502 Inorganic Chemistry
CH 6503 Physical Chemistry
CH 6504 Analytical Spectroscopic Techniques
IC 6401 Subject Elective (Medicinal chemistry)
CH 6505L Practical:
   (I.) Inorganic Qualitative Analysis
       &
       Physical Chemistry (Kinetics, Solubility and Instruments)
   (II.) Organic Preparation
       &
       Analytical Chemistry (Estimations and Chromatography)

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Subject Elective Course (SEC) | IC 6401 | 2 | 100 | 30 | 70 | 3 | 3
Practical Core Course – I and II | CH 6505L | 5 | 200 | 60 | 140 | 12 | 12

Total Credit 25

N.B.: The practical batch should be maximum of 10 students with respect to the credit.

Semester VI Industrial Chemistry
Effective from June 2016
Subject Elective Paper SEC: Medicinal Chemistry (Theory)
Course Code: IC 6401
No. of Credits: 02
Learning Hours: 30 hrs

Course Overview & Course Objectives
The main objective of the course will be to build the basic foundation for studying industrial chemistry. By the end of the paper, a student should be able to:

a. To learn fundamentals of Pharmacodynamic and pharmacokinetics.
b. To learn about Pharmacodynamic agents
c. To learn basics of pro drug and drug delivery system
d. To learn combinatorial chemistry.

Thus, the knowledge from the course can help in the following:

a. Basic knowledge of these topics in Medicinal chemistry is important for practical’s and Industrial applications
b. The students could pursue a career in chemistry, Industrial chemistry and Post-graduation and also in the field of research in Chemistry.

Unit-1: Pharmacodynamic and Pharmacokinetics
[14 Marks]
[Prerequisites or topics for Self Study:-Fundamental terms and definitions related to Pharmacodynamic and pharmacokinetics]
1. Introduction
2. Drug target : Protein & Enzymes as drug target
3. Drug metabolism

Unit-2: Pharmacodynamic Agents
[14 Marks]
[Prerequisites or topics for Self Study:-Fundamental terms and definitions related to Pharmacodynamic Agents]
1. General Anesthetic: General; Theories of anesthesia; Physical Theories; Neurophysiologic theory, Biochemical theories; Ideal anesthetic; Volatile anesthetics; Halogenated derivatives; Gaseous anesthetics; Intravenous anesthesia.
2. Analgesic Drug: General, Synthetic analgesic derivatives, derivative based on Pepperdine

Unit-3: Pro drug and drug delivery system [14 Marks]
[Prerequisites or topics for Self Study:-Fundamental terms and definitions related to pro drug and drug delivery system]
1. Basic concepts of prodrug
2. Types of prodrug

Unit-4: Combinatorial chemistry [14 Marks]
[Prerequisites or topics for Self Study:-Fundamental terms and definitions related to combinatorial chemistry]
1. Introduction
2. Solution phase combinatorial chemistry
3. Detection and Analysis

Teaching methodologies: Apart from the conventional black board teaching, other modes of teaching that will be adopted are power points, problem solving, and group discussion. Assignments will be designed such that students inculcate the habit of reading reference books and science journals. The use of smart boards for teaching will also be promoted to enable more interaction based teaching.

Reference books: IC 6401: Medicinal chemistry (Theory)
1. An Introduction to Medicinal Chemistry by Graham L. Patrick, 2nd Edition
2. The organic chemistry of drug design & drug action by Richard B., Silverman, 2nd edition

V. Paper SEC: Industrial Chemistry (Practicals)
Course Code: IC 6402 L
No. of Credits: 02
Sessions: Two X 3 hrs

Laboratory Sessions
1. To Prepare Aspirin Drug from salicylic acid.
2. To determine the % of Aspirin in the given sample.
3. To determine the percentage of salicylic acid residual in synthesized Aspirin Drug by spectrophotometer method.
4. To perform the Assay of ZnO by IP 95.
5. Determination of Antacid drug by titration method.
6. To carry out assay of Mebendazole drug by potentiometrically.

References Books: Industrial Chemistry (Practicals)
1. Advanced practical Medicinal Chemistry by Ashutosh Kar.