

SEMESTER- I : CORE COURSE IC-101 (6 credits)

GENERAL INDUSTRIAL CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Section A: Inorganic and Organic Chemistry (30 Lectures)

- I. Nomenclature:** Generic names, Trade names & Proper names. **2 L**
- II. Raw material for organic compounds:** Petroleum, natural gas, fractionation of crude oil, reforming, hydroforming, isomerisation. **10L**
- III. Renewable Natural Resources:** Cellulose & Starch. Their properties & modifications. Important industrial chemicals derived from cellulose & starch. Alcohols and alcohol based chemicals, including oxalic acid & furfural. **8L**
- IV. Inorganic materials of industrial importance:** Alumina, silica, silicates, clay, mica, carbon, zeolites. Their availability, forms, structure and modifications. **10L**

Section B: Material Balance and utilities (30 Lectures)

V. Material Balance without Chemical Reaction:

Flow diagram for materials balance processes. Simple material balance with or without recycle or by pass for chemical engineering operations such as distillation, absorption, crystallization, extraction etc. **10L**

VI. Material balance with Chemical Reaction: Concept of limiting reactant.

Conversion, yield liquid phase reaction & gas phase reaction with/without recycle or by-pass. **8L**

VII. Utilities in Chemical Industry:

Fuel: Types of fuels – Advantages and Disadvantages. Combination of fuels, Calorific values (Bomb's calorimeter, Boy's gas calorimeter and Dulong's Formula) **7L**

Boilers: Types of Boilers and their functions. **5L**

Laboratory course: (60 L) (2 credits)

Instruction: There will be two practicals each of three hours duration from Section A and Section B respectively for the examination.

SECTION A PRACTICALS (30 Hrs. 1 Credit)

I. Simple laboratory techniques:

1. Crystallization from water: i) Sodium Chloride ii) Copper Sulphate **6Hrs.**

2. Distillation : i) Water ii) Ethyl acetate **8Hrs.**

3. Fractional distillation: i) Acetone and water ii) Acetone and toluene **8Hrs.**

II. Determination of depression in melting point of the following compounds:

(i) Calcium chloride in water (ii) sodium chloride in water &

(iii) glucose in water **8Hrs.**

SECTION B (1 Credit:30 Hrs)

B) Boiling point diagrams for following compounds: **(3 × 8 = 24 Hrs.)**

i) Calcium chloride in water

(ii) Sodium chloride in water and

(iii) Glucose in water

D) Phase diagram with three different concentrations for following mixture

(Ethanol + Water + toluene) **(3x 2 = 6 Hrs.)**

Reference Books for Theory

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.

2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.

3. UGC course material as prescribed by UGC

4. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
6. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

Reference Books for Practicals

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
 2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
 3. S.W. Rajbhoj and T. K. Chondhekar, *Systematic Experimental Physical Chemistry*, Anjali Publication, Second Edition 2000.
 4. Sunita Rattan, *Experiments in Applied Chemistry*, S.K. Kataria & Sons, Second edition, 2008
 5. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
 6. UGC practical manual for experimental analysis
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B.Sc. WITH INDUSTRIAL CHEMISTRY

CHOICE BASED CREDIT SYSTEM

SEMESTER- II: CORECOURSE IC-102 (6 credits)

GENERAL INDUSTRIAL CHEMISTRY

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Section A: Metallurgy and Surface Chemistry (30 Lectures)

I. Basic metallurgical operations: Pulverisation, Calcination, Roasting, Refining

Definition of the terms & illustration of the concept with suitable examples **5 L**

II. Physicochemical principles: extraction of Iron, Copper, Lead, Silver, Sodium, Aluminum, Magnesium, Zinc & Chromium

(Emphasis should be laid on physicochemical principles) **10 L**

III. Surface chemistry and Interfacial phenomena:

Adsorption & Adsorption isotherms (Freundlich & Langmuir).

Applications of Adsorption in industrial processes.

Colloids & their classification. Preparation, properties & applications of Sols, Gels, Emulsions, Microemulsions, Micelles & Aerosols.

