

**COURSE STRUCTURE****FOR****S. Y. B. Sc. (SEMESTER – IV) INDUSTRIAL CHEMISTRY**

<b>SEMESTER – IV</b>			
<b>Principal Subject</b>	<b>Course Code</b>	<b>Paper Title</b>	<b>Credits</b>
<b>INDUSTRIAL CHEMISTRY</b>	US04CICH01	ENGINEERING MATERIALS	3 credits
	US04CICH02	CHEMICAL PLANT UTILITIES	3 credits
	US04CICH03	PRACTICALS	3 credits
	US04CPHY01	ELECTROMAGNETIC THEORY AND SPECTROSCOPY	3 credits
	US04CPHY02	SOLID STATE PHYSICS	3 credits
	US04CPHY03	PHYSICS PRACTICAL	3 credits
	US04ECHE05	INDUSTRIAL POLLUTION, ITS CONTROL AND INDUSTRIAL SAFETY	2 credits
	US04ECHE06	INSTRUMENTAL METHODS OF ANALYSIS	2 credits
	US04FENG01	FUNCTIONAL ENGLISH	2 credits

INDUSTRIAL CHEMISTRY  
SEMESTER-IV  
PAPER NO.: US04CICH01. (3 CREDITS, 70 MARKS)  
TITLE: ENGINEERING MATERIALS

---

Unit-1:

Material Sciences: Introduction of material sciences, Classification of engineering materials, Engineering requirements of materials, Level of structures, Structure – properties relationship in materials, Plan for selection of materials, Miscellaneous materials, Thermal electrical and Sound insulating materials.

Unit-2:

Ceramic industries: Raw materials, White wares, Structural clay products.

Refractory: Classification, Properties and manufacture of important refractory, Their selection and failure.

Cement: Portland cement, Other cements, Setting and hardening of cement, Manufacture and uses of ordinary cement.

Glass: Raw materials, Types of glasses, Manufacture and uses.

Unit-3:

Metals and Alloys: Need, preparation, Mechanical & chemical properties, Applications, Composition of important metals and alloys- iron, copper, aluminium, lead, nickel, titanium and their alloys

Unit-4:

Corrosion: Theories of corrosion, Corrosion reactions, Special corrosions, Factors affecting corrosion rate, Protection against the corrosion, Protective coatings and surface preparation, Metallic, Inorganic and organic coatings, Paint manufacture, Characteristics of oil and pigment

REFERENCE BOOKS

1. Material sciences by G.B.S. Narang, Khanna Publications, New Delhi.
2. A text book of Material sciences and metallurgy by O.P. Khanna, Dhampat Rai & Sons.
3. Chemical process industries by Shreve R. N., McGraw Hill.
4. Chemistry of engineering materials by C.V. Agraval, Tara Publications.

INDUSTRIAL CHEMISTRY  
SEMESTER-IV  
PAPER NO.: US04CICH02 (3 CREDITS, 70 MARKS)  
TITLE: CHEMICAL PLANT UTILITIES

---

Unit 1:

Water- Impurities and hardness of natural water, Water for steam making and industrial processes, Boiler water treatments, Calculations on water treatments.

Unit 2:

Fuels-classification, advantages and disadvantages, Analysis of fuels, Heating media  
Air- Specification for industrial uses of air. Industrial applications of CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub> and H<sub>2</sub> .

Unit 3:

Compression equipments, Reciprocating compressor, Work of single stage reciprocating compressor, Effect of clearance, Volumetric efficiency, Multistage compression, Refrigeration, COP & refrigerating effect, Industrial refrigerants, Carnot and other refrigeration cycles.

Unit 4:

Internal combustion engines and external combustion engine, Steam power plant, its working and thermodynamic analysis, Otto engine and Diesel engine.  
Steam boilers – Their classification, Steam generation, Conditions of steam, Steam table.

REFERENCE BOOKS.:

1. Chemistry of Engineering Materials by C. V. Agrawal ( Tara Publication )
2. Introduction to Chemical Engineering Thermodynamics (IV edition) by J. M. Smith & Vanness, (McGraw-Hill Co.)
3. Chemistry in Engineering and Technology, (volume I & II) JC Kuriacose & J.Rajarah (Tata McGraw Hill).
4. Chemistry of Engineering Materials By Jain & Jain. (Dhanpairai Publishing Co.)
5. Shreve's Chemical Process Industries by George T. Austin ( McGraw-Hill Publication, New Delhi)

INDUSTRIAL CHEMISTRY  
SEMESTER-IV  
US04CICH03  
LABORATORY

---

1. Cement Analysis, Inorganic Qualitative Analysis (Semi Micro)
2. Alloy Analysis
3. Analytical Instruments
4. Instrumental methods of Chemical Analysis.

