

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Chromatographic Techniques, Subject Code: CH-301
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I **08**

Separation techniques: Chromatography, Classification of Chromatographic methods, Elution in column chromatography, chromatograms, distribution constant, retention time, stationary phase, mobile phase, principle of adsorption and partition chromatography, column chromatography; principle, adsorbents used, preparation of column, adsorption, elution.

Unit-II **08**

Thin layer chromatography; principle, choice of adsorbent and solvent, R_f value, applications.
Paper chromatography; solvents used, principle, R_f value, factors influencing R_f value, applications. Separation of amino acid mixture.

Unit-III **08**

Gas chromatography: Introduction, Principles of gas-liquid chromatography, Instrumentation; Carrier gas system, Sample injection, Columns, Stationary phase, Detectors (Flame Ionization, Electron capture and Thermal conductivity) and Industrial applications.

Unit-IV **08**

High performance Liquid Chromatography: Introduction of HPLC, Normal and reverse phase HPLC, Isocratic and gradient elution, Instrumentation; mobile phase reservoir, column and detector (UV-visible absorption, Electrochemical) and Industrial applications of HPLC.

Unit-V **08**

Ion exchange chromatography: principle, resins, action of resins, experimental techniques, applications, separation of metal ions, separation of chloride and Bromide ions - removal of interfering radicals.

Books recommended:

1. Fundamentals of Analytical chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, 7th edition, Harcourt college publications.
2. Principles and practice of analytical chemistry, F. W. Fifield, D. Kealey, 5th edition, Blackwell publication.
3. Analytical chemistry, Gary D. Christian, 6th edition, Wiley and sons publication.
4. Handbook of instrumental techniques for analytical chemistry, Frank A Settle, Prentice Hall Publication.
5. Analytical chemistry- Instrumental Techniques (Vol. II) – Mahindu Singh, Dominant publishers.
6. Basic concepts of analytical chemistry, S. M. Kopper, New Age International Publishers.
Analytical chemistry, D. Kealey, P.J.Haines, Viva books Pvt. Ltd

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Process in Organic Chemicals Manufacture, Subject Code: CH-302
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I **08**

Nitration: Introduction - Nitrating agents and mechanism of nitration process such as nitration:
i) Benzene to nitrobenzene and m-dinitrobenzene ii) Chlorobenzene to o- and p-nitrochlorobenzenes iii) Toluene. Continuous vs batch nitration.

Unit-II **08**

Sulphonation: Introduction, sulphonating agents, Chemical and physical factors affect sulphonation, mechanism of sulphonation reactions, Commercial sulphonation of benzene, naphthalene, Toluene, batch vs continuous sulphonation.

Unit-III **08**

Alkylation: Introduction, Types of alkylation, Alkylating agents, mechanism of alkylation reactions, manufacture of alcohol, N-alkyl anilines (mono dimethyl and ethyl anilines.).

Unit-IV **08**

Esterification: Introduction, Esterification by organic acids, by addition of unsaturated compounds, esterification of carboxyl acid derivatives, commercial manufacture of ethyl acetate, vinyl acetate, cellulose acetate.

Unit-V **08**

Halogenation: Introduction - Reagents for halogenations, mechanism of halogenation, , halogenation of aromatics. Commercial manufactures - chlorobenzenes, chloral, monochloroacetic and chloromethanes, dichlorofluoromethane.

Books recommended:

1. Shipla and Pandey G.N., Text Book on Chemical Technology, Vol.2 and I, Pubs: Vikas Publishing Company, 1997.
2. Shreve R.N. Brink. J.A., Chemical Process Industries, International student edition, Pubs: McGraw Hill Book Co. New York, 1960
3. Groggins P.M., Unit Process in Organic Synthesis, 5th edition, International student edition, Pubs: McGraw-Hill Book Co., New York, 1998.

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Phytochemistry, Subject Code: CH-303
SYLLABUS REVISED-2015
w.e.f. July-2015

L T P 3 1 0

Unit-I **08**

Terpenoids: Introduction, nomenclature, occurrence, general properties, classification, and isolation of terpenoids, isoprene rule; synthesis of Citral and Menthol.

Carotenoids: Introduction, classification, and isolation of carotenoids.

Unit-II **08**

Alkaloids: Introduction occurrence, functions, nomenclature, chemical classification, isolation, and general properties of alkaloid. Introduction and physiological action; Ephedrine, Adreneline or Epinephrine, Nor adreneline or Nor epinephrine, Nicotine, atropine.