Effect of Surfactants and Hydrophilic- Lipophilic ratio **15 L**

Section B: Energy balance and Industrial Operations (30 Lectures)

IV. Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressures, Enthalpy changes upon dissolution of solids in liquids. **7L**

V. Distillation: Introduction- Batch and continuous distillation. Separation of azeotropes **3L**

VI. Absorption: Introduction- Equipments- packed columns spray columns, bubble columns, packed bubble columns, mechanically agitated contactors. **3L**

VII. Evaporation: Introduction- Equipments- short tube (standard) evaporator, forced

circulation evaporators, falling film evaporators, climbing film (outward flow) evaporators & wiped (agitated) evaporators. **3L**

VIII. Filtration: Introduction- Filter media and filter aids. Equipments- plate and frame filter, press filter, batch filter, rotary drum filter, sparkler filter, candle filter, bag filter, centrifuge. **4L**

IX. Drying: Introduction- Free moisture, bound moisture, drying curve. Equipments- tray dryer, rotary dryer, flash dryer, fluid bed dryer & spray dryer **3L**

X. Fluid flow: Fans, blowers, compressors, vacuum pumps & ejectors. **3L**

Pumps: Reciprocating pumps, Gear pumps & Centrifugal pumps. **4L**

Laboratory course: (60 L) (2 credits)

Instruction: There will be two practicals each of three hours duration from Section A and Section B respectively for the examination.

SECTION A (1 Credit)

I. Ore analysis: (Volumetric analysis only) (5 × 5 = 25 Hrs)

- i) Mg from Dolomite
- ii) Ca from Limestone,
- iii) Fe from Iron ore,
- iv) Mn from Manganese ore.
- v) Analysis of alloys such as cupro-nickel.

II. Study experiments / demonstration experiments in laboratory / factory

Students will have to make a self study report in the journal equivalent to two experiments (non evaluative for examination) **5 Hrs.**

SECTION B (1 Credit)

B) Determination of Physical constants:

- i) Refractive index, **8 Hrs.**

- ii) Surface tension, (effect of surfactants) **4 Hrs.**
- iii) Effect of additives (starch, sugar, NaCl & oil , n - butanol) on viscosity of water **12 hrs.**
- iv) Optical rotation (*two expt* –one showing D-rotation & other showing L-rotation) **6 Hrs.**

Reference Books for Theory

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. UGC course material as prescribed by UGC
4. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
5. R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
6. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
7. S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
8. P. L. Soni, *Text book of inorganic Chemistry*, 20th revised edition.

Reference Books for Practicals

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
 2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
 3. UGC practical manual for experimental analysis.
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(Model Question paper)

B.Sc. INDUSTRIAL CHEMISTRY

SEMESTER I CORE COURSE –IC-101 (6 Credits)

DURATION : 2 Hrs

TOTAL MARKS: 80

Section A: Inorganic and Organic Chemistry (30 Lectures)

Q.1. Answer **ANY FIVE** from the following **(2 x 5 = 10 Marks)**

- i) Nomenclature
- ii) Raw material for organic compounds
- iii) Renewable Natural Resources:
- iv) Inorganic materials of industrial importance
- v) Raw material for organic compounds
- vi) Inorganic materials of industrial importance
- vii) Renewable Natural Resources:

Q.2. A. Answer the following

- i) Raw material for organic compounds **4 Marks**
- ii) Renewable Natural Resources **3 Marks**

OR

Q.2. A. iii) Raw material for organic compounds **4 Marks**

iv) Renewable Natural Resources **3 Marks**

Q.2.B.i) Raw material for organic compounds **4 Marks**

ii) Renewable Natural Resources **4 Marks**

Q.3. A. Answer the following

i) Inorganic materials of industrial importance **4 Marks**

ii) Raw material for organic compounds **3 Marks**

OR

Q.3. A. iii) Inorganic materials of industrial importance **4 Marks**

iv) Inorganic materials of industrial importance **3 Marks**

- Q.3.B i) Inorganic materials of industrial importance **4 Marks**
ii) Inorganic materials of industrial importance **4 Marks**

Section B: Energy balance and Industrial Operations (30 Lectures)

Q.4. Answer ANY FIVE from the following (2 x 5 = 10 Marks)

- i) Material Balance without Chemical Reaction
- ii) Material balance without Chemical Reaction
- iii) Material balance with Chemical Reaction
- iv) Material balance with Chemical Reaction
- v) Fuel
- vi) Boilers
- vii) Material Balance without Chemical Reaction

Q.5. A. Answer the following

- i) Material Balance without Chemical Reaction **4 Marks**
- ii) Material balance with Chemical Reaction **3 Marks**

OR

Q.5. A. iii) Material Balance without Chemical Reaction 4 Marks

iv) Material balance with Chemical Reaction 3 Marks

Q.5.B.i) Material Balance without Chemical Reaction 4 Marks

ii) Material balance with Chemical Reaction 4 Marks

Q.6. A. Answer the following

- i) Material Balance without Chemical Reaction **4 Marks**
- ii) Fuel **3 Marks**

OR

Q.6 A. iii) Fuel 4 Marks

iv) Boilers 3 Marks

Q.6.B i) Fuel 4 Marks

ii) Boilers 4 Marks

Laboratory course: (2 credits : 30 Hrs.)