**Subject: Physics**

**Course: US04CPHY01  
Electromagnetic Theory and Spectroscopy  
(Three Credit Course –3 Hours per week)  
(Effective from June-2012)**

**UNIT - I        Electrostatics**

**Electric field:** Brief introduction to Gradient, Divergence, Curl and Coordinate Systems, Coulomb's Law, The Electric field, Continuous charge distribution, **Divergence and curl of Electrostatic fields:** Field lines, Flux and Gauss's law, The Divergence of E, Application's of Gauss's law, The Curl of E, **Electric Potential:** Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, **Work and Energy in Electrostatics:** The work done to move a charge, The energy of a point charge distribution, The energy of a continuous charge distribution, Related Numericals

**UNIT - II        Magnetostatics**

**The Lorentz Force Law:** Magnetic fields, Magnetic forces, Currents, **The Biot-Savart law:** Steady currents, The Magnetic field of a steady current, **The Divergence and Curl of B:** Straight-Line currents, The Divergence and Curl of B, Applications of Ampere's law, Comparison of Magnetostatics and Electrostatics, **Magnetic Vector Potential:** The Vector potential, Summary; Magnetostatic boundary conditions, Multipole expansion of the vector potential, Related Numericals

**UNIT - III       Atomic Spectra**

Investigation of Spectra, Production of Spectra, Types of Spectra, Wave Number, The Spinning Electron, Space Quantization, Quantum Numbers and their Physical Interpretation, L-S Coupling, J-J Coupling, Experimental study of Zeeman Effect, Classical Interpretation of Normal Zeeman Effect, Anomalous Zeeman Effect, Stark Effect

**UNIT - IV       X-ray Spectra**

Production of X-rays, X-rays, Light and Electromagnetic Spectrum, Diffraction of X-Radiations, Bragg's law, Continuous X-ray spectrum, Characteristic Emission Spectrum, Characteristic absorption Spectrum, A Close Survey of Emission Spectrum, Explanation of Emission and Absorption Spectra, Comparison of Optical and X-ray Spectra, Moseley's Law, The Fluorescence yield and Auger Effect

**Books Recommended:**

1. Introduction to Electrodynamics  
David J Griffiths, Prentice-Hall of India Private Ltd.
2. Electricity and Magnetism  
A S Mahajan and A A Rangwala  
Tata McGraw Hill Publishing Company Ltd
3. Elements of Electromagnetics  
Sadiku, Oxford University Press
4. Elements of Spectroscopy  
S L Gupta, V Kumar, R C Sharma  
Pragati Prakashan
5. Molecular structure and Spectroscopy  
G Aruldas, Prentice-Hall of India Private Limited

Course: US04CPHY02

**Solid State Physics**  
**(Three Credit Course –3 Hours per week)**  
**(Effective from June-2012)**

**UNIT-I Basic Elements of Crystallography**

Introduction, Lattice points and space lattice, The basics and crystal structure, Unit Cell, Unit Cell versus Primitive Cell, Unit Cell and lattice parameters, Crystal types, Two dimensional crystal lattice, Seven crystal system, Symmetry Operations (Translational, Point, & Hybrid), Metallic crystal structures, Relation between the density of crystal materials and lattice constants, Directions planes and Miller Indices of crystal planes, Important features of Miller indices in a cubic crystal, Separation between lattice planes in cubic crystal

**UNIT-II Atomic Cohesion, Crystal Binding, Atomic Size**

Introduction, Force between atoms, Cohesion of atoms and cohesive energy, Calculation of cohesive energy, Calculation of lattice energy of ionic crystals, Calculation of Madelung constant of ionic crystals, The Born–Haber cycle, Bonding in solids, Primary Bonds (Covalent, Metallic, Ionic and Mixed), Secondary bonds (van der Waals and Hydrogen Bond), Properties of primary and secondary bonds, Wave mechanical concept of atom, Atomic size, Ionic radii, Empirical ionic radii, variation of ionic radii, Covalent radii, Metallic radii, van der Waals radii