Unit-III **08**

Steroids and Hormones: Introduction, occurrence, structure and physiological action; cholesterol, Ergosterol. Steroidal hormones; Progesterone, Testosterone, Androgen, Oestrogens.

Unit-IV **08**

Vitamins: Introduction, Classification, Sources of vitamins and their deficiency diseases. Physiological function of water and fat soluble vitamins. Structure and uses; Vit. A, Vit. B₁, B₂, B₆, and Vit. C.

Unit-V **08**

Phytopharmaceuticals: Recent development and commercialization of plant derived natural products. Structure and medicinal uses of caffeine, theophylline and theobromine.

Books recommended:

1. Natural products: Chemistry and Biological Significance, J. Mann, R. S. Davidson, J. B. Hobbs, d. V. Banthrope and J. B. Harborne, Longman, Essex.
2. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
3. Chemistry, Biological and Phrmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta Anda. Marston, Harwood Academic Publishers.
4. Chemistry of natural products, S.V. Bhat, B.A.Nagasampagi, M. Sivakumar.
5. Natural products from plants, Peter B. Kaufman, Leland J. Creke, Sara Warber, James A. Dupe, Harry L. Briemann , CRC publication
6. Organic chemistry of natural products, Vol. I and II , Gurdeep Chatwal, Himalya Publishing

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Unit Operations in Chemical Industry, Subject Code: CH-304
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Unit-I **08**

Distillation: Introduction, Bath and continuous distillation, Separation of azeotropes, Plates columns and packed columns

Absorption: Introduction: Equipments- packed columns spray Columns, bubble columns, packed bubble columns, mechanically agitated contractors.

Unit-II **08**

Evaporation: Introduction, Equipments- short tube (standard) Evaporator forced circulation evaporators, falling film evaporators, climbing film (upward flow) evaporators, wiped (agitated) film evaporator.

Unit-III **08**

Filtration: Introduction, filter media and filter aids, equipments- plate and frame filter press, nutch filter, rotary drum filter, sparkler filter, candle filter, bag filter, centrifuge

Drying: Introduction, free moisture, bound moisture drying curve; equipments- tray dryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.

Unit-IV **08**

Crystallization: Introduction: solubility, super-saturation nucleation, crystal growth; Equipment- tank crystallizer, agitated crystallizer, evaporator, crystallizer, draft tube crystallizer.

Unit-V **08**

Extraction: Introduction: selection of solvent; Equipments- Spray column, packed column rotating disc column, mixer-settler. Mixing- Introduction; mixing of liquid-liquid solid- Solid, liquid-solid systems.

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.

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Pulp, Paper, Leather and Textile Industry, Subject Code: CH-305
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Unit-I **08**

Pulp and paper: Introduction - Manufacture of pulp, Sulphate or Kraft pulp, Soda pulp, Sulphite pulp Rag pulp, Beating, refining, filling, sizing and coloring , manufacture of paper and paper making additives; processing aids, functional additives, strength additives and binders.

Unit-II **08**

Special types of papers and their manufacturing process: Ammonia paper, Art paper, Bituminized water proof paper, Emery Paper, Toilet paper, Wall paper , Wax coated paper and polymeric modified papers.

Unit-III **08**

Leather Industry-1: Introduction - Constituents of Animal Skin - Preparing skins and hides - Cleaning and soaking - Liming and degreasing.

Unit-IV **08**

Leather Industry-II: Introduction, Manufacture of leather, Preparation of hides for tanning, Vegetable, chrome and oil tanning - Byproduct.

Unit-V **08**

Textiles Chemistry: Indian textile industries, general consideration of textile fibres: cotton, wool, silk, and rayon fibres; General considerations of synthetic fibres; Identification of textile fibres; Water soluble resins, and epoxy resins.

Books recommended:

1. Chemical process industries N.R Nerris shreve
2. Chemical process principales: part 1 & II – O.A / Hougen, K.M Watson RA Ragatz (CBS)
3. Shrev's Chemical process Industries: 5th edition – George T. Austin, Mc Graw Hill Book Co.
4. Handbook of industrial chemistry: Volume I & II , KH Davis , FS Berner, CBS Publication.
5. Plastic Additives Technology Hand Book: Himadri Panda, Engineers India Research Institute.
6. Industrial Chemistry B.K.Sharma, goel publishing house

Integral University, Lucknow
Department of Chemistry
B.Sc. (Hons.) Industrial Chemistry, 3rd Year/ 5th Semester
Subject Name: Dyes, Subject Code: CH-306
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w.e.f. July-2015

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Unit-I **08**

Chemistry of Intermediates: Introduction of the History of Dyes. Landmarks in the historical development from Natural to synthetic dyes. Benzene intermediates-Chloronitrobenzenes, Nitroanilines, Bromonitroanilines, Nitroanisole.