IC-101

SECTION -A

Experiment: 15 marks + Oral: 04 + Journal: 3 marks + OJT: 03 marks = 25 marks

Break up : Preliminary test/ arrangements	02 marks
Experimental reading	08 marks
Systematic presentation	02 marks
Results	03 marks
Oral (Viva)	04 marks
Journal	03 marks
On- Job –Training	03 marks

Total

25 marks

SECTION – B

IC-101

Each Practical of three hours duration. (25 marks)

Experiment: 15 marks + Oral: 05 + Journal: 5 marks = 25 marks

Break up : Preliminary test/ arrangements	02 marks
Experimental reading	08 marks
Systematic presentation	02 marks
Results	03 marks

Oral (Viva) 05 marks

Journal 05 marks

Total 25 marks

B.Sc. INDUSTRIAL CHEMISTRY

SEMESTER II CORE COURSE –IC-102 (6 Credits)

DURATION : 2 Hrs

TOTAL MARKS: 80

Section A: Metallurgy and Surface Chemistry (30 Lectures)

Q.1. Answer **ANY FIVE** from the following

(2 x 5 = 10 Marks)

- i) Basic metallurgical operations
- ii) Physicochemical principles of extraction
- iii) Physicochemical principles of extraction of Iron
- iv) Physicochemical principles of extraction of Iron
- v) Surface chemistry and Interfacial phenomena
- vi) Surface chemistry and Interfacial phenomena
- vii) Surface chemistry and Interfacial phenomena

Q.2. A. Answer the following

- i) Basic metallurgical operation **4 Marks**
- ii) Physicochemical principles of extraction **3 Marks**

OR

- Q.2. A. iii) Physicochemical principles of extraction **4 Marks**
- iv) Physicochemical principles of extraction **3 Marks**

- Q.2.B.i) Basic metallurgical operations **4 Marks**
- ii) Physicochemical principles of extraction **4 Marks**

Q.3. A. Answer the following

- i) Surface chemistry and Interfacial phenomena **4 Marks**
- ii) Surface chemistry and Interfacial phenomena **3 Marks**

OR

- Q.3. A. iii) Surface chemistry and Interfacial phenomena **4 Marks**
- iv) Surface chemistry and Interfacial phenomena **3 Marks**

- Q.3.B i) Surface chemistry and Interfacial phenomena **4 Marks**

ii) Surface chemistry and Interfacial phenomena

4 Marks

Section B: Energy balance and Industrial Operations

(30 Lectures)

Q.4. Answer **ANY FIVE** from the following

(2 x 5 = 10 Marks)

i) Energy Balance

ii) Distillation

iii) Absorption

iv) Filtration

v) Fluid flow

vi) Evaporation

vii) Drying

Q.5. A. Answer the following

i) Energy Balance

4 Marks

ii) Energy Balance

3 Marks

OR

Q.5. A. iii) Energy Balance

4 Marks

iv) Energy Balance

3 Marks

Q.5.B.i) Distillation

4 Marks

ii) Absorption

4 Marks

Q.6. A. Answer the following

i) Filtration

4 Marks

ii) Drying

3 Marks

OR

Q.6 A. iii) Evaporation

4 Marks

iv) Filtration

3 Marks

Q.3.B i) Fluid flow

4 Marks

ii) Drying

4 Marks

Laboratory course: (30 L) (2 credits)

IC-102

SECTION –A

Each Practical of three hours duration. (25 marks)

Experiment: 15 marks + Oral: 04 + Journal: 3 marks + OJT: 03 marks = 25 marks

Break up : Preliminary test/ arrangements	02 marks
Experimental reading	08 marks
Systematic presentation	02 marks
Results	03 marks
Oral (Viva)	04 marks
Journal	03 marks
On- Job –Training	03 marks

Total	25 marks
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SECTION – B

Each Practical of three hours duration. (25 marks)

Experiment: 15 marks + Oral : 05 + Journal : 5 marks = 25 marks

Break up : Preliminary test/ arrangements	02 marks
Experimental reading	08 marks
Systematic presentation	02 marks
Results	03 marks

Oral (Viva) 05 marks

Journal 05 marks

Total 25 marks
