

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Industrial Aspects of Physical Chemistry, Subject Code: CH-201
SYLLABUS REVISED-2015
w.e.f. July-2015

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Unit-I **08**

Adsorption: Physisorption and Chemisorptions, Applications of adsorption, Adsorption of gases by solids, Freundlich adsorption isotherm, Langmuir's theory of adsorption, BET theory of multilayer adsorption, Determination of surface area, Adsorption isotherms.

Unit-II **08**

Catalysis: General characteristics of catalytic reactions Acid-base catalysis, Enzyme catalysis, Mechanism and kinetics of enzyme catalyzed reactions, Michaelis-Menten equation, Effect of temperature on enzyme catalysis, Heterogeneous catalysis, Surface reactions, Kinetics of surface reactions.

Unit- III **08**

Colligative Properties: Lowering of vapour pressure, Raoult's law, Determination of molecular mass of solute from lowering of vapour pressure, Elevation of boiling point, Relation between elevation of boiling point and lowering of vapour pressure, Determination of molecular mass of solute from elevation of boiling point, Depression of freezing point, Relation between depression of freezing point and lowering of vapour pressure, Determination of molecular mass of solute from depression of freezing point, Osmosis and osmotic pressure, van't Hoff's equation.

Unit-IV **08**

Azeotropic mixtures: Distillation of immiscible liquids, Solubility of partially miscible liquids, Phenol water system, CST and effect of impurities on CST.

Unit-V **08**

Corrosion and its control: Introduction, Economic aspects of corrosion, Dry or Chemical Corrosion, Wet or electrochemical corrosion, Mechanism of Electrochemical Corrosion, Prevention from corrosion.

Books recommended:

1. Admson, A.W., Physical Chemistry of Surfaces, 4th edition, Pubs: John Wiely & Sons, New York, 1982.
2. Austin H. T., Shreve's Chemical Process Industries, Pubs: McGraw Hill Book Company, New York(1984).
3. Kent James A. (ed.), Reigel's Handbook of Industrial Chemistry, Pubs: Van Nostrand inhold Company, London (1983).
4. Pandey C.N., Text Book of Chemical Technology, Vol. I & II, Pubs: Vikas Publishing House, Pvt. Ltd., New Delhi (1999).
5. Buchner V., Sohliebs P., Winter G. & Buchel K.H., Industrial Inorganic Chemistry, Pubs: V. Ch. Publishers, New York (1989).

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Industrial Aspects of Inorganic Chemistry, Subject Code: CH-202
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I **08**

Metallurgy: Basic metallurgical operations- crushing and pulverization, concentration, calcinations, roasting, types of roasting, reduction and refining.

Unit-II **08**

Physico Chemical Principles of Extraction: Methods of extraction and refining of Copper, lead, aluminium and Zinc from their ores.

Unit-III **08**

Inorganic materials of industrial importance: Availability, forms, structure and modification. Alumina, silica, silicates, zeolites.

Unit-IV **08**

Metals and alloys: Important metals and alloys, iron, copper, aluminium, lead, nickel, titanium and their alloys, mechanical and chemical properties and their applications.

Unit-V **08**

Adhesives: Introduction, Classification of adhesives, adhesives action, development of adhesive strength, chemical factors influencing adhesive action.

Books recommended:

1. Austin H. T., Shreve's Chemical Process Industries, Pubs: McGraw Hill Book Company, New York (1984).
2. Kent James A. (ed.), Reigel's Handbook of Industrial Chemistry, Pubs: Van Nostrand Hold Company, London (1983).
3. Pandey C.N., Text Book of Chemical Technology, Vol. I & II Pubs: Vikas Publishing House, Pvt. Ltd., New Delhi (1999).
4. Buchner V., Sohliebs P., Winter G. & Buchel K.H., Industrial Inorganic Chemistry, Pubs: V. Ch. Publishers, New York (1989).
5. Fumer I.E. and Zaitsev V.N., General Chemical Engineering, Pubs: Mir Publishers, Moscow (1961).
6. Badger W.L. and Bancher J.T., Introduction to Chemical Engineering, Pubs: McGraw-Hill Co., U.S.A, 1986.
7. McCabe W.L. and Smith J.C., Unit Operations in Chemical Engineering, Pubs: McGraw-Hill Book Company, New York, 1984.
8. Perry J.H., Chemical Engineering Handbook, Pubs: McGraw-Hill Book Company, New York, 1993.

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Industrial Aspects of Organic Chemistry, Subject Code: CH-203
SYLLABUS REVISED-2015
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L T P 3 1 0

Unit-I **08**

Techniques in Organic Synthesis: Bio-transformations – Enzyme catalysed reactions, Microwave induced reactions-Principle, conditions, advantages over conventional heating methods- Applications, sonication.

Unit-II **08**

Organometallic Reagents: Synthesis and applications of Grignard reagents-organolithium, Zinc, Copper, Palladium, Nickel compounds in organic synthesis- Homogeneous catalytic reactions-hydrogenation, hydroformylation.