**UNIT- III Thermal & Dielectric Properties of Solids**

Introduction, The specific heat of solid, The classical lattice heat capacity, The Einstein Model, The density of states, The Debye theory of heat capacity, Thermal conductivity of solids, Thermal conductivity due to electrons and phonons, Thermal resistance of solids, Dipole moment, Polarization, The electric field of a dipole, Local electric field at an atom, Dielectric constant and its measurement, Polarizability, The classical theory of electronic Polarizability, Dipolar Polarizability

**UNIT-IV Structure of Polymers and its Applications**

Introduction, Hydrocarbon molecules, Polymer molecules, The chemistry of polymer molecules, Molecular weight, Molecular shape, Molecular structure, Molecular Configurations, Thermoplastic and thermosetting polymers, Copolymers, Mechanical Behavior of polymers (Stress-Strain behavior, Macroscopic deformation, Viscoelastic deformation, Fracture of polymers, Miscellaneous mechanical characteristics), Mechanisms of deformation for strengthening of polymers (deformation of semi-crystalline polymers, factors that influence the mechanical properties of semi-crystalline polymers, deformation of elastomers), Polymer Types (Plastics, Elastomers, Fibers)

**Books Recommended:**

1. Solid State Physics  
M A Wahab, Narosa Publishing House.
2. Solid State Physics  
S O Pillai, , New Age International Publisher
3. Material Science and Engineering  
W D Callister Jr. Wiley India (P) Ltd.
4. Introduction to Solid State Physics  
C Kittel, (5<sup>th</sup> Edition) Wiley Eastern Ltd.
5. Elements of Solid State Physics  
J P Srivastava, Prentice-Hall of India

**Subject: Physics (Practical)**  
**Course No. US04CPHY03**  
**(Three Credit Course –6 Hours per week)**  
**(Effective from June-2012)**

**List of Practicals:**

1. Characteristics of FET
2. Miller Indices using X-Ray diffraction pattern.
3. De-Broglie Relation using electron diffraction pattern.
4. Wave length of a monochromatic light ' $\lambda$ ' using Double Slit method.
5. Study of a Hartley Oscillator
6. Study of a Colpitts Oscillator
7. Thermal Conductivity (K) by Lee's method
8. Frequency Response of RC Coupled amplifier (with negative feedback).
9. Study of L-C-R Parallel Resonance
10. Wave length of a monochromatic light ' $\lambda$ ' using Lloyd's mirror
11. Study of a Thermocouple
12. Cauchy's Constants
13. Find the Stefan's Index
14. Numerical Integration
15. Propagation of errors in observation.

**Note:** To provide flexibility up to the maximum of 20% of total experiments can be replaced/ added to the list by the board of studies.

**Books Recommended:**

1. Advanced Practical Physics for students  
B L Wosnop and H T Flint  
Methuen and Co. Ltd., London
2. B.Sc. Practical Physics  
C L Arora  
S.Chand & Co. Ltd., New Delhi
3. Advanced Practical Physics  
M S Chauhan and S P Singh  
Pragati Prakashan, Meerut
4. Advanced Practical Physics  
S L Gupta and V Kumar  
Pragati Prakashan, Meerut

SEMESTER-IV  
PAPER NO.: US04EICH05 (2 CREDITS, 70 MARKS)  
TITLE: INDUSTRIAL POLLUTION, ITS CONTROL AND INDUSTRIAL SAFTY

---

Unit1:

Atmosphere, Eco-System and Air Pollution, Sources and Effect of Air Pollutants, Green House Effect, Air Pollution control Technique.

Unit 2:

Water Pollution and its source, Types of water pollutants and their adverse effects, Waste water treatment, BOD and COD tests, Pesticide Pollution and sound pollution.

Unit 3:

Solid Waste Management, Collection and Disposal of solid waste, Radio activity and Radiation Pollution, Pollution Statutory limits.

Unit 4:

Industrial hazards, Safety consideration in chemical industries, Chemical, Electrical and mechanical hazards, Fire and explosion hazard, Health hazard, Laboratory Safety, Safety Practice, Factory acts.