Unit-II **08**

Classification: Introduction and classification of dyes on the basis of structure and the mode of application to the fibre. Colour and chemical constitution of dyes; Chemistry of the dyes with respect to general structural features, mode of application to fibre, colour shades, synthesis of typical 4-5 dyes., uses.

Unit-III **08**

Anthraquinone Dye: Anthraquinone mordant dyes; Alizarin, Alizarin Orange, Alizarin Red S. Anthraquinone vat dyes; Indanthrone blue, Pyranthrone. Anthraquinone acid dyes, Anthraquinone Disperse dye.

Unit-IV **08**

Azodyes: Diazotization, Diazo Coupling, Types of Azo dyes; Acidic azo dyes (Methyl Orange, Tartrazine). Basic azo dyes; aniline, butter yellow. Direct or substantive azodyes; Congored. Ingrain azodyes; para red.Mordant azodyes; Eriochrome Black-T. synthetic fibre dyes; red disperse dye.

Unit-V **08**

Miscellaneous dyes: Structure and uses; Phenolphthalein, fluorescein, Eosin, Malachite green, Methylene blue, Indigo. Naphthol yellow-S, Crystal violet.

Books recommended:

1. Gurdeep R. Chatwal, Synthetic dyes, Himalya publishing House.
2. Venkataraman K., The Chemistry of Synthetic Dyes, Vols 1-8, Pubs: Academic Press, 2009.
3. Industrial Chemistry B.K.Sharma, goel publishing house

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Subject Name: Industrial Chemistry Lab-5, Subject Code: CH-307
SYLLABUS REVISED-2015
w.e.f. July-2015

LTP008

List of Experiments

1. Separation of amino acid by Thin layer chromatography.
2. Separation of amino acid by paper chromatography.
3. Separation of sugar by Thin layer chromatography.
4. Isolation of lactose & casein.
5. Isolation of lycopene from tomato.
6. Isolation of caffeine from tea.
7. Isolation of piperine from black pepper.
8. Isolation of eugenol from cloves.
9. Isolation of nicotine from tobacco.
10. Determination of protein content of food.
11. Determination of fat content of food.
12. Determination of acetic acid content of vinegar.
13. Determination of acid value of oil.
14. Preparation of methyl orange.

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L T P 3 1 0

Unit-I **08**

Chemistry of Intermediates: Introduction of the History of Dyes. Landmarks in the historical development from Natural to synthetic dyes. Benzene intermediates-Chloronitrobenzenes, Nitroanilines, Bromonitroanilines, Nitroanisole.

Unit-II **08**

Classification: Introduction and classification of dyes on the basis of structure and the mode of application to the fibre. Colour and chemical constitution of dyes; Chemistry of the dyes with respect to general structural features, mode of application to fibre, colour shades, synthesis of typical 4-5 dyes., uses.

Unit-III **08**

Anthraquinone Dye: Anthraquinone mordant dyes; Alizarin, Alizarin Orange, Alizarin Red S. Anthraquinone vat dyes; Indanthrone blue, Pyranthrone. Anthraquinone acid dyes, Anthraquinone Disperse dye.

Unit-IV **08**

Azodyes: Diazotization, Diazo Coupling, Types of Azo dyes; Acidic azo dyes (Methyl Orange, Tartrazine). Basic azo dyes; aniline, butter yellow. Direct or substantive azodyes; Congored. Ingrain azodyes; para red.Mordant azodyes; Eriochrome Black-T. synthetic fibre dyes; red disperse dye.

Unit-V **08**

Miscellaneous dyes: Structure and uses; Phenolphthalein, fluorescein, Eosin, Malachite green, Methylene blue, Indigo. Naphthol yellow-S, Crystal violet.

Books recommended:

1. Gurdeep R. Chatwal, Synthetic dyes, Himalya publishing House.
2. Venkataraman K., The Chemistry of Synthetic Dyes, Vols 1-8, Pubs: Academic Press, 2009.
3. Industrial Chemistry B.K.Sharma, goel publishing house