Unit-III **08**

Methods in Organic Synthesis-I: Organosilicon Compounds: Preparation and applications in organic synthesis; Applications of Pd (0) and Pd (II) complexes in organic synthesis- Suzuki and Sonogashira coupling, Heck reaction, Preparation and applications of lithium organocuprates.

Unit-IV **08**

Methods of Organic Synthesis-II: Reduction with lithium aluminium hydride, sodium borohydride, alkoxides, bismethoxyethoxyaluminium hydride, boron aluminium hydride and derivatives-catalytic metal hydrogenation-dissolving metal reductions, Non-metallic reducing agents including enzymatic and microbial reductions.

Unit-V **08**

Carbon nanotubes: Synthesis, Single walled carbon nanotubes, Structure and characterization, Mechanism of formation, chemically modified carbon nanotubes, Doping, Functionalizing nanotubes, Applications of carbon nanotubes.

Books recommended:

1. McCabe W.L. and Smith J.C., Unit Operations in Chemical Engineering, Pubs:McGraw-Hill Book Company, New York,1984.
2. Perry J.H., Chemical Engineering Handbook, Pubs: McGraw-Hill Book Company, New York, 1993.
3. Rao, C. N. R, Muller,A and Cheetam, A.K. (Eds) (2004): The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH, Weinheim.
4. Poole,C. P and Owens,Jr: F. J (2003): Introduction to Nanotechnology Wiley Interscience, New Jersey.
5. Kenneth J. Klabunde (Ed) (2001), Nanoscale materials in Chemistry, WileyInterscience, New York.
6. Cary, F. A and Sundberg,R. I. (2009) :Advanced Organic Chemistry, Part A and B, 5th Edition, Springer.
7. Smith,M. B. (2005): Organic Synthesis, 2nd Edition, McGraw-Hill: New York.
8. Bansal R K(1999): Heterocyclic Chemistry, New Age International
9. Acheson R H, (1976): An introduction to the chemistry of Heterocyclic compounds, Wiley

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Materials & Energy Balance, Subject Code: CH-204
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I **08**

Units and Dimensions: Introduction, Dimensions & Systems of Units, Fundamental quantities, Derived Quantities, Conversions & Problems.

Unit-II **08**

Basic Chemical Calculations: Introduction, Concept of atom, Mole and mole fraction, Methods of expressing the composition of mixtures (mass percent, volume percent, mole percent), equivalent weight, normality, molarity, molality.

Unit-III **08**

Material balance: Process classification, Choice of system and basis of molecular processes with chemical reactions, Material balance calculations, multiple unit processes, Recycle and bypass.

Unit-IV **08**

Energy Balance: Energy balance: Forms of energy, Energy balance, Energy changes in physical processes, Energy changes in reactions, Energy balance Calculations.

Unit-V **08**

Material Balances without Chemical Reactions: Material Balance without chemical reactions: Flow diagram for material balance, simple material balance without recycles or bypass for chemical engineering operations such as distillation, evaporation, absorption and crystallization.

Books recommended

1. Bhatt
B.I. and Vora S.M., Stoichiometry, 3rd edition, Pubs: Tata McGraw-Hill Publishing Company Ltd. New Delhi, 1984.
2. Badger W.L. and Bancher J.T., Introduction to Chemical Engineering, Pubs: McGraw-Hill Co., U.S.A, 1986.
3. McCabe W.L. and Smith J.C., Unit Operations in Chemical Engineering, Pubs: McGraw-Hill Book Company, New York, 1984.
4. Perry J.H., Chemical Engineering Handbook, Pubs: McGraw-Hill Book Company, New York, 1993.
5. Himmelbkause D.M., Basic principles and catenations of chemical Engineering, 6th edition, Pubs: Prentic Hall, 2003.
6. Forst A.S., Wenzel L.A., Clump C.W., Maus L., Andersen L.B., Principles of unit operations, 2nd edition, Pubs: John Wiley and Sons, 1994.
7. Chattopadhyay P., Unit Operations of Chemicals Engineering, Vol I, Pubs: Khanna Publishers, Delhi, 1996.

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Industrial Aspects of Microbiology, Subject Code: CH-205
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I

Classification and Nomenclature of Microorganisms: Concept of kingdom-protista, prokaryotes and eukaryotes, Introduction to Microbial Diversity: General characteristics and importance of Viruses, Bacteria, *Actinomycetes*, algae and fungi. Use of microorganisms in fermentation industry.

Unit-II

Pure culture and preservation of microbes: Growth phases – kinetics, asynchronous, synchronous, batch and continuous culture. Factors affecting growth.

Bacterial Nutrition & Fermentation media: Components, Natural and synthetic media.

Microbiological Assay: Bioassay of growth supporting substances- Amino acids and Vitamins.

Unit-III:

Basic concept of fermentation: Types of fermentation. General Structure of a Fermenter. Introduction to upstream and downstream processing. Unit operations in Downstream processing (DSP): Disintegration of cells, Separation, Extraction, Concentration and purification of products.