REFERENCE BOOKS:

1. Environmental Chemistry, B. K. Sharma (Krishna Prakashan Media (P) Ltd., Meerut).
2. Environmental Pollution Control Engineering, C. S. Rao (Wiley Eastern Ltd., New Delhi)
3. Engineering Chemistry, Jain and Jain ( Dhanpat Rai and Sons)
4. Introduction to Environmental Engineering and Science, G. M. Masters
5. Environmental pollution, H.N.DIX (J.W & Sons).
6. Chemical technology, Vol I, D.Venkateshwaraly (C.Chand & co)



SEMESTER-IV  
COURSE NO.: US04ECHE06 (2 CREDITS, 70 MARKS)  
TITLE: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

---

Unit-1:

pH metry: Introduction and determination of pH, applications. Potentiometric titrations: Introduction, Types of titrations, Advantages of potentiometric titrations. Conductometric measurements: Introduction, Some important laws, Definition and relations, Effect of dilution, Applications of conductance measurements, Types of titrations, Advantages and disadvantages.

Unit-2:

Chromatography: Introduction, Classification and application

Paper chromatography: Experimental details for qualitative analysis, Experimental details for quantitative analysis. Thin layer chromatography: Superiority of TLC over the other techniques, Experimental techniques, Limitations, Scope.

Column chromatography: Introduction, Experimental details, Theory of development, factors affecting column efficiency.

Unit-3:

HPLC and GC: Introduction, Instruments involved, Sampling methods, Experimental details and applications.

Unit-4:

Visible spectrophotometry and Colorimetry: Introduction, Theory of spectrophotometry and colorimetry, Deviation from Beer's Law, Instrumentation, Applications. Ultra Violet Spectroscopy: Introduction, Origin and theory of ultraviolet spectra, Choice of solvent, instrumentation, Applications.

REFERENCE BOOKS

1. Instrumental methods of chemical analysis by Chatwal – Anand, Himalaya Publishing House.
2. Instrumental methods of chemical analysis by B.K. Sharma, Krishna Publication Media (P) Ltd., Meerut.
3. Organic spectroscopy by William Kemp, Macmillan Press Ltd., London.
4. Analytical chemistry by Gray D. Christian, 4<sup>th</sup> edition, Wiley & Sons, Inc.
5. Instrumental methods of analysis by Willard Merritt, Dean Settle, CBS Publishers & Distributors, New Delhi.
6. Principles of instrumental analysis by Skoog, Holler, Nieman, Thomson Asia Pvt. Ltd., Singapore.
7. Basic concept of analytical chemistry by S.M. Khopkar, New Age International Publishers.
8. Instrumental methods of chemical analysis by Galen W. Ewing, McGraw – Hill Book Company.

Syllabus of B.Sc. ( Fourth Semester)  
Foundation Course in English  
Subject: Functional English  
Course Code: (US04FENG01)  
2 credits (Practical)  
Hours per week (2 hours/batch)  
Internal 30 marks + External 70 marks

Total: 100 Marks

**Unit 1 Listening for Specific Purposes**

**Marks**

- |          |  |           |
|----------|--|-----------|
| <b>1</b> | Listening for information (Fill in the blanks)<br>(46 to 60) | <b>10</b> |
| <b>2</b> | Listening for Gist of the audio/video<br>Writing the gist    | <b>03</b> |
| <b>3</b> | Identify the language functions                              | <b>02</b> |

**Total= 15**

**Unit 2 Writing Skills**

- |          |  |           |
|----------|--|-----------|
| <b>1</b> | Letters for social occasions (Condolence, Invitations,<br>encouragement and best wishes)   | <b>07</b> |
| <b>2</b> | Words used in Newspaper Headlines<br>(Match the meaning with words given in the headlines) | <b>04</b> |
| <b>3</b> | Notice Writing   | <b>05</b> |
| <b>4</b> | Collocations   | <b>04</b> |

**Total= 20**

**Unit 3 Oral Skills**

- |          |   |           |
|----------|---|-----------|
| <b>1</b> | Mock Interviews(Introduction, talking about their field, interest and<br>body language) | <b>15</b> |
|----------|---|-----------|

**Total= 15**  
**15+05 journal= 20**

**Unit 4 Grammar and Vocabulary**

- |          |  |           |
|----------|--|-----------|
| <b>1</b> | Prepositions of place, time and direction<br>(fill in the blank) | <b>04</b> |
| <b>2</b> | Punctuation ( In a paragraph)                                    | <b>04</b> |
| <b>3</b> | Question tags (fill in the blank)                                | <b>03</b> |
| <b>4</b> | Articles and plural forms<br>(fill in the blank)                 | <b>04</b> |

**Total= 15**