Unit-IV

Industrial production: Production of antibiotics- Penicillin and semi-synthetic penicillins. Production of enzymes-Amylase. Immobilization of enzymes and applications of immobilized enzymes. Production of solvent- Ethanol. Production of Vitamins- Cyanocobalamin. Production of Organic Acids- Acetic Acid. Production of Amino Acids- Glutamic Acid.

Unit-V

Contamination problem in fermentation: Microbiological examination of water and common contaminant. Food poisoning. Control of microorganisms, Sterilization, inhibiting substances- Antibiotics, Minimum inhibitory concentration.

Books Recommended:

1. Medical Microbiology, Vol. 1: Microbial Infection, Vol. 2 : Practical Medical Microbiology, Authors- Mackie and McCartney.
2. Epidemiology and Infections, Author- Smith
3. Microbiology in Clinical Practice, Author- D.C. Shanson.
4. Diagnostic Microbiology, Authors- Baron, Peterson and Finegold.
5. Textbook of Industrial Microbiology, Author- A. H. Patel.
6. Industrial Microbiology, Author- L. E. Cassida
7. Industrial Microbiology, Author- G. Reed.
8. Industrial Microbiology, Author- Agarwal and Parihar.
9. Biology of Industrial Microorganisms. A.L. Demain.
10. Principles of Fermentation Technology, Authors- Standbary, Whitaker and Hall.
11. Textbook of Industrial Microbiology, Author- A. H. Patel.
12. Industrial Microbiology, Author- L. E. Cassida

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Biochemistry, Subject Code: CH-206
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit I **08**

Carbohydrates: Introduction and classification, monosaccharide (glucose and fructose) physical and chemical properties and their uses. Disaccharides (Sucrose), Physical and chemical properties and their uses. Polysaccharides (Starch and Cellulose); Physical and Chemical Properties and their uses.

Unit-II **08**

Amino Acids, Peptides and Proteins: Introduction, Classification, and Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitter ion and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Unit-III **08**

Enzymes: Introduction and Characteristic features of enzymes. Factors influencing enzyme activity, Coenzymes, prosthetic group, Lock and key hypothesis, induced fit hypothesis. Introduction to Biocatalysis: Importance in "Chemical Industry".

Unit IV **08**

Lipids: Introduction, Classification, Triglycerides, Fatty acids, Hydrogenation of Triglycerides, Saponification of Triglycerides, Reaction of carboxyl groups of fatty acids, Structure and Biological importance of Prostaglandins.

Unit-V **08**

Nucleic acid: Introduction, Nucleosides and nucleotides; Heterocyclic aromatic amine bases, monosaccharides (D-ribose or 2-deoxy-D-ribose) and phosphate ions, Structure of primary and secondary (double helix model) of DNA.

Books recommended:

1. Organic Chemistry by Robert Thornton Morrison, Robert Neilson Boyd, and Saibal Kanti Bhattacharjee, Seventh edition, Pearson publication.
2. Organic Chemistry by Jonathan Clayden, Nick Greeves, and Stuart Warren, Second edition, Oxford Publication.
3. Organic Chemistry by T.W.Graham Solomons, and Craig B. Fryhle, Ninth edition, Wiley Publication.
4. Organic Chemistry by I.L. Finar, Volume 1 & 2, Sixth edition, Pearson Publication.
5. J.M. Berg, J.L. Tymoczko and L. Stryer, Biochemistry, 6th Edn. W.H. Freeman and Co. (2006).
6. D.L. Nelson, M.M. Cox, and A.L. Lehninger, Principles of Biochemistry. IV Edition. W.H. Freeman and Co. (2009).
7. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's
8. Illustrated Biochemistry. XXVIII edition. Lange medical Books/ McGraw-Hill (2009).

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Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 2nd Year/ 3rd Semester
Subject Name: Industrial Chemistry Lab-3, Subject Code: CH-207
SYLLABUS REVISED-2015
w.e.f. July-2015

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List of Experiments

1. To determine the density or specific gravity of an unknown liquid.
2. To determine the water equivalent of calorimeter.
3. Conductometric titration.
4. Preparation of chrome alum.
5. Preparation of borax/ boric acid.
6. Estimation of Calcium in Chalk by permanganometry.
7. To study the absorption of acid on activated charcoal.
8. To determine the pH of given HCl solution by using pH meter.

Microbiology and Biochemistry:

9. Qualitative test of protein & amino acid by any two methods (Millon's test, Biuret test, Ninhydrin test, Xanthoprotein's test, hopkin's test).
10. Qualitative test of carbohydrate by any two methods (Molish test, Fehling's test, Benedict's test, Barfoed's test, Phenyl Hydrazine test, iodine test, Seliwanoff's test, Music acid test, Bail's test, Nelson Somogy's method).
11. Methods of sterilisation and preparation of various culture media.
12. Identification of isolated bacteria, Gram staining and gram staining method.
13. Find out the isoelectric point of protein.
14. Protein separation by polyacrylamide gel electrophoresis.
15. Enumeration of microorganism from water/soil sample, colony purification.
16. Purification techniques serial dilution, pour plate and streak plate method.